CITY OF AUSTIN

PROJECT MANUAL
Contract Documents and Technical Specifications

VOLUME 1 of 1

St. Elmo Service Center 8 Renovations

C.I.P. PROJECT NUMBER: 6011.035
SOLICITATION NUMBER: CLMC858

CITY OF AUSTIN
Andrew Clements, RA, LEED AP BD+C, Project Manager
Architectural Project Management Division
Public Works Department

04/26/2021

The City of Austin is committed to compliance with the Americans with Disabilities Act. Reasonable modifications and equal access to communications will be provided upon request.

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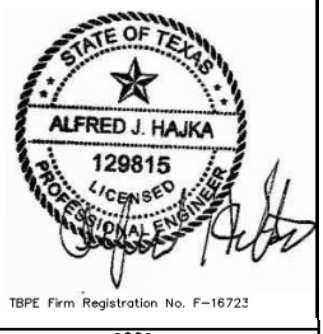
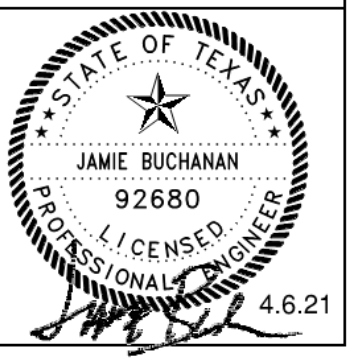
Owner	City of Austin	Professional Seal
Architect	Bonita Tice Gray, AIA LEED AP BD+C **GSC Architects** 3100 Alvin DeVane Blvd. Building A, Suite 200-B Austin, Texas 78741 (512) 477-9417	
Civil	Al Hajka, P.E. **Martinez Engineer** 111 Congress, Suite 457 Austin, Texas 78701 (713) 530-7810	
Structural	Jamie Buchanan, PE, LEED AP **Tsen Engineering** 210 Barton Springs Rd. Suite 250 Austin, Texas 78704 (512) 474-4001 x1005	

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VOL. 2 of 2 08/2019 **MBE/WBE Procurement Program Package**

END

1. OVERVIEW AND PROJECT INFORMATION

Following is a summary of information for this Project. Bidder is cautioned to refer to other sections of the Project Manual, Drawings and Addenda (Bid Documents) for further details.

The City of Austin, hereafter called OWNER, is requesting Bids for furnishing all labor, materials, equipment, supervision, and incidentals, and for performing all Work required for the following:

Project:	St. Elmo Service Center 8 Renovations
Located at:	4411 Meinardus Drive, Austin, Texas (St. Elmo Service Center)
CIP ID No.:	6011.035
Solicitation No.:	CLMC858

The Work includes demolition of curbs, paving, and exterior CMU wall. Construction includes the expansion of an existing concrete parking lot (West), new ADA parking, a new remote heavy-vehicle concrete parking lot (East) with the construction of a fence and lighting and a remote pole yard asphalt parking lot (East). New HVAC and lighting support the new secure service entry and parking lots.

2. BID DOCUMENTS

Bid Documents are obtained through the City's Vendor Connection website, log on www.austintexas.gov/financeonline/vendor_connection/index.cfm. A complete set of Bid Documents, including all sections of the Project Manual and Drawings, are included in the attachments section of each solicitation.

All addenda and answers to Bidders' questions will also be posted in the attachments section for each solicitation on the City's Vendor Connection website.

3. SUBMISSION OF BIDS

Sealed Bids may be submitted to the Capital Contracting Office Bid Opening Desk located at One Texas Center, 505 Barton Springs Rd., Suite 1045-B, Austin, Texas 78704, or may be submitted electronically (see eResponse, Attachment 1 -Submitting Bids in Austin Finance Online).

Sealed Bid may be mailed using address below:

Address for US Mail (If mailed to the physical address, the proposal will be returned unopened)	
City of Austin	
Capital Contracting Office	
P. O. Box 1088	
Austin, Texas 78767-8845	

NOTE: Bids must either be received and time stamped in the Capital Contracting Office prior to the Due Date and Time or submitted electronically via Austin Finance Online. The time of record for those electronically submitted is the time received in Austin Finance OnLine. It is the responsibility of the Offeror to ensure that their Bid arrives at the reception desk in the Capital Contracting Office or electronically prior to the time and date indicated. Arrival at the City's mailroom, mail terminal, or post office box will not constitute the Proposal arriving on time.

Public Bid Opening Update
Due to the unprecedented event of COVID-19 and to help prevent the further spread, Capital Contracting Office will NOT be conducting an in person bid opening. Bidders must either submit their bids and compliance plans no earlier than 10:00 AM and prior to 2:00 PM on the date bids are due to One Texas Center, 505 Barton Springs Rd., Suite 1045-B, Austin, Texas 78704; or must submit Bids and Compliance Plans electronically via Austin Finance Online prior to 2:00 PM on the day proposals are due. Bids and compliance plans submitted after 2:00 PM on the date bids are due will not be accepted. The Capital Contracting Office will open both the sealed bids and bids received electronically via Austin Finance Online at 3:00 PM on the date bids are due.

Bidders may watch the bid opening online using the following Web link: CCO Web Bid Opening Click Here

Disclaimer: The result of the bid opening does not become final until all bids are verified, and the bid tab is certified. The pencil bid tab and certified bid tab will be posted in Austin Finance Online at the following link:

https://www.austintexas.gov/financeonline/account_services/solicitation/solicitations.cfm

ALL BIDS AND COMPLIANCE PLANS ARE DUE PRIOR TO (Austin time) 2:00 PM on Thursday, May 27th, 2021.
BIDS WILL BE OPENED AT (Austin time) 3:00 PM on Thursday, May 27th, 2021.

ALL BIDS AND COMPLIANCE PLANS NOT RECEIVED PRIOR TO THE DATE AND TIME SET FORTH ABOVE WILL NOT BE ACCEPTED FOR CONSIDERATION. The time stamp clock in SUITE 1045B is the time of record and is verified with www.time.gov, the official U.S. time. For Bids submitted electronically via Austin Finance Online, the time of record is the time received in Austin Finance Online.

4. VENDOR REGISTRATION AND NON-DISCRIMINATION

Prime Contractors must be registered with the OWNER prior to submitting a Bid electronically via Austin Finance Online. All CONTRACTORS must be registered to do business with OWNER prior to the Contract Award. All Subcontractors must be registered with the OWNER prior to execution of a contract. Prime Contractors are responsible for ensuring that their Subcontractors are registered as vendors with the City of Austin. Registration can be done through the OWNER's on-line Vendor Registration system. Log onto and follow directions: https://www.austintexas.gov/financeonline/account_services/account/login.cfm

The City of Austin, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

5. MBE/WBE PROCUREMENT PROGRAM

All City procurements are subject to the City's Minority-Owned and Women-Owned Business Enterprise Procurement Program found at Chapter 2-9-A of the City Code, as amended. The Program provides Minority-Owned and Women-Owned Business Enterprises (MBEs/WBEs) or Disadvantaged Business Enterprises (DBEs) full opportunity to participate in all City contracts. Goals for MBE/WBE or DBE participation are stated for each solicitation. Information on achieving the goals or documenting good faith efforts to achieve the goals are contained in the MBE/WBE Procurement Program Package or DBE Procurement Program Package attached

to the solicitation. When goals are established, Bidders are required to complete and return the MBE/WBE or DBE Compliance Plan with their Bid. If a Compliance Plan is not submitted prior to the date and time set forth in the solicitation, the Bid will not be accepted for consideration. (See Section 00820 for MBE/WBE requirements on "no goal" solicitations.)

6. BID GUARANTY

All Bids shall be accompanied by an acceptable Bid guaranty in an amount of not less than five percent (5%) of the total Bid, as specified in Section 00100, Instructions to Bidders.

7. BONDS AND INSURANCE

Performance and payment bonds when required shall be executed on forms furnished by OWNER. Each bond shall be issued in an amount of one hundred percent (100%) of the Contract Amount by a solvent corporate surety company authorized to do business in the State of Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law.

Minimum insurance requirements are specified in Section 00810, Supplemental General Conditions.

8. WAGE COMPLIANCE

Minimum wage rates have been established and are specified in Section 00830, Wage Rates and Payroll Reporting.

9. CONTRACT TIME

Contract Time is of the essence and all Work shall be **substantially completed within two-hundred seventy (270) Calendar Days** after date specified in the Notice to Proceed, in accordance with the Bid Form, Section 00300.

Final completion shall be achieved within thirty (30) Calendar Days after substantial completion.

Liquidated damages are **five hundred-sixty dollars ($560) per Calendar Day** for failure to substantially complete the work and **three hundred-sixty dollars ($360) per Calendar Day** for failure to achieve final completion within thirty (30) Calendar Days after substantial completion, in accordance with the Bid Form, Section 00300.

10. OWNER'S RIGHTS

OWNER reserves the right to reject any or all Bids and to waive any minor informality in any Bid or solicitation procedure (a minor informality is one that does not affect the competitiveness of the Bid).

11. PRE-BID CONFERENCE

A **mandatory** Pre-Bid Conference will be held on **Wednesday, May 5th, 11:00 a.m. (Austin time)**, via webinar and teleconference. Bidders may participate in the virtual pre-bid conference by clicking this link: Click Here

Attendance is not mandatory unless otherwise stated. Bidders must attend any mandatory Pre-Bid Conference and are encouraged to attend any non-mandatory Pre-Bid Conference to ensure their understanding of OWNER's bidding and contracting requirements, particularly MBE/WBE or DBE Procurement Program requirements. **Bidder must virtually arrive and sign-in via Microsoft Forms** by either using the QR code which will be displayed on the

introduction slide or by clicking on the provided link that will be posted into the live stream question and answer field. If you have trouble accessing the link or QR code please send an email to **Sofie.Johnson@austintexas.gov** with the subject line **CLMC858**, providing the following information: Your name, email address, the firm you are representing, whether you are a prime firm or subcontractor, and also indicate if your firm is a MBE/WBE or DBE. If the Pre-Bid Conference is mandatory, Bidders must sign into the meeting using one of the methods above within fifteen (15) minutes of the scheduled start time of the meeting, otherwise the Bidder will not be allowed to submit a Bid for the project.

12. SITE VISIT

A **mandatory** Site Visit will be held on **Thursday, May 6th, 2021 at 2:00 p.m. (Austin time)**. Participants will meet at the Fleet Mobility Services Building #8, at 4411 Meindardus Drive D (Service Center #8), Austin, Texas 78744 (St. Elmo Service Center). Parking in encouraged on Sponberg Drive or Meindardus Drive, outside Service Center #8 security gate. Meet in parking lot outside building front door.

NOTICE: While this non-mandatory Site Visit is deemed essential, due to the unprecedented event of COVID-19 and to help prevent the further spread, the following protocols will be observed before, during, and after the Site Visit:

- Representatives that are visibly sick will not be allowed
- Hand sanitizer will be available
- Physical spacing (minimum of six (6) feet between people) will be maintained
- Face coverings are required
- Each interested Bidder should limit themselves to one (1) Representative to be present at the Site Visit.

13. ANTI-LOBBYING AND PROCUREMENT

On June 14, 2018, the Austin City Council adopted Ordinance No. 20180614-056 replacing Chapter 2.7, Article 6 of the City Code relating to Anti-Lobbying and Procurement. The policy defined in this Code applies to Solicitations for goods and/or services requiring City Council approval under City Charter Article VII, Section 15 (Purchase Procedures). The City requires Offerors submitting Offers on this Solicitation to certify that the Offeror has not in any way directly or indirectly had communication restricted in the ordinance section 2-7-104 during the No-Lobbying Period as defined in the Ordinance. The text of the City Ordinance is posted on the Internet at:

https://assets.austintexas.gov/purchase/downloads/New_ALO_Ordinance_No_20180614-056.pdf

14. AUTHORIZED CONTACT PERSONS

The persons listed below may be contacted for information regarding the Invitation for Bid.

PROJECT MANAGER: Andrew Clements, phone: 512-974-7152, email: Andrew.Clements@austintexas.gov

CAPITAL CONTRACTING OFFICE CONTACT: Sofie Johnson, phone 512-978-9143, email: Sofie.Johnson@austintexas.gov

SMALL & MINORITY BUSINESS RESOURCES DEPARTMENT CONTACT: Keisha Hardwick, phone 512-974-7738, email Keisha.Harwick@austintexas.gov

END

INSTRUCTIONS TO BIDDERS
Section 00100

1. PREPARATION OF BID

1.1 Bid Documents. Each Bidder must prepare its Bid on forms furnished by OWNER or as otherwise specified or permitted. Blank spaces for each item in Bid form must be filled. Bidder must submit a price for each item in Bid. In case of conflict between unit prices and extensions, unit prices shall govern. The Bid must be executed in the complete and correct legal name of individual, partnership, firm, corporation or other legal entity constituting the Bidder.

1.2 Vendor Registration. Prime Contractors must be registered with the OWNER prior to submitting a Bid electronically via Austin Finance Online. All CONTRACTORS must be registered to do business with OWNER prior to Contract Award. All Subcontractors must be registered with the OWNER prior to execution of a contract. Prime Contractors are responsible for ensuring that their Subcontractors are registered as vendors with the City of Austin. Registration can be done through the OWNER's on-line Vendor Registration system. Log onto https://www.austintexas.gov/financeonline/account_services/account/login.cfm and follow the directions.

1.3 Pre-Bid Conference. Unless otherwise notified, Bidders must attend the Pre-Bid Conference to ensure their understanding of OWNER's bidding and contracting requirements, particularly MBE/WBE Procurement Program requirements.

1.4 Sales Tax Exemption. The Owner is a tax-exempt organization as defined by Chapter 11 of the Property Tax Code of Texas. Bid prices shall not include sales tax on materials, supplies, or equipment that are incorporated into the real property interest of the OWNER or are otherwise completely used and consumed in the performance of the Contract. OWNER will furnish CONTRACTOR with a Sales Tax Exemption Certificate to be issued to Suppliers in lieu of the tax.

1.5 Minimum Wages. Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) for Building Construction and Heavy and Highway Trades "AS APPLICABLE" and/or the minimum wage required by City of Austin Ordinance No. 20160324-015, whichever is higher. The Total Minimum Wage required can be met using any combination of cash and non-cash qualified fringe benefits provided the cash component meets or exceeds the minimum wage required.

1.6 Addenda. Bidder shall be knowledgeable of all Addenda issued and shall acknowledge all Addenda in spaces provided on Bid form. Further information regarding the Bid documents and the Project may be obtained from the Project Manager listed at the end of Section 00020, Invitation for Bids.

1.7 Required Items. Bids must include all specified items in this section and be submitted in accordance with paragraph No. 7 below. Any additional requirement to the bid submittal is specified in Section 00820. Any corrections to a Bid shall be initialed by the person signing the Bid.

1.8 Professional Services. Bidders must secure any required professional services that are defined as professional services under the Professional Services Procurement Act, Chapter 2254 of the Texas Government Code (for example: registered professional land surveyors and professional engineers) using the qualifications based selection process

prescribed by that chapter. (Note: It is a violation of State Law to solicit Bids for professional services.)

1.9 Further Information. Prospective Bidders desiring further information or interpretation of Project Manual or Drawings must make a written request for such information to OWNER addressed to the Authorized Contact Person listed in Section 00020 no later than seven (7) Working Days before Bid opening. Interpretation of Project Manual or Drawings will be made by Addendum only and obtained through the City's Vendor Connection website. Log on to: www.austintexas.gov/financeonline/vendor_connection/index.cfm. Any verbal communications will not be binding on the OWNER.

1.10 Anti-Lobbying and Procurement. Article 6, Chapter 2-7, City Code, repealed and replaced effective on June 25, 2018, prohibits lobbying activities or representations by Offerors during the No Lobbying Period as defined in the Ordinance.

1.10.1. FINDINGS; PURPOSE.

(A) The council finds that persons who enter a competitive process for a city contract voluntarily agree to abide by the terms of the competitive process, including the provisions of this article.

(B) The council finds that it is in the City's interest:

(i) to provide the most fair, equitable, and competitive process possible for selection among potential vendors in order to acquire the best and most competitive goods and services; and

(ii) to further compliance with State law procurement requirements.

(C) The council intends that:

(i) each response is considered on the same basis as all others; and

(ii) respondents have equal access to information regarding a solicitation, and the same opportunity to present information regarding the solicitation for consideration by the City.

1.10.2. APPLICABILITY.

(A) This article applies to all solicitations except:

(i) City social service funding;

(ii) City cultural arts funding;

(iii) federal, state or City block grant funding;

(iv) the sale or rental of real property;

(v) interlocal contracts or agreements; and

(vi) solicitations specifically exempted from this article by council.

(B) Absent an affirmative determination by the council, the purchasing officer has the discretion to apply this article to any other competitive process.

(C) City Code Section 1-1-99 (*Offenses; General Penalty*) does not apply to this article.

1.10.3. DEFINITIONS.

In this article:

(A) AGENT means a person authorized by a respondent to act for or in place of the respondent in order to communicate on behalf of that respondent. Each of the following is presumed to be an agent:

(i) a current full-time or part-time employee, owner, director, officer, member, or manager of a respondent;

(ii) a person related within the first degree of consanguinity or affinity to a current fulltime or part-time employee, owner, director, officer, member, or manager of a respondent;
(iii) a person related within the first degree of consanguinity or affinity to the respondent, if a respondent is an individual person; and Section 0200 V2, Solicitation Instructions 4 Rev. 06-26-2018
(iv) a lobbyist, attorney, or other legal representative of the respondent that has been retained by the respondent with respect to the subject matter of either the solicitation or the respondent's response to the solicitation.

(B) AUTHORIZED CONTACT PERSON means a City employee designated in a City solicitation as the point of contact for all purposes for that solicitation.
(C) CITY EMPLOYEE is defined in Section 2-7-2 (*Definitions*), and further includes an independent contractor hired by the City with respect to the solicitation.
(D) CITY OFFICIAL is defined in Section 2-7-2 (*Definitions*).
(E) NO-LOBBYING PERIOD means the period of time beginning at the date and time a solicitation is published and continuing through the earliest of the following:
(i) the date the last contract resulting from the solicitation is signed;
(ii) 60 days following council authorization of the last contract resulting from the solicitation; or
(iii) cancellation of the solicitation by the City
(F) PURCHASING OFFICER means the City employee authorized to carry out the purchasing and procurement functions and authority of the City.
(G) RESPONSE means a written offer or submission in reply to a solicitation.
(H) RESPONDENT means a person or entity that has timely submitted or subsequently timely submits a response to a City solicitation, even if that person subsequently withdraws its response or has been disqualified by the City for any reason. Respondent includes:
(i) a subsidiary or parent of a respondent;
(ii) a joint enterprise, joint venture, or partnership with an interest in a response and in which a respondent is a member or is otherwise involved, including any partner in such joint enterprise, joint venture, or partnership; and
(iii) a subcontractor to a respondent in connection with that respondent's response.
(I) SOLICITATION means an opportunity to compete to conduct business with the City that requires council approval under City Charter Article VII Section 15 (*Purchase Procedure*), and includes, without limitation:
(i) an invitation for bids;
(ii) a request for proposals;
(iii) a request for qualifications;
(iv) a notice of funding availability; and
(v) any other competitive solicitation process for which the purchasing officer, in the purchasing officer's sole discretion, affirmatively determines this article should apply in accordance with Section 2-B.

1.10.4. RESTRICTION ON LOBBYING.

Subject to the exclusions in Section 5 (*Permitted Communications*), during a no-lobbying period,

(A) a respondent or an agent shall not communicate directly with a City official or a City employee, or both in order to:

(i) provide substantive information about any respondent or response with respect to the solicitation to which the communication relates;
(ii) encourage the City to reject one or more of the responses to the solicitation to which the communication relates;
(iii) convey a complaint about the solicitation to which the communication relates; or
(iv) ask any City official or City employee to favor or oppose, recommend or not recommend, vote for or against, consider or not consider, or take action or refrain from taking action on any vote, decision, or agenda item regarding the solicitation to which the communication relates.

(B) a City official shall not contact or communicate with a respondent regarding a response or the solicitation to which the no-lobbying period applies;
(C) a City employee, other than the authorized contact person, shall not contact or communicate with a respondent regarding a response or the solicitation to which the no-lobbying period applies.

1.10.5. PERMITTED COMMUNICATIONS.

The following communications are permitted under this article at any time:
(A) any communication between a respondent or agent and any authorized contact person, including, without limitation and in accordance with regulation, any complaint concerning the solicitation;
(B) any communication between a respondent or agent and any person to the extent the communication relates solely to an existing contract between a respondent and the City, even when the scope, products, or services of the current contract are the same or similar to those contained in an active solicitation;
(C) any communication between a respondent or an agent and a City employee to the extent the communication relates solely to a non-substantive, procedural matter related to a response or solicitation;
(D) any communication required by or made during the course of a formal protest hearing related to a solicitation;
(E) any communication between a respondent or an agent and the City's Small & Minority Business Resources Department, that solely relates to compliance with Chapters 2-9A through 2-9D (*Minority-Owned and Women-Owned Business Enterprise Procurement Program*) of the City Code;
(F) any communication between an attorney representing a respondent and an attorney authorized to represent the City, to the extent the communication is permitted by the Texas Disciplinary Rules of Professional Conduct;
(G) any communication made by a respondent or an agent to the applicable governing body during the course of a meeting properly noticed and held under Texas Government Code Chapter 551 (*Open Meetings Act*);
(H) any communication between a respondent or an agent and a City employee whose official responsibility encompasses the setting of minimum insurance requirements for the solicitation to which the communication relates, to the extent the communication relates solely to the insurance requirements established by the City in the solicitation; and
(I) any contribution or expenditure as defined in Chapter 2-2 (*Campaign Finance*).

1.10.6. MODIFICATION OF RESTRICTION.

The purchasing officer may waive, modify, or reduce the requirements in Section 4 (*Restrictions on Lobbying*) in order to allow respondents to communicate with a City employee or a City official other than the authorized contact person when the purchasing officer determines, in writing, that the solicitation must be conducted in an expedited manner, including but not limited to a solicitation conducted for reasons of health or safety under the shortest schedule possible with no extensions. Any such modification authorized by the purchasing officer shall be stated in the solicitation.

1.10.7. NOTICE.

(A) Each solicitation shall include a notice advising respondents and prospective respondents:

(i) of the requirements of this article;

(ii) that any communication initiated by a City employee or City official, other than the authorized contact person, during the no-lobbying period regarding a response or the solicitation may result in a violation of Section 4(A) if the respondent subsequently lobbies that City employee or City official.

(B) The purchasing officer, or a City employee designated by the purchasing officer, shall provide weekly written notice, accessible to all City employees and City officials, of each solicitation for which the no-lobbying period is in effect.

1.10.8. DISCLOSURE OF VIOLATION.

A City official or a City employee other than the authorized contact person that becomes aware of a violation of Section 4 (*Restrictions on Lobbying*) shall notify the authorized contact person in writing as soon as practicable.

1.10.9. ENFORCEMENT.

(A) A respondent that has been disqualified pursuant to Section 10(A) (*Disqualification; Contract Voidable*) may appeal such disqualification to a subcommittee that is less than a quorum of the Ethics Review Commission established in Chapter 2-7, Article 2 (*Ethics Review Commission*), whose decision on appeal shall be final and binding. Any appeal must be filed in the manner prescribed by the Ethics Review Commission within 5 calendar days of the notice given by the purchasing officer pursuant to Section 10(B).

(B) The purchasing officer shall waive a violation of Section 4(A) if the violation was solely the result of communications initiated by a City official or a City employee other than the authorized contact person.

(C) The purchasing officer has the authority to enforce this article through rules promulgated in accordance with Chapter 1-2 (*Adoption of Rules*), which at a minimum shall include a notice and protest process for respondents disqualified pursuant to Section 10 (*Disqualification;Contract Voidable*), including:

(1) written notice of the disqualification imposed pursuant to Section 10 (*Disqualification;Contract Voidable*);

(2) written notice of the right to protest the disqualification imposed; and

(3) written notice of the right to request an impartial hearing process.

1.10.10. DISQUALIFICATION; CONTRACT VOIDABLE.

(A) If the purchasing officer finds that a respondent has violated Section 2-7-104(1), the respondent is disqualified from participating in the solicitation to which the violation related.
(B) The purchasing officer shall promptly provide written notice of disqualification to a disqualified respondent.
(C) If a respondent is disqualified from participating in a solicitation as a result of violating Section 2-7-104(1) and the solicitation is cancelled for any reason, that respondent is also disqualified from submitting a response to any reissue of the same or similar solicitation for the same or similar project. For the purposes of this section, the purchasing officer may determine whether any particular solicitation constitutes a "same or similar solicitation for the same or similar project".
(D) If a respondent violates Section 104(1) and is awarded a contract resulting from the solicitation to which the violation relates, the City may void that contract.
(E) Respondents that violate Section 2-7-104(1) three or more times during a five year period may be subject to debarment from participating in any new contracts with the City for a period of up to three years.

1.11 City's Minority-Owned and Women-Owned Business Enterprise / Disadvantaged Business Enterprise (MBE/WBE or DBE) Program Requirements. Good Faith Efforts. When a bidder cannot achieve the MBE/WBE or DBE goals or subgoals established for the project, the bidder must document its Good Faith Efforts to meet the goals or subgoals. Good Faith Effort evaluations will consider, at a minimum, the bidder's efforts to do the following:

1.11.1 Soliciting through at least two reasonable, available and verifiable means MBEs/WBEs within the Significant Local Business Presence boundaries at least seven (7) business days prior to the bid opening date to allow the MBEs/WBEs or DBEs to respond to the bid.

1.11.2 Providing interested MBEs/WBEs or DBEs adequate information about the bid documents and requirements, including addenda, in a timely manner to assist them in responding to the bid.

1.11.3 Negotiating in good faith with interested MBEs/WBEs DBEs that have submitted bids to the bidder.

1.11.4 Publishing notice in a local publication such as a newspaper, trade association publication or via electronic/social media.

1.11.5 Not rejecting MBEs/WBEs or DBEs as being unqualified without sound reasons based on a thorough investigation of their capabilities.

1.11.6 Making economically feasible portions of the work available to MBE/WBE or DBE subcontractors and suppliers and to select those portions of the work or material needs consistent with the available MBE/WBE or DBE subcontractors and suppliers, so as to facilitate meeting the goals or subgoals.

1.11.7 The ability or desire of the bidder to perform the project work with its own organization does not relieve the bidder of the responsibility to make Good Faith Efforts.

1.11.8 Bidders are not required to accept higher quotes in order to meet the goals

or subgoals.

1.11.9 Effectively using the services of Minority Person/Women community organizations; Minority Person/Women Contractors groups; local, state and federal Minority Person/Women business assistance offices; and other organizations to provide assistance in solicitation and utilization of MBEs, WBEs and/or DBEs.

1.11.10 In assessing minimum Good Faith Efforts, the OWNER may consider (1) whether the bidder sought guidance from the City of Austin Small and Minority Business Resources Department (SMBR) on any question regarding compliance with these requirements; and (2) the performance of other bidders in meeting the goals.

For additional information, refer to the MBE/WBE or DBE Compliance Program Requirements Volume of the Project Manual.

Bid shopping is not allowed in conjunction with this solicitation and may result in the disqualification of prospective bidders and subcontractors.

2. ESTIMATES OF QUANTITIES (UNIT PRICE CONTRACTS ONLY)

Quantities listed in unit price Bid form are to be considered approximate quantities and will be used only for comparison of Bids. Payment to CONTRACTOR will be made only for actual quantities of Work performed or materials furnished in accordance with Contract and it is understood that quantities may be increased or decreased as provided in Section 00700, General Conditions, and as may be modified by Section 00810, Supplemental General Conditions.

3. DRAWINGS, PROJECT MANUAL AND SITE (S) OF WORK

Before submitting a Bid, the Bidder shall carefully examine the Bid Documents, site(s) of the proposed Work, soils, and other conditions that may affect the performance of the Work to satisfy the Bidder as to character, quality and quantities of Work to be performed and materials to be furnished. By submitting a Bid, the Bidder will be deemed to have certified that the Bidder has complied with these requirements. If, during preparation of the Bid, the Bidder discovers any suspected discrepancies or errors, the Bidder must immediately notify the Authorized Contact Person in writing of the suspected discrepancy or error. Failure to provide written notice of any suspected discrepancies or errors may be cause for rejection of the Bid.

4. BID GUARANTY

All Bids shall be accompanied by a Bid guaranty in an amount of not less than five percent (5%) of the total Bid. Bid guaranty will be a Bid bond with Power of Attorney attached, issued by a solvent surety authorized under laws of the State of Texas and acceptable to OWNER. For Bidders electing to submit Bids and Bid Guaranties electronically via Austin Finance Online, Bid Guaranties will be verified by the Owner prior to bid certification and electronic copies of Bid Guaranties will not be returned to Bidders.

The Bid guaranty accompanying the Bid of the three (3) apparent low Bidders will be retained until Contract is awarded and successful Bidder executes Contract and furnishes required bonds and insurance, after which Bid guaranties will be returned to the Bidders. All other Bid guaranties will be returned after Bid certification. In the event that the Bidder to whom the Contract is awarded fails to execute the Contract within five (5) working days of receipt

of a complete set of Contract Documents whether in electronic or hard copy form, the Bidder agrees that the OWNER in its discretion may rescind the initial award and award the Contract to the next lowest responsible Bidder.

5. PERFORMANCE AND PAYMENT BONDS

When performance and/or payment bonds are required, each shall be issued in an amount equal to the Contract Amount as security for the faithful performance and/or payment of all Contractor's obligations under the Contract Documents. Performance and payment bonds shall be issued by a solvent corporate surety authorized to do business in the State of Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law.

6. CONSIDERATION OF BID AMOUNT

For purpose of award, after Bids are opened, reviewed, and certified, the total amount of the Bid, including accepted Bid alternates, will be considered the amount of the Bid. Certified Bid tabulations will be made available to the public through the City's Vendor Connection website, log on www.austintexas.gov/financeonline/vendor_connection/index.cfm. OWNER reserves the right to reject any or all Bids and to waive any minor informality in any Bid or solicitation procedure (a minor informality is one that does not affect the competitiveness of the Bids).

7. SUBMISSION OF BID

Each Bid must be completed and signed by person(s) authorized to bind individual, partnership, firm, corporation, or any other legal entity submitting the Bid, and, shall include the following in one envelope or electronically via Austin Finance Online (see eResponse, Attachment 1 -Submitting Bids in Austin Finance Online):

7.1 One copy of Bid form (Section 00300L or 00300U) completed and signed.

7.2 Acknowledgment of receipt of Addenda issued in spaces provided in Bid form.

7.3 Required Bid guaranty (copy of Bid guaranty if submitted electronically via Austin Finance Online).

7.4 Required Information indicated in Drawings or Project Manual as specified in Section 00820.

7.5 One copy of Total Bid Form if bid is submitted electronically via Austin Finance Online.

Bid must be accompanied by an MBE/WBE or DBE Compliance Plan. Compliance Plans will either be submitted separately, in a second envelope or electronically via Austin Finance Online, prior to the date and time set forth in Section 00020, Invitation for Bids. The Compliance Plan forms are included in the MBE/WBE Procurement Program Package or DBE Procurement Program Package (a separately bound volume).

Bid shall include all specified items in this section submitted electronically via Austin Finance Online, or may be submitted to the Capital Contracting Office in a sealed envelope, clearly identified on outside as a Bid to OWNER, with Bidder's company name and address, project name, bid due date/time, signed acknowledgement of the number of Addenda received and authorized signature. Failure to submit Bid appropriately may subject Bidder to

disqualification.

Sealed Bids may be mailed using the address below:

Address for US Mail (If mailed to the physical address, the proposal will be returned unopened)
City of Austin
Capital Contracting Office
P. O. Box 1088
Austin, Texas 78767-1088

NOTE: Bids must either be received and time stamped in the Capital Contracting Office prior to the Due Date and Time or submitted electronically via Austin Finance Online. The time of record for those electronically submitted is the time received in Austin Finance OnLine. It is the responsibility of the Offeror to ensure that their Bid arrives at the reception desk in the Capital Contracting Office or electronically prior to the time and date indicated. Arrival at the City's mailroom, mail terminal, or post office box will not constitute the Proposal arriving on time.

It is the sole responsibility of the Bidder to ensure timely delivery of Bid. OWNER will not be responsible for failure of service on the part of the U.S. Post Office, courier services, or any other form of delivery service chosen by the Bidder. (See Section 00820, Modifications to Bidding Requirements and Contract Forms, for modifications to solicitations without MBE/WBE or DBE goals.)

In submitting its Bid, Bidder certifies that it has not lobbied the City or its officials, managers, employees, consultants, or contractors in such a manner as to influence or to attempt to influence the bidding process. In the event it reasonably appears that the Bidder influenced or attempted to influence the bidding process, the City may, in its discretion, reject the Bid.

8. WITHDRAWAL OF BID

A Sealed Bid may be withdrawn by a Bidder, provided an authorized individual of the Bidder submits a written request to withdraw the Bid prior to the time set for opening the Bids. For withdrawal of electronic bids see eResponse, Attachment 1 -Submitting Bids in Austin Finance Online)

9. REJECTION OF BIDS

9.1 The following **will** be cause to reject a Bid:

9.1.1 Failure to submit Section 00300 (Bid Form) and signed by an individual empowered to bind the Bidder.

9.1.2 Bids which are not accompanied by acceptable Bid guaranty, with Power of Attorney attached, or a letter certifying the Bidder's ability to be bonded, from a surety company, in accordance with Paragraph 4 above.

9.1.3 More than one Bid for same Work from an individual, firm, partnership or corporation.

9.1.4 Evidence of collusion among Bidders.

9.1.5 Sworn testimony or discovery in pending litigation with OWNER which discloses misconduct or willful refusal by contractor to comply with subject contract or instructions of OWNER.

9.1.6 Failure to submit MBE/WBE or DBE Compliance Plan in accordance with the separately bound volume titled MBE/WBE Procurement Program Package or DBE Procurement Program Package.

9.1.7 Failure to have an authorized agent of the Bidder attend the mandatory Pre-Bid Conference, if applicable.

9.1.8 Bids received from a Bidder who has been debarred or suspended by OWNER's Purchasing Officer.

9.1.9 Bids received from a Bidder when Bidder or principals are currently debarred or suspended by Federal, State or City governmental agencies. (Applicable for Bid amounts equal to or in excess of $25,000.00).

9.1.10 Bids received from a Bidder, who is identified on a list maintained by the Texas Comptroller of Public Accounts as a company known to have contracts with or provide supplies or services to a foreign terrorist organization, unless otherwise exempted from sanctions by the United States government.

9.2 The following **<u>may</u>** be cause to reject a Bid:

9.2.1 Poor performance in execution of work under a previous City of Austin contract.

9.2.2 Failure to achieve reasonable progress on an existing City of Austin contract.

9.2.3 Default on previous contracts or failure to execute Contract after award.

9.2.4 Evidence of failure to pay Subcontractors, Suppliers or employees in accordance with Contract requirements.

9.2.5 Bids containing omissions, alterations of form, additions, qualifications or conditions not called for by OWNER, or incomplete Bids may be rejected. In any case of ambiguity or lack of clarity in the Bid, OWNER reserves right to determine most advantageous Bid or to reject the Bid.

9.2.6 Failure to acknowledge receipt of Addenda.

9.2.7 Failure to submit any of the items specified below in paragraph 11, "Submission of Post Bid Information".

9.2.8 Failure to identify a dollar amount (price) of a unit price(s) in the 00300U including all Bid Alternates in the Bid Form 00300U or 00300L.

9.2.9 Failure to submit post-Bid information within the allotted time(s) (see paragraph 11 for post-Bid requirements).

9.2.10 Failure to timely execute Contract after award.

9.2.11 Previous environmental violations resulting in fines or citations by a governmental entity (i.e. U.S. Environmental Protection Agency, Texas Commission on Environmental Quality, etc.).

9.2.12 Safety record as set forth in Section 00410, Statement of Bidder's Safety Experience.

9.2.13 Failure of Bidder to demonstrate the minimum experience required as specified in Section 00400 if that Section is included in the bidding documents.

9.2.14 Evidence of Bidder's lack of sufficient resources, workforce, equipment or supervision, if required by inclusion of appropriate attachments in Section 00400.

9.2.15 Evidence of poor performance on previous Projects as documented in Owner's project performance evaluations.

9.2.16 Unbalanced Unit Price Bid: "Unbalanced Bid" means a Bid, which includes a Bid that is based on unit prices which are significantly less than cost for some Bid items and significantly more than cost for others. This may be evidenced by submission of unit price Bid items where the cost are significantly higher/lower than the cost of the same Bid items submitted by other Bidders on the project.

10. PROTEST PROCEDURES

The OWNER's Capital Contracting Officer has the authority to settle or resolve any claim of an alleged deficiency or protest. The procedures for notifying OWNER of an alleged deficiency or filing a protest are listed below. If you fail to comply with any of these requirements, the Capital Contracting Officer may dismiss your complaint or protest.

10.1 Prior to Bid opening: If you are a prospective Bidder and you become aware of the facts regarding what you believe is a deficiency in the solicitation process before the Bid is opened, you must notify OWNER in writing of the alleged deficiency before that date, giving OWNER an opportunity to resolve the situation prior to the Bid opening.

10.2 After Bid opening: If you submit a Bid to OWNER and (1) you have been found non-responsive, or (2) you believe that there has been a deficiency in the solicitation process or the award, you have the opportunity to protest the solicitation process or the recommended award as follows:

10.2.1 You must file written notice of your intent to protest within four (4) calendar days of the date that you know or should have known of the facts relating to the protest. If you do not file a written notice of intent within this time, you have waived all rights to protest the solicitation process or the award.

10.2.2 You must file your written protest within fourteen (14) calendar days of the date that you know or should have known of the facts relating to the protest unless you know of the facts before the Bid has been opened. If you know of the facts before that date, you must notify OWNER as stated above.

10.2.3 You must submit your protest in writing and must include the following information:

.1 your name, address, telephone, and email address;

.2 the solicitation number and the CIP number, if applicable;

.3 a detailed statement of the factual grounds for the protest, including copies of any relevant documents.

10.2.4 Your protest must be concise and presented logically and factually to help with OWNER's review.

10.2.5 When OWNER receives a timely written protest, the Capital Contracting Officer will determine whether the grounds for your protest are sufficient. If the Capital Contracting Officer decides that the grounds are sufficient, the Capital Contracting Office will schedule a protest hearing, usually within five (5) working days. If the Capital Contracting Officer determines that your grounds are insufficient, you will be notified of that decision in writing.

10.2.6 The protest hearing is informal and is not subject to the Open Meetings Act. The purpose of the hearing is to give you a chance to present your case; it is not an adversarial proceeding. Those who may attend from OWNER are: representatives from the department that requested the purchase, the Law Department, the Capital Contracting Office, and other appropriate City staff. You may bring a representative or anyone else that will present information to support the factual grounds for your protest with you to the hearing.

10.2.7 A decision will usually be made within fifteen (15) calendar days after the hearing.

10.2.8 The Capital Contracting Officer will send you a copy of the hearing decision after the appropriate City staff has reviewed the decision.

10.2.9 When a protest is filed, OWNER usually will not make an award until a decision on the protest is made. However, OWNER will not delay an award if the City Manager or the Capital Contracting Officer determines that:

.1 OWNER urgently requires the supplies or services to be purchased, or

.2 Failure to make an award promptly will unduly delay delivery or performance.

In those instances, the Capital Contracting Office will notify you and make every effort to resolve your protest before the award.

The protest or notice of intent and the protest shall be submitted in writing to:

Address for Delivery Service:
City of Austin
Capital Contracting Office
ATTN: Capital Contracting Officer
One Texas Center
505 Barton Springs Rd.
Suite 1045-A
Austin, Texas 78704
PHONE: 512/974-7141

Address for US Mail:
City of Austin
Capital Contracting Office
ATTN: Capital Contracting Officer
P.O. Box 1088
Austin, Texas 78767-1088

11. SUBMISSION OF POST BID INFORMATION

11.1 Prior to determination of the certified low Bidder, the three (3) apparent low Bidders must submit to OWNER the following information within three (3) business days of receipt

of notice of apparent low Bidder status by the OWNER:

11.1.1 One copy of Attachments A-I and any other specifically designated Attachments of the Statement of Bidder's Experience (Section 00400), completed and signed. (Unless provided to the contrary in Section 00820 Modifications to Bidding Requirements and Contract Forms). (Note: OWNER reserves the right to solely determine whether the comparable experience documentation provided by the Bidder is sufficient and relevant to the Work described in the Contract Documents for the Bidder to be considered a responsible Bidder.)

11.1.2 One Copy of the Certificate of Non-Suspension or Debarment (Section 00405), completed and signed. (Applicable for Bid amounts equal to or in excess of $25,000.00.)

11.1.3 One copy of Section 00410, Statement of Bidder's Safety Experience, including required attachments, completed and signed.

11.1.4 One copy of the Title VI Assurances Appendix A (Section 00631), completed and signed.

11.1.5 One copy of the Title VI Assurance Appendix E (Section 00632), completed and signed.

11.1.6 One copy of Exhibit A Federal Provisions (Section 00810A) completed and signed. (Federal projects only)

11.1.7 Such other information as is required to evaluate Bid or Bidder.

11.2 Upon notification of status as certified low Bidder, Bidder shall submit the following information to OWNER within three (3) business days:

11.2.1 Confirmation Letters between Bidder and all subcontractor(s) and all supplier(s) identified in the MBE/WBE Compliance Plan.

11.2.2 Section 00425A, Insurance Cost Form. For ROCIP projects.

11.2.3 Section 00425B, Contractor Affidavit of Receipt and Provision of ROCIP Information, and Subcontractor Affidavit of Receipt and Provision of ROCIP Information (for Subcontractor(s) of all tiers identified in the MBE/WBE Compliance Plan). For ROCIP projects.

11.2.4 Such other information as required. In addition, the Bidder acknowledges and agrees that the failure to timely provide the additional information required by this section will result in a determination that, for the purposes of this solicitation, the Bidder has not provided sufficient information for the OWNER to be able to determine that the Bidder is a responsible Bidder.

12. AWARD AND EXECUTION OF CONTRACT

OWNER will process Bids expeditiously. Award of Contract will be to the lowest, responsible Bidder meeting all requirements of the Bid Documents. OWNER may not award Contract to a nonresident Bidder unless the nonresident underbids the lowest Bid submitted by a responsible resident Bidder by an amount that is not less than the amount by which a resident Bidder would be required to underbid the nonresident Bidder to obtain a

comparable contract in the state in which the nonresident's principal place of business is located.

Award of Contract will occur within the period identified on the Bid form, unless mutually agreed between the parties. Capital Contracting Officer shall submit recommendation for award to the City Council for those project awards requiring City Council action. Contract will be signed by City Manager or his/her designee after award and submission of required documentation by Bidder. Contract will not be binding upon OWNER until it has been executed by both parties. OWNER will process the Contract expeditiously. However, OWNER will not be liable for any delays prior to the award or execution of Contract.

Upon contract award, the selected Bidder must submit either their existing or an updated personnel policy (on letterhead) documenting conformity with City Code, Chapter 5-4, § 5-4-2. If the company does not submit a copy of their personnel policy incorporating the non-discrimination policy, the City of Austin Nondiscrimination Policy (Section 00630) will be considered the Bidder's nondiscrimination policy.

In any case of ambiguity or lack of clarity in the Bid, OWNER reserves the right to determine the most advantageous Bid or to reject the Bid.

Notwithstanding anything in this Section 00100 to the contrary, the OWNER may award a contract for construction services in an amount of less than $100,000 to a bidder whose principal place of business is in the City of Austin and whose bid is within 5% of the lowest bid price received from a bidder whose principal place of business is not within the City of Austin, if the City finds that the local bidder offers the City the best combination of contract price and additional economic development opportunities for the City created by the contract award including the employment of resident of the City and increased tax revenues to the City.

13. PARTNERING

In order to complete the Work in a manner that is most beneficial to the OWNER and CONTRACTOR, OWNER and CONTRACTOR may form a "Partnering Team", which will include the E/A, and any major Subcontractors. This partnering relationship will draw on the strength of all parties to identify and achieve mutual goals. The objectives of this partnering relationship are effective and efficient communication and Contract performance, which is intended to ensure that the Project is completed within budget, on schedule, and in accordance with the Drawings and Specifications and other Contract requirements. While the partnering relationship will be multilateral in makeup and participation will be totally voluntary, the OWNER and CONTRACTOR agree to cooperate and use reasonable good faith efforts to discuss and resolve any and all Project issues and disputes. Section 01100, Special Project Procedures and/or Section 01200, Project Meetings contain additional information regarding the intent of the partnering relationship and responsibilities of the entities entering into the partnering charter.

14. ROCIP REQUIREMENTS

If the insurance on this Project will be under the Rolling Owner Controlled Insurance Program (ROCIP), the Bidder is directed to Section 00810, Supplemental General Conditions, Section 00820, Modifications to Bidding Requirements and Contract Forms, and the Project Safety Manual included with these contract documents for information and bidding requirements.

The Insurance Cost Form, Section 00425A must be accurately completed and submitted with the Bid to indicate insurance removed from Base Bid and Alternates. CONTRACTOR shall remove from the Bid the cost of insurance for the CONTRACTOR and Subcontractors of all tiers working on site.

The Rolling Owner Controlled Insurance Program Information, Section 00425 B, Contractor Affidavit of Receipt and Provision of ROCIP Information and Subcontractor Affidavit of Receipt and Provision of ROCIP Information for subcontractor(s) of all tiers identified in the MBE/WBE Compliance Plan must be accurately completed and submitted by the certified low bidder as a post bid submittal. Subcontractor Affidavits must be submitted throughout the duration of the Contract as Subcontractor(s) are added.

15. SIGNATURE REQUIREMENTS

The Bid and any subsequent supporting Bid documents and Contract must be executed in the Bidder's full name and legal entity status by an authorized representative of the Bidder. Accordingly, a partnership/joint venture must file its partnership/joint venture agreement, a corporation must file its articles and bylaws, a limited liability company must file its certificate of organization and article of organization and regulations, and a limited partnership must file not only limited partnership agreement and the certificate of limited partnership, but also the documentation for its general partner, and any Bidder must file a copy of any assumed name certificate, or such limited portion of such documents reasonably establishing signature authority.

16. CONTRACTOR EVALUATION

The Owner will review and evaluate the Contractor's Work and performance on the Project and provide the Contractor with a written Contractor Evaluation Report in accordance with City of Austin Administrative Rule R161-13.37. Rule R161-13.37 provides an appeal process. http://www.austintexas.gov/department/contract-management

17. TEXAS ETHICS COMMISSION CERTIFICATE OF INTERESTED PARTIES DISCLOSURE FORM

17.1 Definitions:

17.1.1 "Interested Party" – means a person who has a controlling interest in a Business Entity with whom the Owner contacts or who actively participates in facilitating the Contract or negotiating the terms of the Contract, including a broker, intermediary, adviser, or attorney for the Business Entity.

17.1.2 "Business entity" - includes an entity through which business is conducted with a governmental entity or state agency, regardless of whether the entity is a for-profit or nonprofit entity. The term does not include a governmental entity or state agency.

17.2 As a condition to entering the Contract, the Business Entity constituting the successful Bidder must provide a Texas Ethics Commission Certificate of Interested Parties Form to the Owner at the time the Business Entity/Bidder submits the signed Contract to the Owner in full compliance with the following requirements under which the successful Bidder shall:

17.2.1 Go to the Ethics Commission's website (www.ethics.state.tx.us),

17.2.2 Complete the "Interested Parties" information, in accordance with the requirements of the Texas Ethics Commission Rules published at Title 1, Part 2, Chapter 46, of the Texas Administrative Code and available on the referenced website,

17.2.3 Include the City's contract identification number,

17.2.4 Include a short description of the goods or services to be used by the City, and

17.2.5 Indicate whether each interested party has a controlling interest in the business entity, is an intermediary in the contract for which the disclosure is being filed, or both.

17.3 In accordance with the Commission Rules, the Certificate of Filing and completed Certificate of Interested Parties must be (i) printed, (ii) signed by an authorized agent of the business entity, and (iii) submitted to the City at the time of the submission of the signed contract to the City. The City then must notify the Ethics Commission in electronic format of receipt of the document within 30 days of contracting and the Commission will make the disclosure of interested parties available to the public on its website.

END

GEOTECHNICAL DATA
Section 00220

1. OVERVIEW

Depending on Project requirements, OWNER may have obtained geotechnical information, which may include laboratory test results and logs of borings from geotechnical consultants. That information will be included in this section and/or on the Drawings. The CONTRACTOR shall be familiar with the subsurface materials and conditions on the Project and shall be knowledgeable of how they will affect the Work. The following is a partial listing of sources of information available to the CONTRACTOR about subsurface materials and conditions: the geotechnical information provided by the OWNER; geologic maps, publications and reports available from the University of Texas Bureau of Economic Geology at the J.J. Pickle Research Center in Austin, Texas; subcontractors familiar with local ground conditions; and, local consulting geologists and geotechnical engineers. The CONTRACTOR may make their own subsurface investigations.

Geotechnical Engineering Report, **COA Service Center Improvements – St. Elmo SCB #8**, dated October 14, 2020, prepared by Terracon is attached. The requirements in the Drawings and Specifications shall be used in the event of a conflict between this report and the Drawings and Specifications.

END

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Geotechnical Engineering Report

COA Service Center Improvements – St. Elmo SCB #8
Austin, Texas
October 14, 2020
Terracon Project No. 96195433

Prepared for:
GSC Architects
Austin, Texas

Prepared by:
Terracon Consultants, Inc.
Austin, Texas

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October 14, 2020

GSC Architects
3100 Alvin DeVane Blvd., Bldg. A, Suite 200-B
Austin, Texas 78741

Attn: Ms. Bonny Gray – Senior Associate
P: (512) 433-2504
E: gray@gscarchitects.com

Re: Geotechnical Engineering Report
COA Service Center Improvements – St. Elmo SCB #8
Sponberg Dr. & Meinardus Dr.
Austin, Texas
Terracon Project No. 96195433

Dear Ms. Gray:

We have completed a subsurface exploration and Geotechnical Engineering evaluation for the above referenced project. This study was performed in general accordance with Terracon Proposal No. P96195433, Rev. 2 dated January 24, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, subgrade preparation, and the design and construction of foundations, pavements, and site improvements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Larson M. Snyder, P.E.
Senior Staff Geotechnical Engineer

STATE OF TEXAS
LARSON M. SNYDER
133600
LICENSED
PROFESSIONAL ENGINEER

10/14/2020

Bryan S. Moulin, P.E.
Senior Principal, Geotechnical Services

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Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

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Geotechnical Engineering Report

COA Service Center Improvements – St. Elmo SCB #8
Sponberg Dr. & Meinardus Dr.
Austin, Texas

Terracon Project No. 96195433
October 14, 2020

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed COA Service Center Improvements – St. Elmo SCB #8 project to be located at Sponberg Dr. & Meinardus Dr. in Austin, Texas. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Demolition considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of one (1) test boring designated SE-1 to a depth of approximately 30 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring log and as separate graphs in the **Exploration Results** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project is at the existing St. Elmo Service Center Building located at the southeast corner of the Sponberg Dr. & Meinardus Dr. intersection in Austin, Texas. See **Site Location**
Existing Improvements	One industrial structure, two storage structures, and associated pavement sections and landscaped areas.
Current Ground Cover	Grass, scattered trees, asphalt, and concrete.
Existing Topography	Based on Google Earth Pro®, the project site appears to slope from the highest elevation of EL ~653 feet in the northeast corner to the lowest elevation of EL ~647 feet in the southwest corner of the project site.
Geology	Based on the available geologic information and the samples obtained, the subsurface profile at the project site consists of deep soil deposits of expansive fat clays and clayey gravels.

PROJECT DESCRIPTION

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

Item	Description
Information Provided	The project information and site location were provided via e-mail on November 23, 2019 from Ms. Bonny Gray of GSC Architects.
Proposed Structures	Secure entry, building addition, and new parking along Meinardus Drive.
Finished Floor Elevation	Unknown at this time but anticipated to be ≤ 3 feet from existing grades.
Grading/Slopes	Unknown at this time but anticipated to be ≤ 3 feet from existing grades.
Below-Grade Structures	None planned.
Free-Standing Retaining Walls	None planned.
Pavements	Flexible (asphalt) and rigid (concrete) pavement sections are being considered.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at the exploration point are indicated on the individual log. The individual log can be found in the **Exploration Results** section.

Model Layer	Layer Name	General Description
1	Upper Fat Clay	Fill Material; Dark brown to brown to gray, stiff to hard; with chert fragments and plastic debris
2	Intermediate Clayey Gravel	Light tan to pale brown; dense to very dense
3	Lower Fat Clay	Tan, very stiff; with light gray seams and ferrous stains

Groundwater

The borehole was observed while drilling and after completion for the presence and level of groundwater. Groundwater was not observed in the boring while drilling, nor for the short duration the boring could remain open. However, this does not necessarily mean no groundwater may be present at the site as groundwater conditions can (and likely will) vary between the time of the geotechnical investigation and the timeframe of construction activities.

Groundwater seepage is possible at this site, particularly in the form of seepage traveling along pervious seams/fissures (most likely Stratum 2 clayey gravel) and/or along soil stratum interfaces. Due to the low permeability of the fat clay soils encountered in the boring, a relatively long period may be necessary for a groundwater level to develop and stabilize in a borehole. Long term observations in piezometers sealed from the influence of surface water are often required to define groundwater levels in materials of this type. Please contact us if this is desired. Groundwater conditions should be evaluated immediately prior to construction.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the boring was performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring log. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

The near surface, stiff to hard high plasticity Stratum 1 fat clay could become problematic with typical earthwork and construction traffic, especially after precipitation events. Effective drainage should be completed early in the construction sequence and maintained after construction to avoid potential issues. Additional site preparation recommendations including subgrade improvement and fill placement are provided in the **Earthwork** section.

The subgrade soils consist of high plasticity fat clay, therefore extensive subgrade preparation is necessary in order to reduce post-construction movements to about ¾ inch. Alternatively, floor slabs may be designed as a structurally suspended slab with void forms underneath the slab. The **Building Subgrade Preparation** section addresses both slab options.

Support of floor slabs and pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by following the recommendations contained in this report. To take advantage of the cost benefit of not removing the entire amount of undocumented fill, the owner must be willing to accept the risk associated with building over the undocumented fills following the recommended reworking of the material. Should this be the case, development can be supported on a shallow foundation system.

The **Shallow Foundations** section addresses the support of the structure addition on a monolithic slab-on-grade foundation or spread/strip footing foundation bearing into select fill. The **Deep Foundations** section addresses support of the structure addition on drilled piers bearing into Stratum 2 soils. The **Building Subgrade Preparation** section addresses slab support of the structure addition.

Asphaltic concrete and/or portland cement concrete pavement systems are recommended for this site. The **Pavements** section addresses the design of pavement systems.

The **General Comments** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include demolition, clearing and grubbing, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

After demolition of the existing site improvements, construction areas should be stripped of all vegetation, concrete, asphalt, loose soils, fill soils, top soils, construction debris, and other unsuitable material currently present at the site. Roots of trees to be removed within construction areas, if any, should be grubbed to full depths, including the dry soil around the roots. All remnants of existing foundations, if any, should be completely excavated and removed to at least 2 feet below finished grades. If any unusual items are unearthed during or after demolition, please contact us for further evaluation. Utilities to be abandoned should be completely removed from all proposed construction areas. If this is not feasible, then the abandoned utility piping should be filled with flowable fill (COA Item No. 402S) and plugged such that it does not become a conduit for water flow. We recommend that Terracon be retained to assist in evaluating exposed subgrades during earthwork so that unsuitable materials, if any, are removed at the time of construction.

Proof-Rolling

Once initial subgrade elevations have been achieved (i.e., after cuts but prior to fills), the exposed subgrade in all construction areas (except landscaping) should be carefully and thoroughly proof-rolled with a 20-ton pneumatic roller, fully-loaded dump truck, or similar equipment to detect weak zones in the subgrade. Weak areas detected during proof-rolling, zones containing debris or organics, and voids resulting from removal of tree roots, existing foundation elements, utilities, fill, boulders, etc. should be removed and replaced with soils exhibiting similar classification, moisture content, and density as the adjacent in-situ soils (or flowable fill). Proper site drainage should be maintained during construction so that ponding of surface runoff does not occur and cause construction delays and/or inhibit site access.

Moisture-Conditioned Subgrade

After proof-rolling, and just prior to placement of fill, the exposed soil subgrade in all construction areas (except landscaping) should be evaluated for moisture and density through field density testing. If the moisture and/or density requirements do not meet the moisture and density requirements below, the subgrade should be scarified to a minimum depth of 6 inches, moisture conditioned and compacted as per the fill compaction requirements.

Existing Fill

As noted in **Geotechnical Characterization**, boring SE-1 encountered existing fill to depths ranging from about 0 to 6 feet. We have no records to indicate if the fill was placed in a controlled manner or, the degree of control if it was placed in a controlled manner. Support of footings, floor slabs, and pavements on or above existing fill soils is discussed in this report. However, even with the recommended construction procedures, there is an inherent risk for the owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions associated with the fill cannot be eliminated without completely removing the existing fill, but can be reduced by following the recommendations contained in this report.

If the owner elects to construct the footings and floor slabs in areas of existing fill, the recommendations provided in **Building Subgrade Preparation** should be followed.

If the owner elects to construct pavements on the existing fill, the following protocol should be followed. Once the planned grading has been completed, the area should be undercut 12 inches within the pavement areas. Once materials have been removed, the entire area should be proof-rolled to aid in delineating areas of soft, or otherwise unsuitable soil. Once unsuitable materials have been remediated, and the subgrade has passed the proof-roll, grades can be raised to finished grades with properly compacted pavement fill.

Fill Material Types

Fill required to achieve design grade should be classified as select/structural fill and general fill. Select/structural fill is material used below, or within 5 feet of structures. General fill is material used to achieve grade in paving, non-reinforced earthen slopes, landscape, or other general areas (non-structural areas). Earthen materials used for select fill and general fill should meet the following material property requirements:

Fill Type [1]	USCS Classification	Acceptable Specifications
Imported Select/Structural Fill [2,3]	CL, SC, and/or GC	■ TxDOT Item 247, Type A, Grade 3, OR ■ Percent Retained on No. 4 Sieve ≤ 40 percent with 7≤PI≤20 and rocks ≤ 4 inches in maximum dimensions, OR ■ Crushed concrete (TxDOT Item 247, Type D, Grade 3 or better)
Paving Fill and General Fill [4]	CH, CL, SC and/or GC	■ On-Site Soils: Rocks ≤ 4 inches in maximum dimension ■ Imported Soils: PI ≤ 30; Rocks ≤ 4 inches in maximum dimension

Fill Type [1]	USCS Classification	Acceptable Specifications

1. Structural and general fill should consist of approved materials free of organic matter and debris. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. As an alternative to the Acceptable Specifications above, a low-plasticity granular material which does not meet these specifications may be used only if approved by Terracon.
3. Based on the laboratory testing performed during this exploration, the excavated Stratum 1 fat clay soils are not suitable for re-use as select fill. We do not recommend these soils be considered for re-use as select fill when planning budgets. It is possible that some of the Stratum 2 clayey gravel could be acceptable (one test yielded a PI of 23); however, additional testing would be needed on the excavated soils to determine its suitability for select fill.
4. Excavated on-site soils, if free of organics, debris, and rocks larger than 4 inches may be considered for re-use as fill in pavement, landscape, or other general areas. Please note that the on-site soils exhibit high to very high shrink/swell potential. For economic reasons, expansive soils are often used in pavement and/or flatwork areas. The owner should be aware that the risk exists for future movements of the subgrade soils which may result in movement and/or cracking of pavement and/or flatwork. If paving fill is imported, the PI should not exceed 30.

Fill Compaction Requirements

Recommended compaction and moisture content criteria for engineered fill materials are as follows.

Material Type		Minimum Compaction Requirement (%)[1]	Moisture Content Range (%)	Maximum Loose Lift Thickness (in) [2]
Select/Structural Fill		95 [3]	-3 to +3	8 inches
Moisture Conditioned Building Subgrade and Fill	**PI ≤ 25**	95	-3 to +3	
	PI > 25	95	Optimum to +4	
Paving Fill, Paving Subgrade and General Fill	**PI ≤ 25**	95	-3 to +3	
	PI > 25	95	Optimum to +4	
Crushed Limestone Base (beneath pavements)		100 [4]	-3 to +3	

1. Per TEX-114-E or TEX-113-E, depending upon material type and gradation.
2. Fill lift thickness must be reduced (typically 4 to 6 inches) if light compaction equipment is used, as is customary within a few feet of retaining walls and utility trenches.
3. **For fills greater than 5 feet in depth, if any, the compaction should be increased to at least 100 percent of the maximum dry unit weight.**
4. Per TEX-113-E.

Utility Trench Backfill

Leaking pipes underneath and/or near the foundations will increase the moisture content of the surrounding subgrade soils and will likely result in a PVR greater than discussed for these soils. For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. We recommend constructing an effective clay or flowable fill "trench plug" that extends at least 2 feet out from the face of the building exterior. The clay fill/flowable fill should be placed to completely surround the utility line and it should fill the utility trench completely in width and height, with the exception of topsoil at the surface. If clay plug is used, it should be fat clay with a minimum PI of 30 and should be compacted to comply with the water content and compaction recommendations for moisture conditioned building subgrade fill as specified in **Fill Compaction Requirements**. If flowable fill is used, it should be in accordance with COA Item 402S.

Utility lines will be placed in backfilled trenches surrounded by highly expansive clays capable of moving cyclically throughout the year as much as 2½ inches. This level of movement can lead to bending, cracking, or separation of utility connections. After surrounding the utility pipe with bedding material, utility trenches should be backfilled with similar soils as the surrounding subsurface (i.e. select fill within the building pad and on-site clays in landscaping and paving areas). In unpaved areas outside of the building, the utility trenches should be capped with a trench cap of fat clays at least 18 inches thick. Joints and connections to the building should be designed by the MEP as flexible connections to tolerate the potential soil movements. If the slab is elevated with a crawl space, the utilities could be hung from the bottom of the slab above the fat clay soils. Hanging utilities will still require flexible connections where they connect into underground portions of the utility.

Grading and Drainage

The performance of the proposed addition will not only be dependent upon the quality of construction, but also upon the stability of the moisture content of the near surface soils. Therefore, we highly recommend that site drainage be developed so that ponding of surface runoff near the addition does not occur. Accumulation of water near the addition may cause significant moisture variations in soils adjacent to the addition, thus increasing the potential for structural distress.

Effective drainage away from the addition must be provided during construction and maintained through the life of the proposed project. Infiltration of water into excavations should be prevented during construction. It is important that foundation soils are not allowed to become wetted. All grades must provide effective drainage away from the addition during and after construction. The most effective way to achieve this would be to provide concrete aprons (i.e., concrete sidewalks/pavements directly abutting the building) around the exterior perimeter of the addition for at least 6 feet (1 foot wider than the select fill overbuild). The concrete should be sloped to provide drainage away from the addition and all joints should be sealed, particularly those directly abutting the addition. In lieu of providing concrete aprons and if sloping unpaved ground is planned around the addition, then the select fill overbuild (recommended 5 feet beyond the building limits) should be excavated to a depth of at least 2 feet below final grades, removed and replaced with a minimum of 2 feet of moisture conditioned and compacted on-site fat clay soils. The fat clay soils should be compacted and moisture conditioned as per the **Fill Compaction Requirements** section of this report. This procedure is recommended to reduce the possibility of surface runoff infiltrating into the more pervious select fill soils and ponding below the proposed building. We would be glad to discuss other measures (e.g. horizontal or vertical barriers) to reduce moisture infiltration in unpaved areas, if desired. Exposed (unpaved) ground should be sloped at a minimum of 5 percent away from the addition for at least 10 feet beyond the perimeter of the addition. Locally, flatter grades may be necessary to transition ADA access requirement for flatwork.

Roof runoff and surface drainage should be collected and discharged away from the s addition to prevent wetting of the foundation soils. Roof gutters should be installed and connected to downspouts and pipes directing roof runoff at least 10 feet away from the addition or discharged on to positively sloped pavements.

Sprinkler mains and spray heads should preferably be located at least 5 feet away from the addition such that they cannot become a potential source of water directly adjacent to the addition. In addition, the owner and/or builder should be made aware that placing large bushes and trees adjacent to the structures may cause significant moisture variations in the soils underlying the structures. In general, tree roots can adversely influence the subsurface soil moisture content to a distance of 1 to 1½ times the mature height of the tree and beyond the tree canopy. Watering of vegetation should be performed in a timely and controlled manner and prolonged watering should be avoided. Landscaped irrigation adjacent to the foundation units should be minimized or eliminated. Special care should be taken such that underground utilities do not develop leaks with time.

After building construction and landscaping, final grades should be verified to document effective drainage has been achieved. Grades around the addition should also be periodically inspected and adjusted as necessary as part of the structure's maintenance program. Where paving or flatwork abuts the addition, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration. Water permitted to pond next to the addition can result in greater soil movements than those discussed in this report. Estimated movements described in this report are based on effective drainage for the life of the addition and cannot be relied upon if effective drainage is not maintained.

Earthwork Construction Considerations

Based on our test boring, highly expansive Stratum 1 soils that exhibit a potential for volumetric change during moisture variations are present at this site. These subgrade soils at the surface may experience expansion and contraction due to changes in moisture content. Based on estimated final grades and existing grades, the soils at this site could exhibit a Potential Vertical Rise (PVR) of up to about 2½ inches, as estimated by the TxDOT Method TEX-124-E.

Excavations, for the proposed structure and utilities, are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of floor slabs. Construction traffic over the completed subgrades should be avoided as much as possible. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over, or adjacent to, construction areas should be removed. If the subgrade desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted, prior to floor slab construction.

Groundwater may affect over-excavation efforts, especially during the construction of the building pad or replacement of lower strength soils. A temporary dewatering system consisting of sumps with pumps could be necessary to achieve the recommended depth of over-excavation. Sump pits should preferably be excavated just outside the building pad limits.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be documented under the direction of the Geotechnical Engineer. This should include documentation of adequate removal of vegetation and top soil, proof-rolling and mitigation of areas delineated by the proof-roll to require mitigation and density/moisture testing of subgrade and fills. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should be contacted to evaluate the conditions.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Fill should be tested for density and water content at a frequency of at least one test for every 5,000 square feet per lift of compacted fill in the building areas (with a minimum of 3 tests per lift) and 10,000 square feet per lift in pavement areas. A minimum of one density and water content test should be conducted for every 100 linear feet of compacted utility trench backfill in paving areas.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

If the site has been prepared in accordance with the requirements noted in **Earthwork** and **Building Subgrade Preparation**, the following design parameters are applicable for shallow foundations.

Design Parameters – Monolithic Slab-On-Grade

A conventional monolithic slab-on-grade foundation system bearing into select fill would be appropriate to support the proposed structure additions provided subgrade preparation as described in **Building Subgrade Preparation** is followed. The slab foundation design parameters presented in the tables below are based on the criteria published by the Building Research Advisory Board (BRAB), the Prestressed Concrete Institute (PCI), and the Wire Reinforcement Institute (WRI). These are essentially empirical design methods and the recommended design parameters are based on our understanding of the proposed project, our interpretation of the information and data collected as a part of this study, our area experience, and the criteria published in the BRAB, PCI, and WRI design manuals.

Conventional Slab and Beam System Parameters	
Description	**Design Parameter**
Minimum Embedment of Grade Beams below Final Grade [1]	18 inches
Bearing Stratum	Select Fill
Bearing Pressures (allowable) [2]	Net Dead plus Sustained Live Load – 1,700 psf Net Total Load – 2,500 psf
Subgrade Modulus (k) [3]	125 pci
Approximate Potential Vertical Rise (PVR)	About ¾ inch [4,5]

1. Embedment is to reduce surface water migration below the foundation elements and to develop proper end bearing and is not based on structural considerations. The grade beam width and depth should be properly evaluated by the structural engineer. Grade beams may be thickened and widened at interior column locations to serve as spread footings at these concentrated load areas.
2. Grade beams should bear on compacted select fill.
3. Several design methods use the modulus of subgrade reaction, k, to account for soil properties in design of flat, floor slabs. The modulus of subgrade reaction is a spring constant that depends on the kind of soil, the degree of compaction, and the moisture content. Based on our recommendations provided in **Building Subgrade Preparation**, the above indicated subgrade modulus can be used for design of a flat, grade-supported floor slab.
4. Differential movements may result from variances in subsurface conditions, loading conditions and construction procedures. We recommend that measures be taken whenever practical to increase the tolerance of the building to post-construction foundation movements. An example of such measures would be to provide frequent control joints for exterior masonry veneers and interior sheetrock walls (particularly near doors and windows) to control cracking across such walls and concentrate movement along the joints.
5. The building subgrade should be properly prepared as described in **Building Subgrade Preparation**.

BRAB/WRI/PCI Parameters			
Description	**Design Parameter**		
Design Plasticity Index (PI) [1]	BRAB/WRI/PCI	Prepared Subgrade [2]	24
Climatic Rating (C_w)			17
Unconfined Compressive Strength			1.0 tsf
Soil Support Index (C) for BRAB		Prepared Subgrade [2]	0.90

1. The BRAB effective PI is equal to the near surface PI if that PI is greater than all of the PI values in the upper 15 feet. If the near-surface PI is not highest (i.e., after the building pad is prepared), then the effective PI is the weighted average of the upper 15 feet. The WRI/PCI effective PI is always the weighted average of the PI values in the upper 15 feet.
2. The building subgrade should be properly prepared as described in **Building Subgrade Preparation**.

Design Parameters – Footings

Principal column and wall loads for the proposed structure may be supported on isolated (spread) and/or continuous (strip) footings bearing into select fill. Design parameters for spread/strip footing foundations are provided below.

Description	Design Parameter
Bearing Stratum [1]	Select Fill
Minimum Embedment Below Final Grade [2]	24 inches
Minimum Footing Dimensions	Spread – 3 feet by 3 feet square Strip – 18 inches wide
Allowable Bearing Pressures [3,4]	Net dead plus sustained live load – 1,700 psf Net allowable total load – 2,500 psf
Approximate Total Movement [5]	¾ inch
Estimated Differential Movement [6]	½ to ¾ inch
Nominal (unfactored) Passive Resistance [7]	360 psf per foot of depth
Coefficient of Sliding Resistance [8]	0.35
Nominal (unfactored) Uplift Resistance [9]	Foundation Weight (150 pcf) & Soil Weight (120 pcf)

1. Unsuitable or soft soils must be over-excavated and replaced per the recommendations presented in **Earthwork** and the building area should be prepared as per **Building Subgrade Preparation**.
2. To bear within select fill soils.
3. Whichever condition yields a larger bearing area.
4. Values provided are for maximum loads noted in **Project Description**.
5. The estimated post-construction settlement of the shallow footings is assuming proper construction practices are followed.
6. Differential settlements may result from variances in subsurface conditions, loading conditions and construction procedures. The settlement response of the footings will be more dependent upon the quality of construction than upon the response of the subgrade to the foundation loads.
7. Passive resistance should be neglected in the first 12 inches below finished grades. Care should be taken to avoid disturbance of the footing bearing area since loose material could increase settlement and decrease resistance to lateral loading. If the footing is formed during construction, the open space between the footings and the in-situ soils should be backfilled with concrete.
8. Lateral loads transmitted to the footings will be resisted by a combination of soil-concrete friction on the base of the footings and passive pressure on the side of the footings. We recommend that the allowable frictional resistance be limited to 500 psf.
9. The nominal values should be reduced by an appropriate factor of safety to compute allowable values.

Construction Adjacent to Existing Building

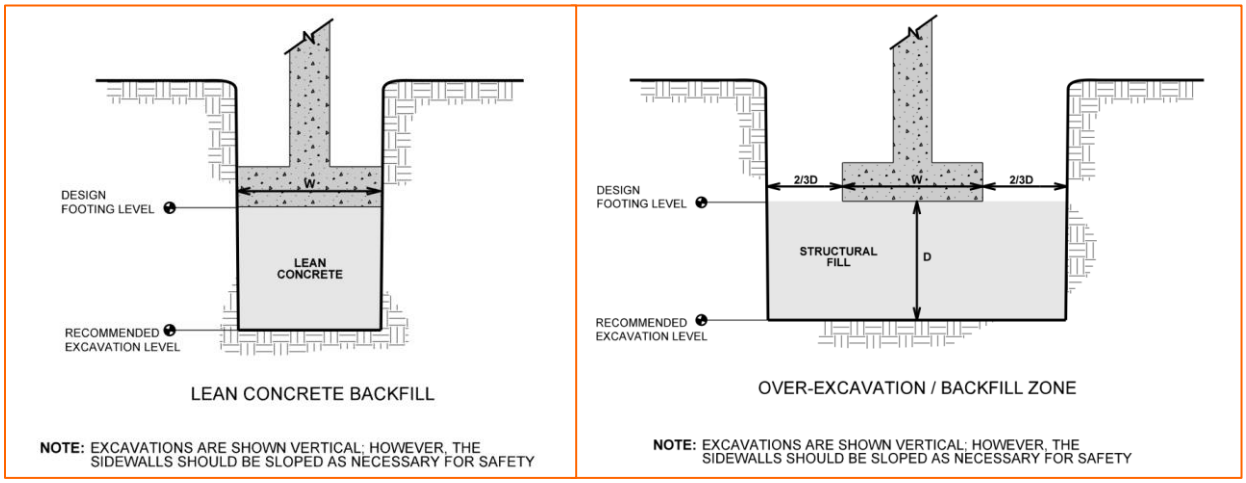
Differential settlement between the additions and the existing building is expected to approach the magnitude of the total settlement of the addition. Expansion joints should be provided between the existing building and the proposed addition to accommodate differential movements between the two structures. Underground piping between the two structures should be designed with flexible couplings and utility knockouts in foundation walls should be oversized, so minor deflections in alignment do not result in breakage or distress. Care should be taken during excavation adjacent to existing foundations, to avoid disturbing existing foundation bearing soils.

New footings or grade beams should bear at or near the bearing elevation of immediately adjacent existing foundations. Depending upon their locations and current loads on the existing footings, footings for the new addition could cause settlement of adjacent walls. To reduce this concern and risk, clear distances at least equal to the new footing widths should be maintained between the addition's footings and footings supporting the existing building.

Foundation Construction Considerations

Footings or grade beams should be neat excavated, if possible. If neat excavation is not possible, the foundation should be properly formed. If a toothed bucket is used, excavation with this bucket should be stopped approximately 6 inches above final grade of the footings and the footing excavation be completed with a smooth-mouthed bucket or by hand labor. Debris in the bottom of the excavation should be removed prior to steel reinforcement placement. The foundation excavation should be sloped sufficiently to create internal sumps for runoff collection and removal. If surface runoff water or groundwater seepage in excess of ½-inch accumulates at the bottom of the foundation excavation, it should be collected, removed, and not allowed to adversely affect the quality of the bearing surface.

If unsuitable bearing soils are encountered at the base of the planned footing excavation (such as low strength or disturbed soils), the footing excavations should be deepened to expose suitable bearing materials. The footings could then bear directly on these soils at the lower level, on lean concrete backfill placed in the excavations, or on compacted structural fill backfilled in the excavations and compacted as in **Earthwork**. This is illustrated in the figure below.



Concrete should be placed as soon as possible after excavation to reduce bearing soil disturbance. Soils at bearing level that become disturbed or saturated should be removed prior to placing reinforcing steel and concrete. Adequate water control/dewatering system will aid in minimizing the need for over-excavation and backfill of any soils disturbed by prolonged exposure. It is important that the foundation subgrade not be disturbed by construction activities (e.g., setting forms and placing reinforcing steel). If disturbance occurs, we recommend that the disturbed soils be removed and that the foundation subgrade be protected with the placement of a lean concrete "mud mat".

Foundation Construction Observation

The performance of the foundation system for the proposed structure will be highly dependent upon the quality of construction. Thus, we recommend that the foundation construction be monitored by Terracon to identify the proper bearing strata and depths and to help evaluate foundation construction. We would be pleased to develop a plan for foundation observation to be incorporated in the overall quality assurance program.

DEEP FOUNDATIONS

Drilled Pier Design Parameters

Soil design parameters are provided below in the **Drilled and Underreamed Pier Design Summary** table for the design of straight-sided drilled and underreamed pier foundations bearing into Stratum 2 clayey gravel soils. The values presented for allowable side friction and end bearing include a factor of safety.

Drilled Pier Design Summary	
Description	**Drilled Pier Design Parameters**
Bearing Stratum [1]	Stratum 2 soils
Minimum Concreted Pier Length	12 feet
Minimum Pier Diameter	18 inches
End Bearing Pressure (net allowable) [2]	Net dead plus sustained live load – 8,000 psf Net total load – 12,000 psf
Side Friction (net allowable) [3]	800 psf
Minimum Percentage of Steel [4]	½ percent
Approximate Total Settlement [5,6]	¾ inch maximum
Estimated Differential Settlement [5,6]	Approximately ½ to ¾ inch

1. To bear within the Stratum 2 and/or 3 soils.
2. Whichever condition yields a larger bearing area. The minimum pier depth refers to the concreted length of the pier and is based on existing site surface grades.
3. Side friction should be neglected in the upper 7 feet of the pier in contact with soil. Permanently cased pier sections, if any, may not be accounted towards the side friction capacity.
4. Soil-related uplift does not appear to be a concern at this site, assuming the recommendations in **Earthwork** and **Building Subgrade Preparation** are followed. However, we do recommend that the minimum percentage of reinforcing steel be no less than ½ percent of the gross shaft area and extend over the full length of the pier. If a structurally suspended slab is used without subgrade preparation, then we recommend steel percentage be increased to 1 percent.
5. Provided proper construction practices are followed. For adjacent piers, we recommend a minimum edge-to-edge spacing of at least 2 pier diameters (or 3 pier diameters center to center) based on the larger pier diameter of the two adjacent piers. In locations where this minimum spacing criterion cannot be accomplished, Terracon should be contacted to evaluate the locations on a case-by-case basis.
6. Will result from variances in the subsurface conditions, loading conditions and construction procedures, such as cleanliness of the bearing area or flowing water in the shaft.

Drilled Pier Construction Considerations

Drilled pier foundations should be augered and constructed in a continuous matter. Concrete should be placed in the pier excavations following drilling, underreaming, and evaluation for proper bearing stratum, embedment, and cleanliness. The piers should not be allowed to remain open overnight before concrete placement. Surface runoff or groundwater seepage accumulating in the excavation should be pumped out and the condition of the bearing surface should be evaluated immediately prior to placing concrete. Difficulties in drilling might develop in Stratum 2 clayey gravel soils due to variations in consistency, gravel content, and the possible presence of cobbles and boulders within the soils.

Although groundwater was not encountered during our field program, zones of groundwater inflow and/or sloughing soils are a possibility during pier construction at this site. Therefore, provisions should be incorporated into the plans and specifications to utilize casing to control sloughing and/or groundwater seepage during pier construction.

The use of casing should help to minimize groundwater inflow into the pier excavation. If soil sloughing or groundwater seepage is encountered at the proposed depth of a pier, it may be necessary to extend the excavation to a depth where the casing can control sloughing and/or seal off groundwater. If seepage persists even after casing installation and casing extension, the water should be pumped out of the excavation immediately prior to placing concrete. If groundwater inflow is too severe to be controlled by pumping, the concrete should be tremied to the full depth of the excavation to effectively displace the water. In this case, a “clean-out” bucket should be used to remove loose soil and/or rock fragments from the pier bottom before placing steel and concrete.

Care should be taken to not disturb the sides and bottom of the excavation during construction. The bottom of the shaft excavation should be free of loose material before concrete placement. Water or loose soil should be removed from the bottom of the drilled shafts prior to placement of the concrete. Concrete should be placed as soon as possible after the foundation excavation is completed, to reduce potential disturbance of the bearing surface.

Concrete should exhibit slump as designated in Structural Engineer’s specifications. A design concrete slump of 6 to 8 inches helps to facilitate removal of casings and reduces the possibility of concrete arching/honeycombing. Under no circumstance should loose soil be placed in the space between the casing and the pier sidewalls. The concrete should be placed using a rigid tremie or by the free-fall method provided the concrete falls to its final position through air without striking the sides of the hole, the reinforcing steel cage, or any other obstruction. A drop chute should be used for this free-fall method.

While withdrawing casing, care should be exercised to maintain concrete inside the casing at a sufficient level to resist earth and hydrostatic pressures acting on the casing exterior. Arching of the concrete, loss of seal, mixing of the surrounding soil and water with fresh concrete, and other problems can occur during casing removal and result in contamination of the drilled shaft. These conditions should be considered during the design and construction phases. Placement of loose soil backfill should not be permitted around the casing prior to removal.

The drilled shaft installation process should be monitored under the direction of the Geotechnical Engineer. The Geotechnical Engineer should document the shaft installation process including soil/rock and groundwater conditions encountered, consistency with expected conditions, and details of the installed shaft.

Grade Beams between Drilled Piers

If a structurally suspended floor slab is used without a select fill building pad prepared as provided in **Building Subgrade Preparation**, grade beams spanning between drilled piers should be protected from the expansive soil movement at this site. A minimum 6-inch void provided below the grade beams should allow the expansive clays to swell without causing distress in the grade beams. The sides of the void should be protected with permanent rigid soil retainers so that the soil will not slough beneath the grade beams and thus fill the void. The above also applies to any individual isolated piers, if any, outside of the building footprint. If these isolated piers are overlain by larger pier caps or grade beams, then those caps/beams should also be protected from the clays by using void forms. If a grade-supported floor slab is used with a select fill building pad prepared as provided in **Building Subgrade Preparation**, void boxes below grade beams are not required; however, the grade beams should be designed to span without subgrade support between piers.

We recommend that on-site fat clay soils (LL≥50;PI>30) be utilized for backfill adjacent to grade beams at the exterior surface of the structure (to reduce potential infiltration of surface water into the subgrade areas). The exterior backfill should be compacted as outlined in **Earthwork**. On the interior sides of the perimeter grade beams, backfill should consist of properly compacted select fill or flowable fill (COA Item 402), not sand or gravel. Compaction of select fill on the interior sides of beams should be performed by the Earthwork Contractor's personnel and equipment, not by concrete or utility contractors inexperienced with proper soil placements and compaction.

Foundation Construction Observation

The performance of the foundation system for the proposed structure will be highly dependent upon the quality of construction. Thus, we recommend that the foundation installation be monitored by Terracon to identify the proper bearing strata and depths and to help evaluate foundation construction. We would be pleased to develop a plan for foundation monitoring to be incorporated in the overall quality assurance program.

SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the exploration log and results, it is our professional opinion that the **Seismic Site Classification is D**. Subsurface explorations at this site were extended to a maximum depth of 30 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

BUILDING SUBGRADE PREPARATION

The subgrade soils are comprised of surficial high plasticity clays exhibiting the potential to shrink/swell with changes in water content. Construction of the floor slab and revising site drainage creates the potential for gradual increased water contents within the clays. Increases in water content may cause the clays to swell and potentially damage the floor slab.

Due to the potential for significant moisture fluctuations of subgrade material beneath the select fill pad, the exposed final subgrade should be prepared as discussed in the first three sub-sections of **Earthwork**.

The most positive way to minimize the potential for foundation distress resulting from volumetric changes would be to suspend the building above the subgrade on drilled pier foundations with a crawl space or void boxes under the slab and beams. An alternative to this foundation type would be to prepare the subgrade to reduce the shrink/swell potential of the near-surface soils and use grade-supported floor slabs as mentioned below. Although subgrade preparation does help to reduce the shrink/swell potential of the subgrade, a degree of risk of subgrade movements (and corresponding foundation distress) remains if grade-supported floor slabs are to be utilized

The following sections provide options for floor slab systems and the subgrade preparation for each system. One option is to use a structurally suspended floor slab system, which would not require any extensive subgrade preparation. The other option is a grade-supported floor slab system which would require extensive subgrade preparation.

The post-construction performance of the foundation will likely be influenced more by post-construction volumetric changes of the subgrade due to in-situ moisture variations than upon settlement due to foundation loads. Settlement response of select fill supported slabs will be influenced as much by the quality of construction and fill placements as by soil-structure interaction. Therefore, it is essential that the recommendations for foundation construction be strictly followed during the construction phases of the building pad and foundation.

Structurally Suspended Floor Slab System

For a structurally suspended floor slab system, we recommend a minimum 8-inch void space be provided beneath the floor slabs and the drilled pier foundation system be designed to carry the additional loads. When void forms are used, special care needs to be taken to avoid potential collapse during concrete placement.

The use of a structurally suspended floor slab in conjunction with drilled piers would eliminate the need for subgrade preparation as discussed in the following section. However, a higher minimum steel percentage would need to be utilized in each drilled pier as mentioned in **Deep Foundations**.

Due to the absence of subgrade preparation, the native subgrade and/or general fill soils below the floor slab will be subject to drying and wetting during construction. This could lead to additional shrink/swell and possibly even construction access difficulties. To reduce this potential, we recommend either a thin (3 to 4 inches) non-reinforced mud slab or 6 to 8 inches of crushed limestone base material be installed as soon as possible over the exposed Stratum 1 soils and/or general fill once finished grades below the floor slab are established. If crushed limestone base is used the material will provide a better working surface for construction workers, equipment, and traffic, especially during and after periods of wet weather, but it is not intended to function as a capillary break or moisture barrier for the slab.

If the subgrade elevation beneath the floor slab is lower than that of the exterior ground surface in any areas, we recommend that a series of surface drains be placed such that water accumulating in the void space beneath the slab and the subgrade can be properly collected and removed. Sloping the subgrade toward these drains in a manner where water cannot accumulate adjacent to any of the foundation units is recommended. The above can also be accomplished by sloping the subgrade beneath and outside the building to provide positive drainage away from foundation units. In addition, proper ventilation should be provided to reduce the possibility that a high humidity environment could develop in the void space areas.

Any utilities that penetrate into the building subgrade should exhibit flexible connections such that any shrink/swell movements observed in the clays do not damage the utilities. Failure to implement flexible connections can cause damage to the utilities (i.e. bursting pipes). In addition, we recommend that in areas where utilities cross any grade beams, the top of the pipe be at least 6 inches below any void spaces beneath the grade beams.

Grade-Supported Floor Slab System

While the grade-supported floor slab option is not as effective as a structurally suspended floor slab in reducing slab movements, it does represent a compromise between economics and risk of slab distress. If a grade-supported floor slab is utilized, we recommend that the soils immediately below the slab be prepared as stated below to reduce the potential for foundation movements associated with volumetric changes of the underlying clay soils due to moisture variation.

Information about existing and proposed grades and FFE for the proposed building addition has not been provided to Terracon at this time, However, we assume that the planned FFE is within two to three feet of existing grades. If these assumptions are incorrect, Terracon should be notified to review and modify or verify recommendations in writing.

In order to reduce PVR to ¾ inch, we recommend that the on-site Stratum 1 fat clay soils be removed from the building areas to a depth of 4½ feet below existing grades or shallower if the Stratum 2 clayey gravel is encountered, whichever occurs first. The excavated soils must then be replaced with properly compacted select fill, up to finished grades. All fill within building areas must be select fill. A modulus of subgrade reaction of 125 pci may be used if these recommendations are followed.

General Comments for Pad Preparation

The above building subgrade preparation recommendations should be applied to an area extending a minimum of 5 feet outside of building areas including attached walkways and any other architectural members. We suggest the use of crushed limestone base in the upper 6 inches of the select fill pad from a standpoint of construction access during wet weather, as well as from a standpoint of floor slab support.

For any flatwork (sidewalk, ramps, etc.) outside of the building area which will be sensitive to movement, subgrade preparation as discussed above should be considered to reduce differential movements between the flatwork and the adjacent building. If subgrade preparation as given above for building areas is not implemented in the exterior flatwork areas, those areas may be susceptible to post-construction movements in excess of that given above.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

The potential movement values indicated are based upon moisture variations in the subgrade due to circumstances such as moisture increases due to rainfall and loss of evapotranspiration. In circumstances where significant water infiltration beneath the floor slab occurs (such as a leaking utility line or water seepage from outside the buildings resulting from poor drainage), movements in isolated floor slab areas could potentially be in excess of those indicated in this report.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means. Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

Connections to Existing Structures

We understand that the proposed addition will be built adjacent to the existing structure. Due to the independence of the foundation systems of the existing and proposed structures, it is possible that differential movements may occur between the foundation systems. The magnitude of differential movements will be primarily dependent upon the quality of foundation construction utilized for the addition and the performance of the foundation system of the existing structure. Therefore, any members or connections of the addition which are common to the foundation of the existing structure should be designed such that they are tolerant to movement whenever possible. Any existing beams/footings adjacent to the excavation for the proposed addition should be properly braced/shored to insure minimal distress to the existing structure, when performing subgrade excavations immediately adjacent.

Floor Slab Construction Considerations

Design recommendations for floor slabs assume the requirements in **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the subgrade and select fill pad beneath the floor slab.

Finished subgrade within and for at least 10 feet beyond the floor slab should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs, noted in this section, must be applied to the site, which has been prepared as recommended in the **Earthwork** section.

Pavement designs are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. Support characteristics of the subgrade for pavement design do not account for shrink/swell movements of an expansive clay subgrade, such as the Stratum 1 fat clay soils encountered on this project. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. It is therefore important to minimize moisture changes in the subgrade to reduce shrink/swell movements. Proper site perimeter drainage should be provided so that infiltration of surface water from unpaved areas surrounding the pavement is minimized.

Pavement Design Parameters

Design of Asphaltic Concrete (HMAC) pavements are based on the procedures outlined in the 1993 Guideline for Design of Pavement Structures by the American Association of State Highway and Transportation Officials (AASHTO-1993). Design of Portland Cement Concrete (PCC) pavements are based upon American Concrete Institute (ACI) 330R-01; Guide for Design and Construction of Concrete Parking Lots.

Detailed traffic loads and frequencies were not available; however, we anticipate that traffic will consist primarily of passenger vehicles in the parking areas and passenger vehicles combined with emergency vehicles, occasional garbage trucks, service trucks, and delivery trucks in driveways. If heavier traffic loading is expected or other traffic information is available, Terracon should be provided with the information and allowed to review the pavement sections provided herein. Tabulated below are the assumed traffic frequencies and loads used to design pavement sections for this project.

Pavement Area	Traffic Design Index	Description
Parking Areas (Passenger Vehicles Only)	DI-1	Light traffic – (ESALs [1]<5) Passenger cars and pickup trucks, no regular use by heavily loaded two axle trucks or lightly loaded larger vehicles.
Driveways, Loading/Unloading Areas, and Dumpster Enclosures	DI-2 [2]	Light to medium traffic – (5≤ESALs≤20) Passenger cars and pickup trucks with no more than 50 heavily loaded two-axle trucks or lightly loaded three axle trucks per day. No regular use by heavily loaded trucks with three or more axles.

1. 18-kip equivalent single axle load applications.
2. For Fire Lanes to withstand the occasional HS-20 loading of 32,000 pounds per axle and up to 90,000-pound gross truck weight, use DI-2 pavements or thicker.

Pavement Section Thicknesses

The following tables provides options for HMAC and PCC pavement sections.

Asphaltic Concrete Design		
Layer	**Thickness (inches)**	
	DI-1	**DI-2**
Asphaltic Concrete (HMAC)	2	2.5
Crushed Limestone Base	8	10
Moisture Conditioned Subgrade [1]	6	6

1. Moisture conditioned subgrade thickness should be increased to 12 inches in Stratum 1 fill areas.

Portland Cement Concrete Design		
Layer	**Thickness (inches)**	
	DI-1	**DI-2**
Reinforced Concrete (PCC)	5	6
Moisture Conditioned Subgrade [1]	6	6

1. Moisture conditioned subgrade thickness should be increased to 12 inches in Stratum 1 fill areas.
2. We recommend that dumpster pads and loading dock areas be constructed of at least 7-inches of reinforced concrete pavement. The concrete pad areas should be designed so that the vehicle wheels of the collection truck are supported on the concrete while the dumpster is being lifted to support the large wheel loading

Portland Cement Concrete Design		
Layer	Thickness (inches)	
	DI-1	DI-2
	imposed during waste collection. Dumpster areas that are not designed in this manner often experience localized failures due to large wheel loading imposed during waste collection. Reinforced concrete pavements typically result in better performance and less maintenance than flexible pavement systems in these truck areas.	

Rigid PCC pavements will perform better than HMAC pavements in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavements will perform better in areas subject to large or sustained loads, such as dumpster enclosures and loading/unloading areas.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. As an option, thicker sections could be constructed to decrease future maintenance.

Pavement Materials

Presented below are our recommended material requirements for the various pavement sections.

Item	Value
Hot Mix Asphaltic Concrete (HMAC) [1]	Plant mixed, hot laid Type D (Fine-Grade Surface Course) meeting the specifications in COA Item 340.
Reinforced Portland Cement Concrete (PCC)	28-day flexural strength (third-point loading) ≥ 500 psi, or 28-day compressive strength ≥ 3,500 psi
Crushed Limestone Base [2]	COA Item 210 compacted as outlined in **Earthwork**.
Moisture Conditioned Subgrade [3]	As outlined in **Earthwork**.

1. For acceptance and payment evaluation purposes, we recommend use of provisions in COA Item 340.
2. Each lift of base should be thoroughly proof-rolled just prior to placement of subsequent lifts and/or asphalt. Particular attention should be paid to areas along curbs, above utility trenches, and adjacent to landscape islands, manholes, and storm drain inlets. Preparation of the base material should extend at least 18 inches behind curbs.
3. Subgrade should not dry out or become saturated prior to pavement construction. The pavement subgrade should be thoroughly proof-rolled as outlined in **Earthwork**. Particular attention should be paid to areas along curbs, above utility trenches, and adjacent to landscape islands, manholes, and storm drain inlets. Preparation of the moisture conditioned subgrade should extend at least 18 inches behind curbs.

Presented below are our recommendations for the construction of the reinforced concrete pavements.

Item	Value
Reinforcing Steel	#3 bars spaced at 18 inches on center in both directions. Rebar should be placed at midpoint of concrete section and supported on chairs prior to concrete placement.
Control (i.e., Contraction) Joint Spacing	In accordance with ACI 330R, control joints should be spaced no greater than 12.5 feet for 5-inch thick concrete and 15 feet for 6-inch thick or greater concrete. If sawcut, control joints should be cut within 6 to 12 hours of concrete placement. Sawcut joint should be at least ¼ of the slab thickness.
Expansion (i.e., Isolation) Joint Spacing	ACI 330R indicates that regularly spaced expansion joints may be deleted from concrete pavements, except adjacent to structures, manholes, inlets, light poles, etc. Therefore, the installation of expansion joints is optional and should be evaluated by the design/construction team. Expansion joints, if not sealed and maintained can allow infiltration of surface water into the subgrade.
Dowels at Expansion Joints	¾-inch smooth bars, 18 inches in length, with one end treated to slip, spaced at 12 inches on centers at each joint, and placed level at midpoint of concrete section.

Pavement Drainage

On most projects, rough site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, dry weather may desiccate some areas, rainfall and surface water saturates some areas, heavy traffic from concrete and other delivery vehicles disturbs the subgrade, and many surface irregularities are filled in with loose soils to temporarily improve subgrade conditions. As a result, the pavement subgrade should be carefully evaluated as the time for pavement construction approaches. This is particularly important in and around utility trench cuts. All pavement areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to paving. Thorough proof-rolling of pavement areas should be performed no more than 36 hours prior to surface paving. Proof-rolling should be repeated if the site received rainfall prior to paving. Any problematic areas should be reworked and compacted at that time.

Openings in pavements, such as landscaped islands, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils. The

civil design for the pavements with these conditions should include features to restrict or to collect and discharge excess water from the islands. Examples of features are self-contained planters, edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlet, and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded sufficiently to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g. crack and joint sealing and patching) and global maintenance (e.g. surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2%.
- Subgrade and pavement surfaces should have a minimum 2% slope to promote proper surface drainage.
- Install perimeter pavement drainage systems (i.e., French drains) surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Construct curb, gutter and/or sidewalk directly on clay subgrade soils rather than on granular base course materials.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur beyond the single exploration point location or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

ATTACHMENTS

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EXPLORATION AND TESTING PROCEDURES

Field Exploration

Location	Number of Borings	Boring Depth (feet) [1]
Service Center Site	1	30

1. Below ground surface.

Boring Layout and Elevations: Unless otherwise noted, Terracon personnel provided the boring layout. Coordinates were obtained with a handheld GPS unit (estimated horizontal accuracy of about ±10 feet) and approximate elevation was obtained by interpolation from Google Earth. If more accurate elevation and a more precise boring layout are desired, we recommend the boring be surveyed following completion of fieldwork.

Subsurface Exploration Procedures: Terracon's subcontractor advanced the boring with a truck-mounted rotary drill rig using continuous flight augers (solid stem and/or hollow stem, as necessary, depending on soil conditions). Four to five samples were obtained in the upper 10 feet of the boring and at intervals of 5 feet thereafter. Soil sampling was performed using thin-wall tube (shelby tubes) and/or split-barrel sampling procedures. The split-barrel samplers were driven in accordance with the standard test method for standard penetration test (SPT) and split-barrel sampling of soils (ASTM D1586/D1886M–18). For safety purposes, the boring was backfilled with auger cuttings after completion.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring log. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared a field boring log as part of the drilling operations. The field log included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring log was prepared from the field log. The final boring log represents the Geotechnical Engineer's interpretation of the field log and includes modifications based on observations and tests of the samples in our laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

The laboratory testing program often included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified the soil samples in accordance with the Unified Soil Classification System.

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Exploration Plan

Note: All attachments are one page unless noted above.

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SITE LOCATION

COA Service Center Improvements – St. Elmo SCB #8 ■ Austin, Texas
October 14, 2020 ■ Terracon Project No. 96195433

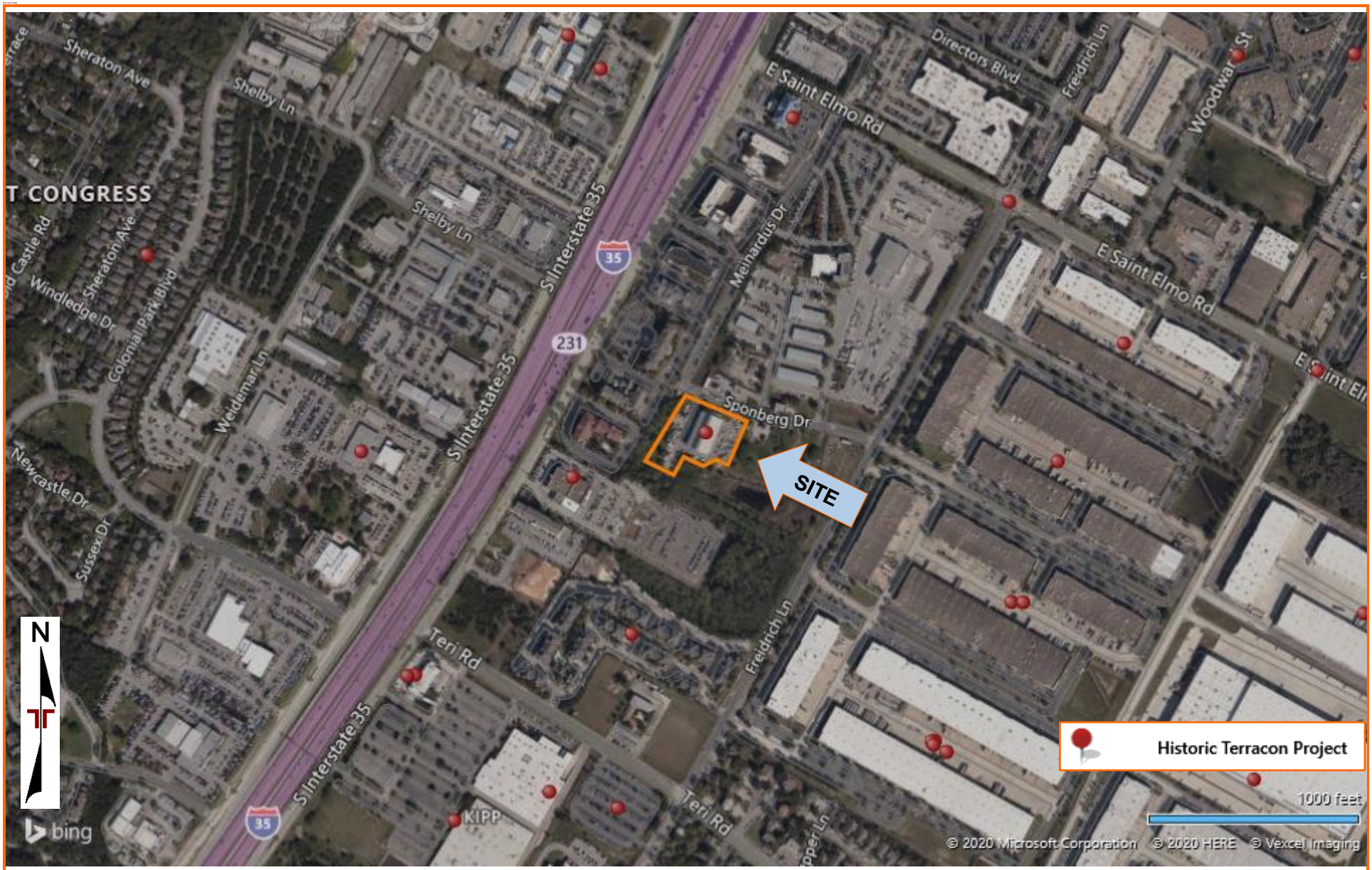


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

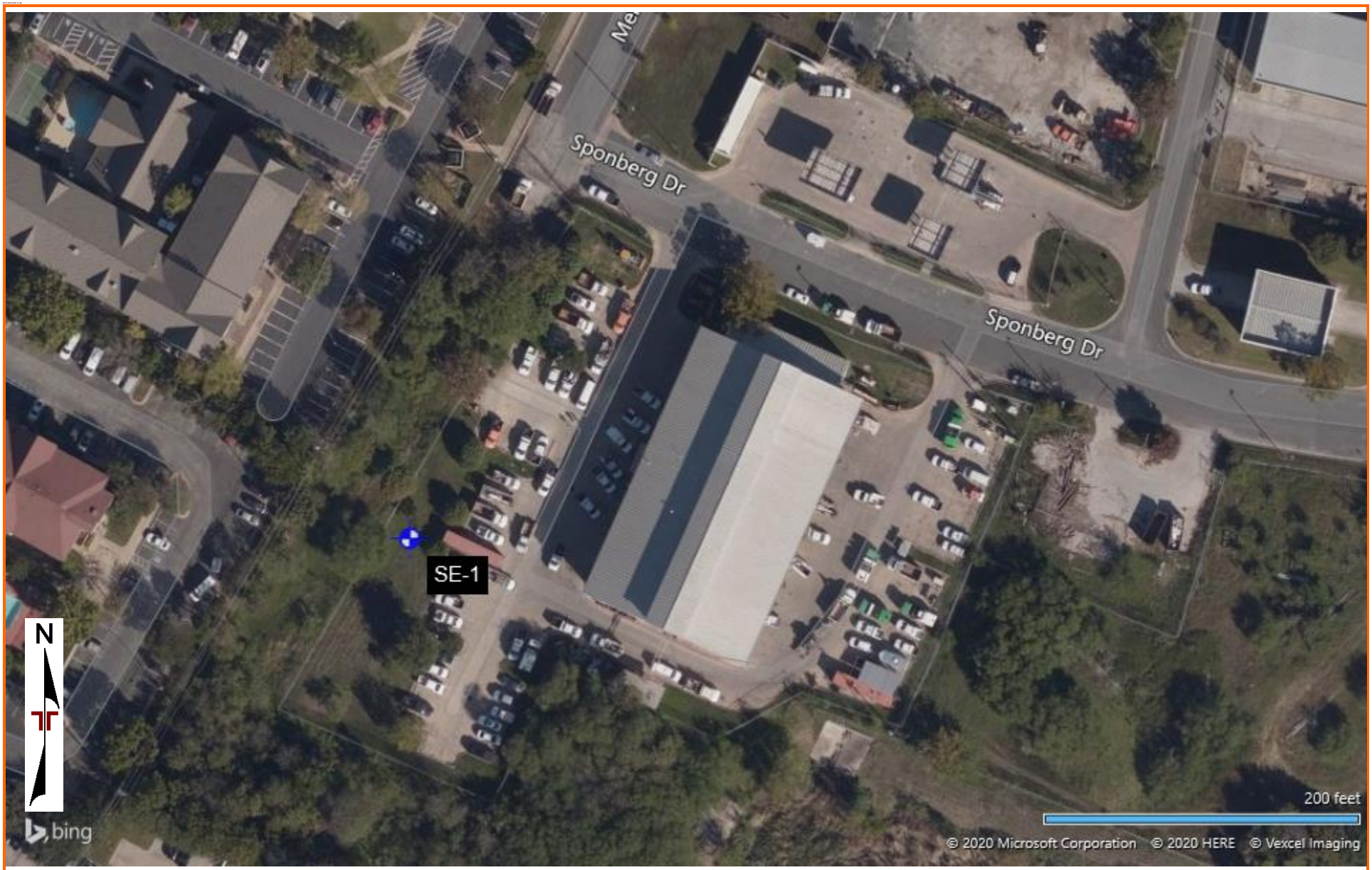


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Boring Log SE-1
Grain Size Distribution
Atterberg Limits

Note: All attachments are one page unless noted above.

BORING LOG NO. SE-1

PROJECT: COA Service Center Pavement & Facility Improvements

CLIENT: GSC Architects
Austin, TX

SITE: Sponberg Dr.
Austin, TX

LOCATION See Exploration Plan

Latitude: 30.2079° Longitude: -97.7542°

Approximate Surface Elev.: 649.0 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1							4.5 tsf (HP)	16		
							8-10-9 N=19	13	53-15-38	85
				5			5-4-5 N=9	5		
							18-14-24 N=38	9	39-16-23	41
							33-50/2"	4		31
2				10						
				15			50/6"	6		
				20			22-50/5"			
3				25			6-12-14 N=26	9	74-20-54	100
				30			8-11-14 N=25			

FILL - FAT CLAY (CH), dark brown to brown to gray, stiff to hard

- with chert fragments and plastic debris below ~4 feet

6.0 643+/-

CLAYEY GRAVEL WITH SAND (GC), light tan to pale brown, dense to very dense

23.0 626+/-

FAT CLAY (CH), tan, very stiff, with light gray seams and ferrous stains

30.0 619+/-

Boring Terminated at 30 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
Dry Augered to 30 feet

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from Google Earth Pro.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

Boring Started: 08-24-2020 | Boring Completed: 08-24-2020

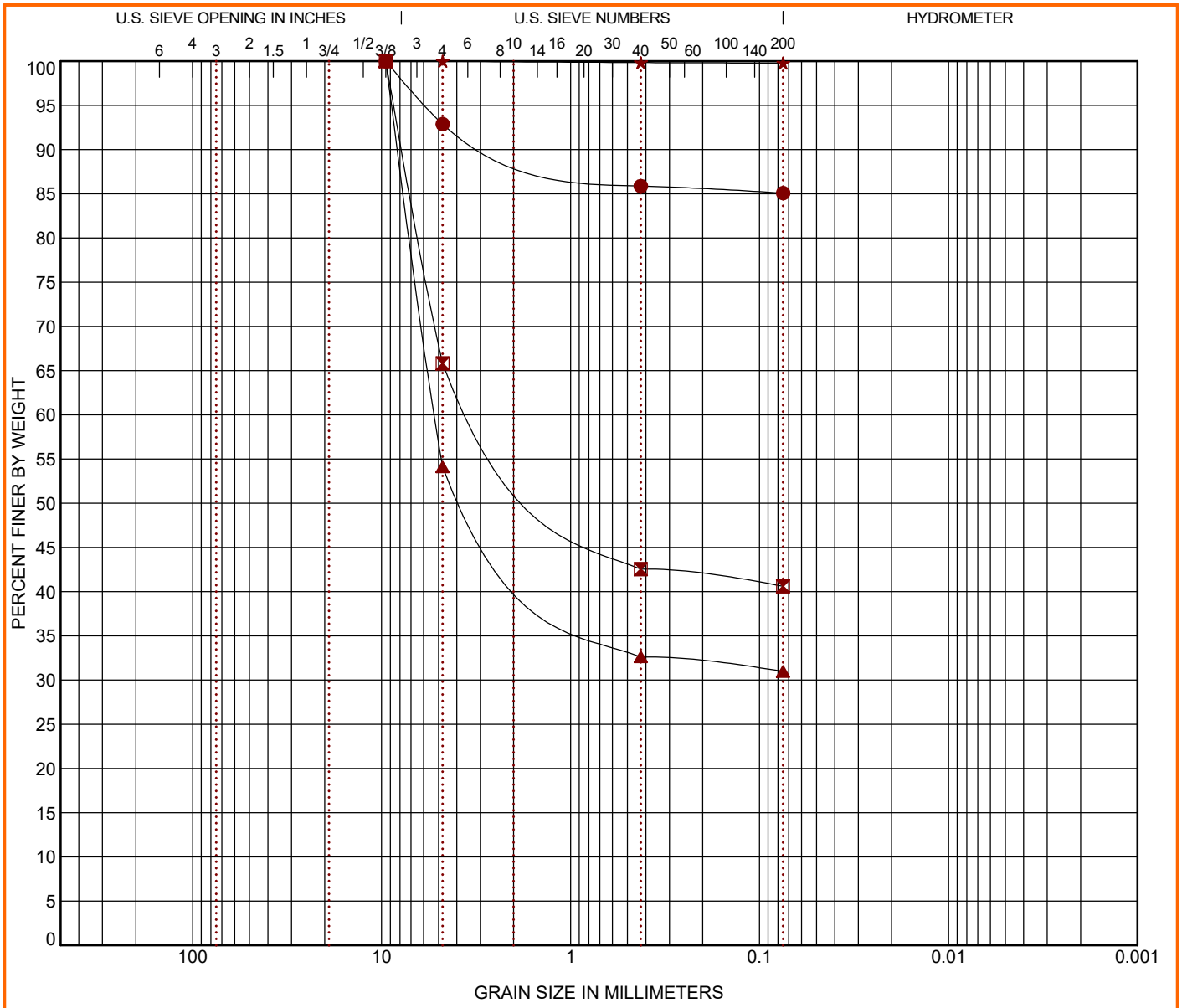
Drill Rig: CME 45 | Driller: Austin Geo-Logic

Project No.: 96195433

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL 96195433.COA SERVICE CENTERS.BORING INFO.GPJ TERRACON_DATATEMPLATE.GDT 9/15/20

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Boring ID	Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	SE-1	2 - 3.5	FAT CLAY (CH)	13	53	15	38		
⊠	SE-1	6 - 7.5	CLAYEY GRAVEL with SAND (GC)	9	39	16	23		
▲	SE-1	8.5 - 9.2		4					
★	SE-1	23.5 - 25	FAT CLAY (CH)	9	74	20	54		

	Boring ID	Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	SE-1	2 - 3.5	9.5				0.0	7.1	7.8		85.1	
⊠	SE-1	6 - 7.5	9.5	2.6			0.0	34.2	25.2		40.6	
▲	SE-1	8.5 - 9.2	9.5	5.192			0.0	45.9	23.1		31.0	
★	SE-1	23.5 - 25	4.75				0.0	0.0	0.2		99.8	

PROJECT: COA Service Center Pavement & Facility Improvements

SITE: Sponberg Dr.
Austin, TX

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

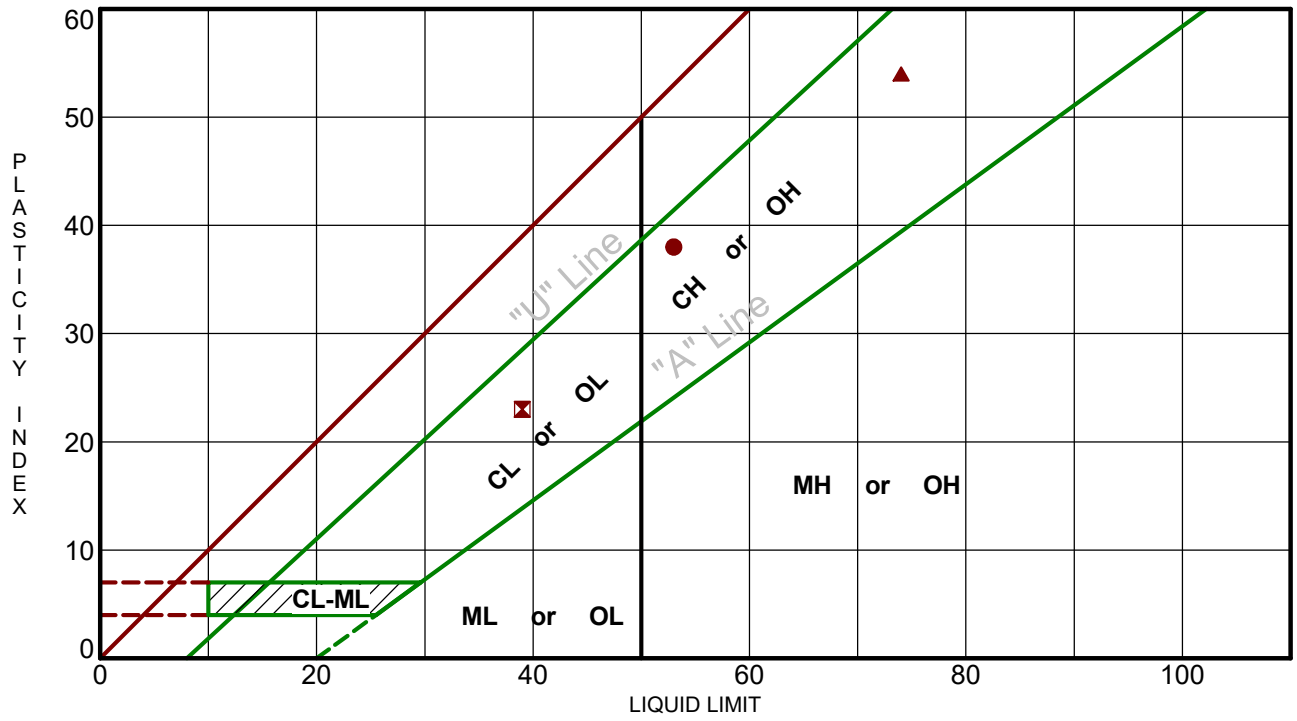
PROJECT NUMBER: 96195433

CLIENT: GSC Architects
Austin, TX

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS-2 96195433.COA SERVICE CENTERS.BORING INFO.GPJ TERRACON_DATATEMPLATE.GDT 9/15/20

ATTERBERG LIMITS RESULTS

ASTM D4318



Boring ID		Depth	LL	PL	PI	Fines	USCS	Description
●	SE-1	2 - 3.5	53	15	38	85.1	CH	FAT CLAY
⊠	SE-1	6 - 7.5	39	16	23	40.6	GC	CLAYEY GRAVEL with SAND
▲	SE-1	23.5 - 25	74	20	54	99.8	CH	FAT CLAY

PROJECT: COA Service Center Pavement & Facility Improvements

SITE: Sponberg Dr.
Austin, TX

Terracon
5307 Industrial Oaks Blvd Ste 160
Austin, TX

PROJECT NUMBER: 96195433

CLIENT: GSC Architects
Austin, TX

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS 96195433.COA SERVICE CENTERS.BORING INFO.GPJ TERRACON_DATATEMPLATE.GDT 9/15/20

SUPPORTING INFORMATION

Contents:

General Notes
Unified Soil Classification System
City of Austin (COA) MSWL Form

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

COA Service Center Pavement & Facility Improvements ■ Austin, TX

Terracon Project No. 96195433

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Shelby Tube Standard Penetration Test	**Water Initially Encountered** **Water Level After a Specified Period of Time** **Water Level After a Specified Period of Time** **Cave In Encountered** Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Terracon GeoReport

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or [Cc<1 or Cc>3.0] [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F, G, H]
			Fines classify as CL or CH		GC	Clayey gravel [F, G, H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or [Cc<1 or Cc>3.0] [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G, H, I]
			Fines classify as CL or CH		SC	Clayey sand [G, H, I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A"		CL	Lean clay [K, L, M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K, L, M, N]
			Liquid limit - not dried			Organic silt [K, L, M, O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K, L, M]
			PI plots below "A" line		MH	Elastic Silt [K, L, M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K, L, M, P]
			Liquid limit - not dried			Organic silt [K, L, M, Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve.

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

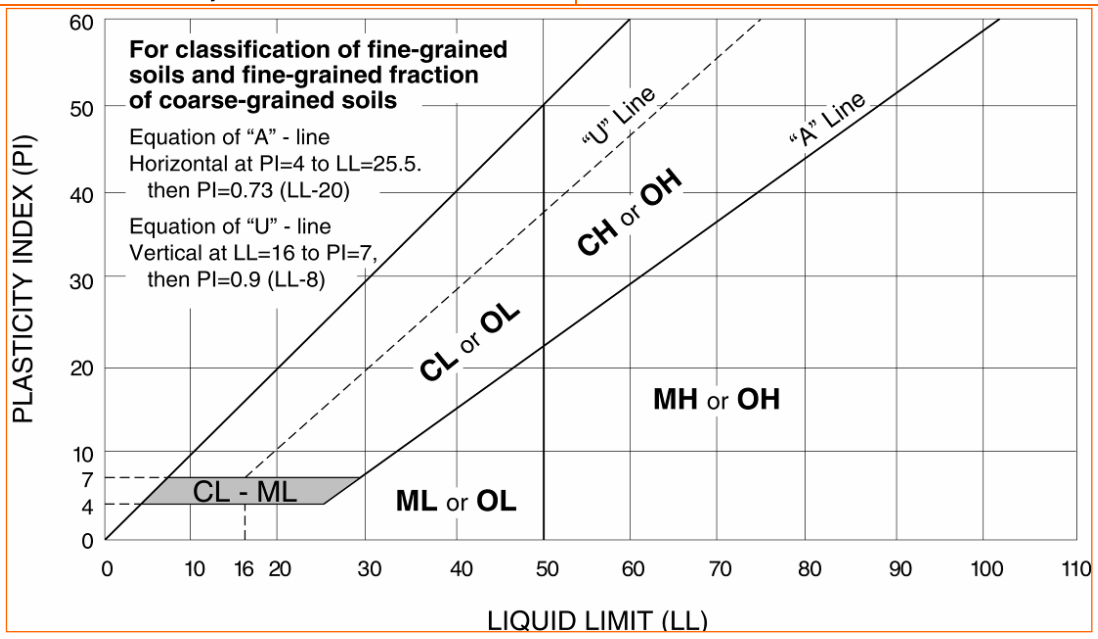
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Certification of Compliance with Ch. 25-1-83 – Applications Relating to a Closed Municipal Solid Waste Landfill

Site Address: **Sponberg Dr. & Meinardus Dr. (SESCB#8), Austin, Texas**

Complete Section A if your site is:

- Less than or equal to 1 acre and **not** within a landfill buffer as shown on the City of Austin Closed Landfills maps.

Complete Section B if your site is:

- Greater than 1 acre; or
- Less than or equal to 1 acre **and** within a landfill buffer as shown on the City of Austin Closed Landfills map.

See back of form for information on where to obtain a map of Austin area closed landfills or how to obtain information about state development regulations.

Section A

The site for which I am submitting an application for subdivision, site plan, or building permit is less than 1 acre, is not within a landfill buffer, and I am not aware of any information indicating the site may contain any portion of a municipal waste landfill.

Signature of Applicant

Print Name

Section B

In our opinion, the subject site does not contain a municipal solid waste landfill as referenced in TAC Ch. 330, Subch. T. This opinion is based on information gathered using:

☐ TCEQ Soil Test 2 –

■ TCEQ Soil Test 3 – Based upon geotechnical borings presented in Terracon Report No. 96195433, no evidence of an existing closed municipal solid waste landfill was encountered.

Signature of Professional Engineer

STATE OF TEXAS
LARSON M. SNYDER
133600
LICENSED
PROFESSIONAL ENGINEER

Larson M. Snyder, P.E.
Print Name

10/14/2020

Form Date 09.12.06

City Manager
Austin, Texas

The undersigned, in compliance with the Invitation for Bids for construction of the following Project for the city of Austin, Texas:

Solicitation No.:	CLMC858
Project:	St. Elmo Service Center 8 Renovations
CIP ID No.:	6011.035

Having examined the Project Manual, Drawings and Addenda, the site of the proposed Work and being familiar with all of the conditions surrounding construction of the proposed Project, having conducted all inquiries, tests and investigations deemed necessary and proper; hereby proposes to furnish all labor, permits, material, machinery, tools, supplies and equipment, and incidentals, and to perform all Work required for construction of the Project in accordance with the Project Manual, Drawings and Addenda within the time indicated.

BASE BID	....	**$**

- The "Base Bid" amount must be used in the MBE/WBE Compliance Plan Summary Page to determine subcontractor participation levels for the established MBE/WBE procurement goals.

- The "Base Bid" amount becomes the Bidder's "TOTAL BID" if allowances and/or alternates are not included.

ALTERNATES:

ALTERNATE NO. 1:	**Proposed New Asphalt pavement (Austin Energy Pole Yard - East), including New Chain-Link Fence (at Pole Yard), New Concrete Driveway, and reinstallation of chain-link gate.**	**$**

TOTAL BID	....	**$**
Includes Base Bid and Alternate 1, (if accepted at Contract Execution)		

Notes:
1. For a more detailed explanation of Bid alternates, see Section 01030.
2. MINIMUM WAGES: Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) for Building Construction and Heavy and Highway Trades "AS APPLICABLE" and/or the minimum wage required by City of Austin Ordinance No. 20160324-015, whichever is higher. The Total Minimum Wage required can be met using any combination of cash and non-cash qualified fringe benefits provided the cash component meets or exceeds the minimum wage required.

BID GUARANTY: A Bid guaranty must be enclosed with this Bid, as required in Section 00020, in the amount of not less than five percent (5%) of the total Bid. Following the Bid opening, submitted Bids may not be withdrawn for a period of ninety (90) Calendar Days. Award of Contract will occur within this period, unless mutually agreed between the parties. The Bid guaranty may become the property of the OWNER, or the OWNER may pursue any other action allowed by law, if:

- Bidder withdraws a submitted Bid within the period stated above;
- Bidder fails to submit the required post Bid information within the period specified in Section 00020 or 00100, or any mutually agreed extension of that period; or
- Bidder fails to execute the Contract and furnish the prescribed documentation (bonds, insurance, etc.) needed to complete execution of the Contract within five (5) Working Days after notice of award, or any mutually agreed extension of that period.

GEOTECHNICAL BASELINE ACKNOWLEDGEMENT: The undersigned Bidder certifies that the Bidder has read and understands the Geotechnical Engineering Report (GER) and all other geological and geotechnical information and data as provided in the Contract Documents, including all Addenda. ***The Bidder acknowledges and agrees that the GER represents the contractual statement of the subsurface conditions reasonably anticipated to be encountered during construction.***

TIME OF COMPLETION: The undersigned Bidder agrees to commence work on the date specified in the written "Notice to Proceed" to be issued by the OWNER and to substantially complete construction of the improvements, as required by the Project Manual, Drawings and Addenda for the Work within **two hundred seventy (270) Calendar Days**.

If a Substantial Completion date has been specified, the Bidder further agrees to reach Final Completion within **thirty (30) Calendar Days** after Substantial Completion as required by the Project Manual, Drawings and Addenda for the work.

The Bidder further agrees that should the Bidder fail to substantially complete the Work within the number of days indicated in the Bid or as subsequently adjusted, Bidder shall pay the liquidated damages for each consecutive day thereafter as provided below; unless the OWNER elects to pursue any other action allowed by law.

WAIVER OF ATTORNEY FEES: In submitting the Bid, in consideration for the waiver of the Bidder's right to attorney's fees by the OWNER, the Bidder knowingly and intentionally agrees to and shall waive the right to attorney's fees under Section 271.153 of the Texas Local Government Code in any administrative proceeding, alternative dispute resolution proceeding, or litigation arising out of or connected to any Contract awarded pursuant to this solicitation process.

LIQUIDATED DAMAGES: The Bidder understands and agrees that the timely completion of the described Work is of the essence. The Bidder and OWNER further agree that the OWNER's actual damages for delay caused by failure to timely complete the Project are difficult, if not impossible to measure. However, with respect to the additional administrative and consultant costs to be incurred by OWNER, the reasonable estimate of such damages has been calculated and agreed to by OWNER and Bidder.

Therefore, the Bidder and the OWNER agree that for each and every Calendar Day the Work or any portion thereof, remains incomplete after the Substantial Completion date as established by the above paragraph, "Time of Completion", payment will be due to the Owner in the amount of **five hundred-sixty dollars ($560) per Calendar Day** as liquidated damages, not as a penalty, but for delay damages to the OWNER.

If both Substantial and Final Completion dates have been specified, the Bidder and the OWNER further agree that for each and every Calendar Day the Work or any portion thereof, remains incomplete after the Final Completion date as established by the above paragraph, "Time of Completion", payment will be due to the OWNER in the amount of **three hundred-sixty dollars ($360) per Calendar Day** as liquidated damages, not as a penalty, but for delay damages to the OWNER. Such amount shall be deducted by the OWNER from any Contract payment due.

In the event of a default or breach by the CONTRACTOR and demand is made upon the surety to complete the project, in accordance with the Contract Documents, the surety shall be liable for liquidated damages pursuant to the Contract Documents in the same manner as the CONTRACTOR would have been.

MINOR INFORMALITY: OWNER reserves the right to reject any or all Bids and to waive any minor informality in any Bid or solicitation procedure (a minor informality is one that does not affect the competitiveness of the Bidders).

ADDENDUM: The undersigned acknowledges receipt of the following addenda:

Addendum No. 1 dated		Received	
Addendum No. 2 dated		Received	
Addendum No. 3 dated		Received	
Addendum No. 4 dated		Received	

BID DOCUMENT EXECUTION AND ACKNOWLEDGEMENT: The undersigned Bidder certifies that the Bidder has read and understands Section 00020 Invitation for Bids, Section 00100 Instructions to Bidders, and all other requirements applicable to the Bidding process provided in the Bid and Contract Documents.

BIDDER's CERTIFICATION OF NON-COLLUSION, NON-CONFLICT OF INTEREST, AND ANTI-LOBBYING (Section 00440): The undersigned Bidder, by its signature, represents and certifies that it has read and can affirmatively swear and subscribe to the statements in Section 00440 Non-Collusion, Non-Conflict of Interest, and Anti-Lobbying Certification. If the Bidder cannot affirmatively swear and subscribe to any of the statements in Section 00440, Bidder represents and certifies that it has provided a detailed written explanation with its Bid on separate pages annexed hereto. The undersigned Bidder further certifies that it has not in any way directly or indirectly had communication restricted in the City Code Chapter 2-7, Article 6 (Anti-Lobbying and Procurement) during the No-Lobbying Period as defined in Chapter 2-7.

BIDDER's CERTIFICATION AS TO NONRESIDENT PROVISIONS (Section 00475): The undersigned Bidder certifies that it has read Section 00475 Nonresident Bidder Provisions and **Bidder certifies that Bidder is a resident of _____** (*Bidder must write in the blank the state of which Bidder is a resident*).

Bidder will initial the blank set forth below to represent and certify that the Bidder has completed, executed, and enclosed the corresponding Bid Documents with the Bid.

_____ MBE/WBE Compliance Document

_____ One copy of Total Bid Form if Bid is submitted electronically via Austin Finance Online

_____ Bid Guaranty

The undersigned, by their signature, represents that they are submitting a binding offer and are authorized to bind the respondent to fully comply with the solicitation documents contained herein. The Respondent, by submitting and signing below, certifies that they have received and read all sections of the entire solicitation document including all revisions, addenda and documents incorporated by reference, and agree to be bound by the terms therein.

_____ _____

Corporate Secretary, *if Bidder is a Corporation Bidder

_____ _____

Email for Secretary Authorized Signature/Print Name

_____

(Seal) Title

_____

Date

_____

_____

Address

_____

Telephone Number / FAX Number

_____

Email for Person Signing Bid

_____

Email for Bidder's Primary Contact Person

END

TOTAL BID FORM

Solicitation No.:	6011.035
Project:	St. Elmo Service Center 8 Renovations
Bidder:	
Total Bid Amount: (includes Base Bid plus any Allowances or Alternates shown in Section 00300)	

Notes:

1. This form will be displayed publicly in Austin Finance Online approximately one hour after the solicitation closes.
2. In the case of discrepancies between this form and Section 00300, Section 00300 takes precedence.

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STATEMENT OF BIDDERS EXPERIENCE

Section 00400

Project Name:	St. Elmo Service Center 8 Renovations
Name of Bidder:	
Solicitation Number:	CLMC858
CIP ID Number:	6011.035

Bidder must complete all Attachments to Section 00400 clearly and comprehensively. If necessary, responses may be continued on separately attached sheets.

To be considered a responsive and responsible bidder, the apparent three (3) low Bidders must complete and submit within three (3) working days of notification of low bidder status Attachments A through I in accordance with Article 11, Section 00100. Contractor Performance Evaluations for previous work with the City will be included in the assessment of the Bidder's experience. Any information in Attachments A through I and in the Contractor's Performance Evaluations that indicates the Bidder or a "Subcontractor" is not responsible or that might negatively impact a Bidder's ability to complete the Work within the Contract Time and for the Contract Price may result in the Bid being rejected.

The Bidder is responsible for the accuracy and completeness of all of the information provided by the Bidder or a proposed Subcontractor in response to this Invitation for Bids.

POST-BID SUBMITTALS

ATTACHMENT A – BIDDER'S INFORMATION

ATTACHMENT B – EXPERIENCE REQUIREMENTS (GENERAL CONTRACTOR)

ATTACHMENT C – PROJECT MANAGER AND SUPERINTENDENT EXPERIENCE

ATTACHMENT D – EXPERIENCE REQUIREMENTS (SPECIFIC CONSTRUCTION OR TECHNICAL EXPERIENCE)

ATTACHMENT E – AVAILABLE EQUIPMENT

ATTACHMENT F – AVAILABLE WORKFORCE

ATTACHMENT G – CURRENT PROJECTS

ATTACHMENT H – COMPLETED PROJECTS

ATTACHMENT I – BIDDER'S AUTHENTICATION

ATTACHMENT A
BIDDER'S INFORMATION

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

Solicitation Number:	CLMC858
CIP ID Number:	6011.035

A.	**Name of Bidder:**	
B.	**Bidder's Permanent Address:**	
C.	**Bidder's Phone Number:**	
D.	**Number of years in business under current company name:**	

(Note: Bidder must have been in existence for a minimum of one (1) year under its current company name. Changes in company name during the experience period are acceptable, if the continuity of the company can be demonstrated. Attach separate documentation, if applicable.)

If Bidder answers "Yes" for <u>any</u> of questions E through H, Bidder must attach separate sheets with a brief description or explanation of the answer and provide pertinent contact information (parties' names, addresses and telephone numbers).

E.	**Has the Bidder ever defaulted on a contract?**	**❒ Yes**	**❒ No**
F.	**Are there currently any pending judgements, claims, or lawsuits against the Bidder?**	**❒ Yes**	**❒ No**
G.	**Does Bidder currently have any pending claims, judgements or lawsuits against any prior client?**	**❒ Yes**	**❒ No**
H.	**Is the Bidder or its principals involved in any bankruptcy or reorganization proceedings?**	**❒ Yes**	**❒ No**

ATTACHMENT B
EXPERIENCE REQUIREMENTS (GENERAL CONTRACTOR)

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

Solicitation Number:	CLMC858
CIP ID Number:	6011.035

GENERAL CONTRACTOR EXPERIENCE:

Bidder must list and describe Bidder's (not proposed subcontractors') construction experience as a general contractor for a minimum of three (3) successfully completed projects of comparable size, scope and complexity to the Work described in the Contract Documents. Bidder should refer to the Section 01010 Summary of Work, subsection 1.2 Description of Work, to determine what is reasonably comparable. Decisions on "comparability" are at the complete discretion of the OWNER.

Bidder must have completed the projects within the past five (5) years.

Attention Bidder: Duplicate this form for each of the three (3) projects.

PROJECT NO. _____		
Name of Project:		
Location:		
OWNER's Name and Address:		
OWNER's Contact Person (Print):		
Phone/Fax No.		
Initial Contract Price:		
Final Contract Price:		
Contract Start Date: *(Date of Notice to Proceed)*		
Contract Time:	Calendar Days:	Working Days:
Contract Substantial Completion Date:		
Actual Substantial Completion Date:		
If contract time extensions were added to the contract as a result of Bidder's responsibilities, provide a short explanation of each:		
Project Description and why it is comparable to this Contract:		

ATTACHMENT C
PROJECT MANAGER & SUPERINTENDENT EXPERIENCE

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

Name of Bidder:	
Solicitation Number:	CLMC858
CIP ID Number:	6011.035

Bidder must attach resumes for the Project Manager and Superintendent who will be assigned to this project. The resumes must demonstrate that these individuals have worked on at least three (3) similar, successfully completed projects in the capacity of Project Manager or Superintendent, or other responsible supervisory capacity, as applicable, during the last 10 years.

Project Manager (name): _____

Superintendent (name): _____

Note: Attach Resumes & Experience

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

SPECIFIC CONSTRUCTION EXPERIENCE (GENERAL CONTRACTOR OR SUBCONTRACTOR PERFORMING THE WORK)

Bidder must provide the following project history information for each Construction Experience requirement listed below. OWNER may in its reasonable discretion deem the provided experience information insufficient and reject the Bid.

For each Construction Experience item listed below, list and describe the applicable Construction Experience for a minimum of three (3) successfully completed projects of comparable size, scope, and complexity to the Work described for this project. Comparability requirements may be spread among the three (3) projects per item submitted, e.g. One Project may demonstrate comparable size, another Project may demonstrate comparable scope and another may demonstrate comparable complexity. Decisions on "comparability" are at the complete discretion of the OWNER.

The Work must have been performed within the past five (5) years.

Bidder must provide all requested information in a complete, clear, and accurate manner. If necessary, additional information may be provided on separate attached sheets. Failure to provide any requested information may cause the Bid to be rejected by OWNER as non-responsive.

If the Bidder proposes to fulfill any specific construction experience requirement with subcontracted resources, the applicable Subcontractor must be included in the Bidder's Original MBE/WBE Compliance Plan. Failure to include subcontractors on the MBE/WBE Compliance Plan may render your bid non-responsive.

SPECIFIC CONSTRUCTION EXPERIENCE ITEMS REQUIRED:

ITEM 1. Installation of Concrete Parking Lots, including reinforced curb/gutters.
ITEM 2. Installation of Asphalt Parking Lots.

The Bidder shall complete and duplicate the following specific Construction Experience Form as required to provide the requested documentation for a minimum of three (3) successfully completed projects for each of the above specific Construction Experience requirements.

CONSTRUCTION EXPERIENCE DOCUMENTATION FORM		
EXPERIENCE ITEM NUMBER:		
Project Number:		
Does Bidder plan to self-perform this work?	☐ **Yes** ☐ **No**	
If "NO", provide the following Subcontractor's information:		
Company's Address:		
Permanent Address:		
Phone No.		
# of years Subcontractor has been in business under current company name:		
Name of Project:		
Location:		
OWNER's Name:		
OWNER's Address:		
OWNER's Contact Person (Print):		
Phone/Fax No.:		
Initial Contract Price:		
Final Contract Price:		
Contract Start Date:		
Contract Time:	Calendar Days:	Working Days:
Contract Substantial Completion Date:		
Actual Substantial Completion Date:		
If contract time extensions were added to the contract as a result of Bidder's responsibilities, provide a short explanation of each:		
Project Description and why it is comparable to this Contract:		

Use additional pages as necessary to achieve a representative listing of 3 projects.

ATTACHMENT E
AVAILABLE EQUIPMENT LIST

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

Name of Bidder:	
Solicitation Number:	CLMC858
CIP ID Number:	6011.035

Provide a list of equipment that is available to the CONTRACTOR or its Subcontractor(s) and is specifically intended to be used on the Work under this Contract. Also indicate whether the equipment is owned or will be leased by the CONTRACTOR and/or Subcontractor(s).

EQUIPMENT	**OWNED OR LEASED**	**COMMITTED TO ANOTHER PROJECT?** (Yes / No)	**AVAILABLE / RELEASE DATE**

Use additional pages, as necessary

ATTACHMENT F
AVAILABLE WORKFORCE

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

Name of Bidder:	
Solicitation Number:	CLMC858
CIP ID Number:	6011.035

Provide a list of the available workforce for the various disciplines and crafts required for the Work on this Project, including the number of work crews, and number and worker classification for each equipment operator, mechanic, and laborer for that portion of the Work that Bidder will actually perform.

Number of Anticipated Work Crews: _____

DISCIPLINE OR CRAFT	NO. OF EMPLOYEES	COMMITTED TO ANOTHER PROJECT? (Yes / No)	AVAILABLE / RELEASE DATE
Professional (specify)			
Superintendent			
Technical (specify)			
Skilled Workers (specify)			
Semiskilled Workers (specify)			
Equipment Operators (list)			
Other			

Use additional pages, as necessary

ATTACHMENT G
CURRENT PROJECT LISTING (INCLUDING ALL CITY OF AUSTIN PROJECTS)

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

Name of Bidder:	
Solicitation Number:	CLMC858
CIP ID Number:	6011.035

Provide a list of <u>all current projects</u>, including <u>*all City of Austin projects*</u>. Include the following for all jobs that Bidder is currently committed to or has currently underway: brief statement regarding the job type; estimated project duration; project contact; and project description.

Name of Project:		
Location:		
Type of Job:		
City of Austin Job?	☐ **Yes**	☐ **No**
Project Start Date		
Estimated Completion Date:		
Project Contact:		
Brief Description:		

Use additional pages as necessary to achieve a representative listing covering 5 years

ATTACHMENT H
COMPLETED PROJECTS (INCLUDING ALL CITY OF AUSTIN PROJECTS)

Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status.

Name of Bidder:	
Solicitation Number:	CLMC858
CIP ID Number:	6011.035

Provide a list of <u>all completed projects</u>, including <u>all City of Austin projects</u> that Bidder has completed in the past five (5) years by calendar year (or life of company if less than five (5) years). Include the following: a brief statement regarding the job type, the estimated project duration, project contact, and project description.

Calendar Year of _____

Name of Project:		
Location:		
Type of Job:		
City of Austin Job?	☐ **Yes**	☐ **No**
Project Duration:		
Project Contact:		
Brief Description:		

Use additional pages as necessary to achieve a representative listing covering 5 years

ATTACHMENT I
BIDDERS AUTHENTICATION

(Attention Bidder: Complete and return within three (3) days of notification of the three (3) low bidders' status)

Solicitation Number:	CLMC858
CIP ID Number:	6011.035

THE STATE OF TEXAS
COUNTY OF TRAVIS

I certify that my responses and the information provided in Attachments A-H are true and correct to the best of my personal knowledge and belief and that I have made no willful misrepresentations in this Section, nor have I withheld any relevant information in my statements and answers to questions. I am aware that any information given by me in this Section may be investigated and I hereby give my full permission for any such investigation and I fully acknowledge that any misrepresentations or omissions in my responses and information may cause my bid to be rejected.

Bidder's full name and entity status:

_____
Company's Name

_____
Signature, Authorized Representative of Bidder

_____
Title

_____
Date

END

CERTIFICATE OF NON-SUSPENSION OR DEBARMENT

Section 00405

Solicitation Number: _____ (to be filled in by Contractor)

The City of Austin is prohibited from contracting with or making prime or sub-awards to parties that are suspended or debarred or whose principals are suspended or debarred from Federal, State, or City of Austin Contracts. Covered transactions include procurement contracts for goods or services equal to or in excess of $25,000.00 and all non-procurement transactions. This certification is required for all bidders on all City of Austin Contracts to be awarded with values equal to or in excess of $25,000.00 and all non-procurement transactions.

The CONTRACTOR hereby certifies that its firm and its principals are not currently suspended or debarred from bidding on any Federal, State, or City of Austin Contracts.

Contractor's full name and entity status:

_____

_____

(Name/Signature of Authorized Official)

_____

Title

_____

Date

END

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BIDDER'S SAFETY EXPERIENCE
(To Be Submitted Post-Bid)

Solicitation Number: _____ (to be filled in by Contractor)

NAME OF BIDDER: _____

Pursuant to Section 252.0435 of the Local Government Code, the OWNER will consider the safety records of bidders prior to awarding a City contract. Upon request, a bidder is required to provide information to demonstrate the safety and health performance of their company. The information obtained from a bidder or from other sources will be used to determine the bidder's safety record, and will not automatically be used to exclude the bidder from selection for this or any future procurement. The OWNER will consider the responses to this Section 00410 document separately when making a discretionary determination of whether to disqualify a bidder, and may also consider the cumulative impact of the information generated by the bidder's responses in making the determination. Bidders are responsible for reviewing the safety records of proposed subcontractors.

Upon notification from the OWNER, the three (3) apparent low bidders are required to provide the following information:

<table>
<tr><th colspan="4">WORKERS' COMPENSATION EXPERIENCE MODIFICATION RATE DATA</th></tr>
<tr><td rowspan="6">Provide bidder's Workers' Compensation Experience Modification Rate (EMR)
Data using the loss experience that occurred within the past five years.

Attach bidder's NCCI workers compensation experience rating sheets for the past five (5) years.</td><td></td><td>Policy Year</td><td>EMR</td></tr>
<tr><td>Current EMR:</td><td></td><td></td></tr>
<tr><td>1 Year Ago:</td><td></td><td></td></tr>
<tr><td>2 Years Ago:</td><td></td><td></td></tr>
<tr><td>3 Years Ago:</td><td></td><td></td></tr>
<tr><td>4 Years Ago:</td><td></td><td></td></tr>
<tr><td colspan="4">Bidder's initialing here certifies that bidder does not have an EMR: _____

(Submit a copy of bidder's Insurance Loss Run Reports for the last five years if bidder does not have an EMR.)</td></tr>
<tr><td colspan="4">Bidder may include additional information explaining any circumstances that may have affected the company's EMR rate.</td></tr>
<tr><td colspan="4">Evaluation: Bidders with a 5-year EMR average that exceeds the 5-year industry average EMR by more than 25% may be deemed non-responsive.</td></tr>
</table>

REGULATORY NOTICE AND CITATION HISTORY DATA	
Provide bidder's information regarding regulatory **OSHA and/or Environmental Protection Agency Notices and Citations** as follows: Describe federal, state, city/municipal or county OSHA notices of noncompliance or citations issued to or received by the bidder within the past three years or any notices from any environmental protection agency, including any notices or citations from any state agency or local government responsible for enforcing environmental protection or other health and safety laws or regulations of any state of the United States, received within the past three years.	**Provide a description of each on the OSHA/EPA form on the following page to include:** • Date of Citation/Notices • Issuing agency • Standard cited • Level of violation (i.e. serious, willful) • Dates and brief description(s) of the event(s) • Brief description(s) of actions taken to correct the violation(s) • Current status (Open, Closed, Contested) • If Closed, date of Closure • If Open, estimated date of Closure
Bidder may include additional information explaining any related circumstances.	
Evaluation: Information may be verified by referring to respective agency. More than two serious or more than one willful or repeated violation (investigation completed) within the past three years may deem the Bidder non-responsive.	

OSHA and/or Environmental Protection Agency Notices Within Past Three Years						
Date of Citation or Notice	Issuing Agency	Violation Level (i.e. serious, willful)	Brief description of event	Brief description of actions taken to correct violation(s)	Current Status (Open, Closed, Contested)	Closed Date, or if Open, estimated Close Date

INJURY AND ILLNESS INCIDENCE RATE DATA	
Provide bidder's ***Total Case Incidence Rate(s) (TCIR)** for the 3 most recent calendar years. Attach bidder's OSHA 300 and 300A logs for the past 3 years.	**TCIR Rates:** Current Rate: _____ 1 Year Ago: _____ 2 Years Ago: _____
DAYS AWAY, RESTRICTED, AND TRANSFER RATE DATA	
Provide bidder's ****Days Away, Restricted, and Transfer Rate(s) (DART)** for the three most recent calendar years.	**DART Rates:** Current Rate: _____ 1 Year Ago: _____ 2 Years Ago: _____
Bidder may include additional information explaining any circumstances that may have affected the submitted rates and/or their associated three year trends.	
Evaluation: Rates will be compared to the most recently published Bureau of Labor Statistics (BLS) national average for the Standard Industrial Classification code (SIC) or North American Industrial Classification Systems (NAICS) code for the construction industry. For consideration of another code within the construction industry, the Bidder must provide the code and justification. Bidders with a 3-year TCIR or DART average that exceeds the 3-year TCIR or DART industry average may be deemed non-responsive.	

**TCIR – To calculate the calendar year TCIR, determine the total number of all recordable injuries and illnesses that occurred during the year in question, divide that total by the total number of hours worked by all employees during that year, and multiply the result by 200,000.*

*** DART – To calculate the calendar year DART, determine the total number of recordable injuries and illnesses resulting in days away from work, restricted work activity, and/or job transfer that occurred during the year in question, divide that total by the total number of hours worked by all employees during that year, and multiply the result by 200,000.*

ACKNOWLEDGEMENT

THE STATE OF TEXAS

COUNTY OF TRAVIS

I certify that my responses and the information I have provided are true and correct to the best of my personal knowledge and belief and I have made no willful misrepresentations in this, or withheld any relevant information in my statements. I am aware that any information given by me in response to this Section 00410 may be investigated and I hereby give my full permission for any such investigations, and I fully acknowledge that any misrepresentations or omissions in my responses and information may cause my bid to be rejected or cause any contract based on misrepresentations to be cancelled.

Contractor's full name and entity status:

_____

_____
(Name/Signature of Authorized Official)

_____
Title

_____
Date

END

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NON-COLLUSION, NON-CONFLICT OF INTEREST AND ANTI-LOBBYING

State of Texas

County of Travis

The term **"Bidder"**, as used herein, includes the individual or business entity submitting the bid includes the directors, officers, partners, managers, members, principals, owners, agents, representatives, employees, other parties in interest of the Bidder, and anyone or any entity acting for or on behalf of the Bidder, including a subcontractor in connection with this bid.

The terms **"City"** and **"Owner"** are synonymous.

1. **Anti-Collusion Statement.** The Bidder has not and will not in any way directly or indirectly:

   a. colluded, conspired, or agreed with any other person, firm, corporation, bidder or potential bidder to the amount of this bid or the terms or conditions of this bid.
   b. paid or agreed to pay any other person, firm, corporation bidder or potential bidder any money or anything of value in return for assistance in procuring or attempting to procure a contract or in return for establishing the prices in the attached bid or the bid of any other bidder.

2. **Preparation of Invitation for Bid and Contract Documents**. The Bidder has not received any compensation or a promise of compensation for participating in the preparation or development of the underlying bid or contract documents., In addition, the Bidder has not otherwise participated in the preparation or development of the underlying bid or contract documents, except to the extent of any comments or questions and responses in the bidding process, which are available to all bidders, so as to have an unfair advantage over other bidders, provided that the Bidder may have provided relevant product or process information to a consultant in the normal course of its business.

3. **Participation in Decision Making Process.** The Bidder has not participated in the evaluation of bids or proposals or other decision making process for this solicitation, and, if Bidder is awarded a contract hereunder, no individual, agent, representative, consultant or sub contractor or consultant associated with Bidder, who may have been involved in the evaluation or other decision making process for this solicitation, will have any direct or indirect financial interest in the Contract, provided that the Bidder may have provided relevant product or process information to a consultant in the normal course of its business.

4. **Present Knowledge.** Bidder is not presently aware of any potential or actual conflicts of interest regarding this solicitation, which either enabled Bidder to obtain an advantage over other bidders or would prevent Bidder from advancing the best interests of OWNER in the course of the performance of the Contract.

5. **City Code.** As provided in Sections 2-7-61 through 2-7-65 of the City Code, no individual with a substantial interest in Bidder is a City official or employee or is related to any City official or employee within the first or second degree of consanguinity or affinity.

6. **Chapter 176 Conflict of Interest Disclosure.** In accordance with Chapter 176 of the Texas Local Government Code, the Bidder:

   a. does not have an employment or other business relationship with any local government officer of OWNER or a family member of that officer that results in the officer of family member receiving taxable income;
   b. has not given a local government officer of OWNER one or more gifts, other than gifts of food lodging transportation or entertainment accepted as a guest, that have an aggregate value of more than $100 in the twelve-month period preceding the date the officer becomes aware of the execution of the Contract or that OWNER is considering doing business with the Bidder; and
   c. does not have a family relationship with a local government officer of OWNER in the third degree of consanguinity or the second degree of affinity.

   As required by Chapter 176, Bidder must file the Conflicts of Interest Questionnaire with the Purchasing Department no later than the seventh business day after the commencement of contract discussions or negotiations with the City or the submission of a Bid, response to a request for proposals, or other writing related to a potential contract with OWNER. The questionnaire must be updated not later than the seventh day after the date of an event that would make a statement in the questionnaire inaccurate or incomplete. There are statutory penalties for failure to comply with Chapter 176.

7. **Anti-Lobbying Ordinance.** On June 14, 2018, the Austin City Council adopted Ordinance No. 20180614-056 replacing Chapter 2.7, Article 6 of the City Code relating to Anti-Lobbying and Procurement. The policy defined in this Code applies to Solicitations for goods and/or services requiring City Council approval under City Charter Article VII, Section 15 (Purchase Procedures). The City requires Offerors submitting Offers on this Solicitation to certify that the Offeror has not in any way directly or indirectly had communication restricted in the ordinance section 2-7-104 during the No-Lobbying Period as defined in the Ordinance. The text of the City Ordinance is included in Section 00100 of this solicitation and is also posted on the Internet at:

   https://assets.austintexas.gov/purchase/downloads/New_ALO_Ordinance_No_20180614-056.pdf

8. **Texas Government Code Chapter 2270.** The City is prohibited from contracting with any "company", for goods and services unless the following verification is included in this contract.

   If CONTRACTOR qualifies as a "company", then CONTRACTOR verifies that it: (a) does not "boycott Israel"; and (b) will not "boycott Israel" during the term of this contract. For the purposes of this Section only, the terms "company" and "boycott Israel" have the meaning assigned by Texas Government Code Section 2270.001. CONTRACTOR's obligations under this Section, if any exist, will automatically cease or be reduced to the extent that the requirements of Texas Government Code Chapter 2270 are subsequently repealed, reduced, or declared unenforceable or invalid in whole or in part by any court or tribunal of competent jurisdiction or by the Texas Attorney General, without any further impact on the validity or continuity of this contract.

NOTE: THE ABOVE STATE LAW HAS RECENTLY BEEN TEMPORARILY ENJOINED. HOWEVER, IF THIS INJUNCTION IS LIFTED OR STAYED BY A COURT OR OTHER ENTITY OF COMPETENT JURISDICTION, THIS SECTION WILL BE AN ENFORCEABLE AND REQUIRED TERM OF YOUR CONTRACT WITH THE CITY. IF YOU DISAGREE WITH THE ABOVE PROVISION OF THE CONTRACT, PLEASE STRIKE THROUGH IT OR INDICATE YOUR OBJECTION ON THIS PAGE. YOUR BID WILL NOT BE AFFECTED BY STRIKING THROUGH THIS PROVISION AT THIS TIME. STRIKING THROUGH THE PROVISION OR STATING YOUR OBJECTION TO IT WILL NOT CAUSE THE CITY TO REJECT YOUR BID.

If the Bidder cannot affirmatively swear and subscribe to the forgoing statements, the Bidder shall provide a detailed written explanation on separate pages to be included with Bid.

END

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NONRESIDENT BIDDER PROVISIONS

Section 00475

Solicitation Number: _____ (to be filled in by Contractor)

Bidder must answer the following questions in accordance with Vernon's Texas Statutes and Codes Annotated Government Code § 2252.002, as amended:

A. Is the bidder that is making and submitting this bid a "resident bidder" or a "non-resident bidder"?

Answer: _____

(1) Texas Resident Bidder - A bidder whose principal place of business is in Texas and includes a Contractor whose ultimate parent company or majority owner has its principal place of business in Texas.

(2) Nonresident Bidder - A bidder who is not a Texas Resident Bidder.

B. If the Bidder is a "Nonresident Bidder", does the state, in which the Nonresident Bidder's principal place of business is located, have a law requiring a Nonresident Bidder of that state to bid a certain amount or percentage under the bid of a Resident Bidder of that state in order for the nonresident bidder of that state to be awarded a contract on his bid in such state?

Answer: ❒ Yes ❒ No Which state? _____

If the answer to Question B is "yes", then what amount or percentage must a Texas Resident Bidder bid under the bid price of a Resident Bidder of that state in order to be awarded a contract on such bid in said state?

Answer: _____

END

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STATE OF TEXAS
COUNTY OF TRAVIS

THIS AGREEMENT is made and entered into by and between the City of Austin, Texas, a municipal corporation, organized and existing under laws of State of Texas, acting through its City Manager or other duly authorized designee, hereinafter referred to as the "OWNER," and _____, of the City of _____, County of _____, and State of_____, hereinafter referred to as the "CONTRACTOR."

In consideration of the promises, performances, payments and agreements set forth herein CONTRACTOR hereby agrees to commence and complete the following Project:

_____
_____

and all Work in accordance with the Project Manual, Drawings and Addenda, which are incorporated herein by reference and made a part hereof and which have been prepared by _____ and approved by OWNER, and OWNER agrees to pay the CONTRACTOR the total amount of:

$	
(Figures)	**(Words)**

The CONTRACTOR hereby agrees to commence work on the date specified in the written "Notice to Proceed" to be issued by the OWNER and to <substantially> <finally> complete construction of the improvements, as required by the Project Manual, Drawings and Addenda for the Work within _____ (___) <Working> <Calendar> Days. <If a Substantial Completion date has been specified, the CONTRACTOR further agrees to reach Final Completion within <_____> (<___>) <Working> <Calendar> Days after Substantial Completion as required by the Project Manual, Drawings and Addenda for the work.> Waiver of any breach of this Contract shall not constitute waiver of any subsequent breach.

In consideration of the award and execution of this Contract, and in consideration of the waiver of its right to attorney's fees by the OWNER, the CONTRACTOR knowingly and intentionally waives its right to attorney's fees under Section 271.153 of the Texas Local Government Code in any administrative proceeding, alternative dispute resolution proceeding, or litigation arising out of or connected to this Contract.

OWNER agrees to pay CONTRACTOR from available funds for performance of the Contract in accordance with the Bid and the provisions of the Contract Documents, subject to additions and deductions, as provided therein.

The OWNER's payment obligations are payable only and solely from funds available for the purposes of this Agreement.

Although drafted by OWNER, this Agreement, in event of any disputes over its meaning or application, shall be interpreted fairly and reasonably, and neither more strongly for nor against either party.

This Agreement is executed to be effective upon the date of the last party to sign.

SAMPLE

The undersigned, by their signature, represents that they are authorized to bind the Contractor to fully comply with the Contract. The Contractor, by signing below, acknowledge that they have read the entire contract and agree to be bound by the terms contained herein.

OWNER

By:_____
(Signature)

_____
Date

_____
Title of Signatory

CONTRACTOR

By:_____
(Signature)

_____
Date

_____
Printed Name of Signatory

_____
Title of Signatory, Authorized Rep

ATTEST (as applicable)

_____

***Corporate Secretary of Corporate Bidder or Corporate General Partner**

END

SAMPLE

PERFORMANCE BOND
Section 00610

STATE OF TEXAS
COUNTY OF _____

Bond No. _____
C.I.P. ID No. _____

Project Name_____

Know All Men By These Presents: That _____ of the City of _____, County of _____, and State of _____, as Principal, and _____, a solvent company authorized under laws of the State of Texas to act as surety on bonds for principals, are held and firmly bound unto _____ (OWNER), in the penal sum of _____U.S. Dollars ($ _____U.S.) for payment whereof, well and truly to be made, said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

Conditions of this Bond are such that, whereas, Principal has entered into a certain written contract with OWNER, dated the _____ day of _____, _____, which Agreement is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

Now, therefore, the condition of this obligation is such, that if said Principal shall faithfully perform said Agreement and shall in all respects duly and faithfully observe and perform all and singular covenants, conditions and agreements in and by said contract agreed and covenanted by Principal to be observed and performed, and according to true intent and meaning of said Agreement hereto annexed, then this obligation shall be void; otherwise to remain in full force and effect. If OWNER notifies Principal and Surety the OWNER is considering declaring Principal in default, Surety agrees to meet with OWNER and Principal no later than fifteen days after receipt of such notice to discuss methods of performing the Work of the Contract.

Provided, however, that this bond is executed pursuant to provisions of Chapter 2253, Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with provisions of said Article to same extent as if it were copied at length herein.

Surety, for value received, stipulates and agrees that no change in Contract Time or Contract Amount shall in anywise affect its obligation on this bond, and it does hereby waive notice of any such change in Contract Time or Contract Amount.

In witness whereof, said Principal and Surety have signed and sealed this instrument this _____day of _____, _____.

_____	_____
Principal	Surety
By_____	By_____
(Signature)	(Signature)
Title_____	Title_____
Address_____	Address_____
_____	_____

SAMPLE

_____ _____

Telephone _____ Fax_____
E-Mail Address _____

Name and address of Resident Agent of Surety:
_____
_____

Note: Bond shall be issued by a solvent Surety company authorized to do business in Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law. A copy of surety agent's "Power of Attorney" must be attached hereto.

END

SAMPLE

PAYMENT BOND

Section 00620

STATE OF TEXAS
COUNTY OF _____

Bond No. _____
C.I.P. ID No. _____

Project Name: _____

Know All Men By These Presents: That _____ of the City of _____, County of _____, and State of _____ as Principal, and _____, a solvent company authorized under laws of the State of Texas to act as surety on bonds for principals, are held and firmly bound unto _____ (OWNER), and all Subcontractors, workers, laborers, mechanics and suppliers as their interests may appear, all of whom shall have right to sue upon this bond in the penal sum of _____ U.S. Dollars ($_____ U.S.) for payment whereof, well and truly to be made, said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, by these presents:

Conditions of this Bond are such that, whereas, Principal has entered into a certain written contract with OWNER, dated the _____ day of _____, _____, which Agreement is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

Now, therefore, condition of this obligation is such, that if the said Principal shall well and truly pay all Subcontractors, workers, laborers, mechanics, and suppliers, all monies to them owing by said Principals for subcontracts, work, labor, equipment, supplies and materials done and furnished for the construction of improvement of said Agreement, then this obligation shall be and become null and void; otherwise to remain in full force and effect.

Provided, however, that this bond is executed pursuant to provisions of Chapter 2253, Texas Government Code as amended and all liabilities on this bond shall be determined in accordance with provisions of said Article to same extent as if it were copied at length herein.

Surety, for value received, stipulates and agrees that no change in Contract Time or Contract Amount shall in anywise affect its obligation on this bond, and it does hereby waive notice of any such change in Contract Time or Contract Amount.

In witness whereof, said Principal and Surety have signed and sealed this instrument this _____day of _____, _____.

_____	_____
Principal	Surety
By_____	By_____
(Signature)	(Signature)
Title_____	Title_____

Address_____ Address_____
_____ _____
_____ _____

Telephone_____Fax_____

E-Mail Address _____

Name and address of Resident Agent of Surety:
_____
_____

Note: Bond shall be issued by a solvent Surety company authorized to do business in Texas and shall meet any other requirements established by law or by OWNER pursuant to applicable law. A copy of surety agent's "Power of Attorney" must be attached hereto.

END

NON-DISCRIMINATION AND NON-RETALIATION CERTIFICATE

Section 00630

City of Austin, Texas
Equal Employment/Fair Housing Office

To: City of Austin, Texas, ("OWNER")

Our firm conforms to the Code of the City of Austin Section 5-4-2 as reiterated below:

Chapter 5-4. Discrimination in Employment by City Contractors.

Sec. 4-2 Discriminatory Employment Practices Prohibited. (B) As an Equal Employment Opportunity (EEO) employer, the Contractor will conduct its personnel activities in accordance with established federal, state and local EEO laws and regulations and agrees:

(1) Not to engage in any discriminatory employment practice defined in this chapter.
(2) To take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without discrimination being practiced against them as defined in this chapter. Such affirmative action shall include, but not be limited to: all aspects of employment, including hiring, placement, upgrading, transfer, demotion, recruitment, recruitment advertising; selection for training and apprenticeship, rates of pay or other forms of compensation, and layoff or termination.
(3) To post in conspicuous places, available to employees and applicants for employment, notices to be provided by OWNER setting forth the provisions of this chapter.
(4) To state in all solicitations or advertisements for employees placed by or on behalf of Contractor, that all qualified applicants will receive consideration for employment without regard to race, creed, color, religion, national origin, sexual orientation, gender identity, disability, veteran status, sex or age.
(5) To obtain a written statement from any labor union or labor organization furnishing labor or service to Contractors in which said union or organization has agreed not to engage in any discriminatory employment practices as defined in this chapter and to take affirmative action to implement policies and provisions of this chapter.
(6) To cooperate fully with OWNER's Equal Employment/Fair Housing Office in connection with any investigation or conciliation effort of said Equal Employment/Fair Housing Office to ensure that the purpose of the provisions against discriminatory employment practices are being carried out.
(7) To require compliance with provisions of this chapter by all subcontractors having fifteen or more employees who hold any subcontract providing for expenditure of $2,000.00 or more in connection with any contract with OWNER subject to the terms of this chapter.

For the purposes of this Bid and any resulting Contract, Contractor adopts the provisions of the City's Minimum Standard Nondiscrimination and Non-Retaliation Policy as set forth below.

City of Austin
Minimum Standard Non-Discrimination and Non-Retaliation in Employment Policy

As an Equal Employment Opportunity (EEO) employer, the Contractor will conduct its personnel activities in accordance with established federal, state and local EEO laws and regulations.

The Contractor will not discriminate against any applicant or employee based on race, creed, color, national origin, sex, age, religion, veteran status, gender identity, disability, or sexual orientation. This policy covers all aspects of employment, including hiring, placement, upgrading, transfer, demotion, recruitment, recruitment advertising, selection for training and apprenticeship, rates of pay or other forms of compensation, and layoff or termination.

The Contractor agrees to prohibit retaliation, discharge or otherwise discrimination against any employee or applicant for employment who has inquired about, discussed or disclosed their compensation.

Further, employees who experience discrimination, sexual harassment, or another form of harassment should immediately report it to their supervisor. If this is not a suitable avenue for addressing their complaint, employees are advised to contact another member of management or their human resources representative. No employee shall be discriminated against, harassed, intimidated, nor suffer any reprisal as a result of reporting a violation of this policy. Furthermore, any employee, supervisor, or manager who becomes aware of any such discrimination or harassment should immediately report it to executive management or the human resources office to ensure that such conduct does not continue.

Contractor agrees that to the extent of any inconsistency, omission, or conflict with its current non-discrimination and non- retaliation employment policy, the Contractor has expressly adopted the provisions of the City's Minimum Non-Discrimination Policy contained in Section 5-4-2 of the City Code as set forth above and the City's Non-Retaliation Policy, as the Contractor's Non-Discrimination and Non-Retaliation Policy or as an amendment to such Policy and such provisions are intended to not only supplement the Contractor's policy, but will also supersede the Contractor's policy to the extent of any conflict.

UPON CONTRACT AWARD, THE CONTRACTOR SHALL PROVIDE A COPY TO THE CITY OF THE CONTRACTOR'S NON-DISCRIMINATION AND NON-RETALIAITON POLICY ON COMPANY LETTERHEAD, WHICH CONFORMS IN FORM, SCOPE, AND CONTENT TO THE CITY'S MINIMUM NON-DISCRIMINATION AND NON-RETALIATION POLICY, AS SET FORTH HEREIN, ***OR*** *THIS NON-DISCRIMINATION AND NON-RETALIATION POLICY, WHICH HAS BEEN ADOPTED BY THE CONTRACTOR FOR ALL PURPOSES (THE FORM OF WHICH HAS BEEN APPROVED BY THE CITY'S EQUAL EMPLOYMENT/FAIR HOUSING OFFICE), WILL BE CONSIDERED THE CONTRACTOR'S NON-DISCRIMINATION AND NON-RETALIATION POLICY WITHOUT THE REQUIREMENT OF A SEPARATE SUBMITTAL.*
(http://austintexas.gov/page/bid-docs).

Sanctions:
Our firm understands that non-compliance with Chapter 5-4 may result in sanctions, including termination of the contract and suspension or debarment from participation in future City contracts until deemed compliant with the requirements of Chapter 5-4.

Term:
The Contractor agrees that this Section 00630 Non-Discrimination and Non-Retaliation Certificate or the Contractor's separate conforming policy, which the Contractor has executed and filed with the Owner, will remain in force and effect for one year from the date of filing. The Contractor further agrees that, in consideration of the receipt of continued Contract payments, the Contractor's Non-Discrimination Policy will automatically renew from year-to-year for the term of the underlying Contract.

END

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TITLE VI ASSURANCES APPENDIX A
Section 00631

Solicitation Number: _____ (to be filled in by Contractor)

During the performance of this contract, the contractor, for itself, its assignees and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. Compliance with Regulations: The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Nondiscrimination in Federally-assisted programs of the U.S. Department of Transportation, the Federal Highway Administration, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.

2. Nondiscrimination: The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate either directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 C.F.R. part 21.

3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding or negotiation made by the contract for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Nondiscrimination on the grounds of race, color, or national origin.

4. Information and Reports: The contractor shall provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its book, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Federal Highway Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information the contractor will so certify to the Recipient, or the Federal Highway Administration, as appropriate, and will set forth what efforts it has made to obtain the information.

5. Sanctions for Noncompliance: In the event of the contractor's noncompliance with the Nondiscrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:

    (a) withholding of payments to the contractor under the contract until the contractor complies, and or
    (b) cancelling, terminating or suspending a contract, in whole or in part.

6. Incorporation of Provisions: The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Recipient or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for non-compliance: Provided, that if a

contractor becomes involved in, or is threatened with, litigation with a subcontractor or supplier because of such direction, the contractor may request the Recipient to enter into any litigation to protect the interests of the Recipient. In addition, the contractor may request the United States to enter into the litigation to protect the interests of the United States.

(Source: DOT 1050.2A, Updated DOT Standard Title VI Assurances and Non-Discrimination Provisions 10/22/2013. Must be inserted into every contract/agreement regardless of funding sources.)

Contractor's full name and entity status:

_____

_____
(Name/Signature of Authorized Official)

_____
Title

_____
Date

END

TITLE VI ASSURANCES APPENDIX E
Section 00632

Solicitation Number: _____ (to be filled in by Contractor)

During the performance of this contract, the contractor (hereinafter includes consultants), for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees to comply with the following nondiscrimination statutes and authorities; including but not limited to:

Pertinent Nondiscrimination Authorities:

1. Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 C.F.R. Part 21.

2. The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C.§ 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);

3. Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);

4. Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 C.F.R. Part 27;

5. The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);

6. Airport and Airway Improvement Act of 1982, (49 U.S.C. § 4 71, Section 4 7123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);

7. The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, subrecipients and contractors, whether such programs or activities are Federally funded or not);

8. Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;

9. The Federal Aviation Administration's Nondiscrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);

10. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures nondiscrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;

11. Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP).

12. To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);

13. Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

(Source: DOT 1050.2A, Updated DOT Standard Title VI Assurances and Non-Discrimination Provisions 10/22/2013. Must be inserted into every contract/agreement regardless of funding sources.)

Contractor's full name and entity status:

_____

_____
(Name/Signature of Authorized Official)

_____
Title

_____
Date

END

CERTIFICATE OF INSURANCE

Section 00650

This Certificate shall be completed by a licensed insurance agent:

Name and Address of Agency:

_____
_____
_____
Phone: _____ / _____

Name and Address of Insured:

_____
_____
_____
Phone: _____/ _____

Prime or Sub-Contractor?: _____

Name of Prime Contractor, if different from Insured: _____

City of Austin Reference:
Project Name:
C.I.P. No.:
Project Location:

Managing Dept.:

Contract No.:
Project Mgr.:

Insurers Affording Coverages:

Insurer A: _____

Insurer B: _____

Insurer C: _____

Insurer D: _____

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFE-CTIVE DATE (MM/DD/YYYY)	POLICY EXPIR-ATION DATE (MM/DD/YYYY)	LIMITS OF LIABILITY	
	Commercial General Liability Policy As defined in the Policy, does the Policy provide:				Each Occurrence	$
					General Aggregate	$
	☐ Yes ☐ No -- Completed Operations/Products				Completed Operations /Products Aggregate	$
	☐ Yes ☐ No -- Contractual Liability				Personal & Advertising Injury	$
	☐ Yes ☐ No -- Explosion				Deductible or Self Insured Retention	$
	☐ Yes ☐ No -- Collapse					
	☐ Yes ☐ No -- Underground					
	☐ Yes ☐ No -- Contractors/ Subcontractors Work					
	☐ Yes ☐ No -- Aggregate Limits per Project Form CG 2503					
	☐ Yes ☐ No -- Additional Insured Form – CG 2010 and CG2037					
	☐ Yes ☐ No -- 30 Day Notice of Cancellation Form – CG 0205					
	☐ Yes ☐ No -- Waiver of Subrogation Form – CG 2404					
	Pollution/ Environmental Impairment Policy				Occurrence	$
					Aggregate	$

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFE-CTIVE DATE (MM/DD/YYYY)	POLICY EXPIR-ATION DATE (MM/DD/YYYY)	LIMITS OF LIABILITY	
	Auto Liability Policy As defined in the Policy, does the Policy provide:				CSL	$
					Bodily Injury (Per Accident)	$
	☐ Yes ☐ No -- Any Auto				Bodily Injury (Per Person)	$
	☐ Yes ☐ No -- All Owned Autos				Property Damage (Per Accident)	$
	☐ Yes ☐ No -- Non-Owned Autos					
	☐ Yes ☐ No -- Hired Autos					
	☐ Yes ☐ No -- Waiver of Subrogation – CA0444					
	☐ Yes ☐ No -- 30 Day Notice of Cancellation – CA0244					
	☐ Yes ☐ No -- Additional Insured – CA2048					
	☐ Yes ☐ No -- MCS 90					
	Excess Liability ☐ Umbrella Form ☐ Excess Liability Follow Form				Occurrence	$
					Aggregate	$
	Workers Compensation and Employers Liability As defined in the Policy, does the Policy provide:				☐ Statutory	
					Each Accident	$
	☐ Yes ☐ No -- Waiver of Subrogation – WC420304				Disease – Policy Limit	$
	☐ Yes ☐ No -- 30 Day Notice of Cancellation – WC420601				Disease – Each Employee	$
	Is a Builders Risk or Installation Insurance Policy provided? ☐ Yes ☐ No					$
	☐ Yes ☐ No -- Is the City shown as loss payee/mortgagee?					
	Professional Liability As defined in the Policy, does the Policy provide:				Each Claim	$
	☐ Yes ☐ No -- 30 Day Notice of Cancellation Retroactive Date: _____				Deductible or Self Insured Retention	$

This form is for informational purposes only and certifies that policies of insurance listed above have been issued to insured named above and are in force at this time. Not withstanding any requirements, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain, insurance afforded by policies described herein is subject to all terms, exclusions and conditions of such policies.

CERTIFICATE HOLDER:

City of Austin
Capital Contracting Office
P.O. Box 1088
Austin, Texas 78767

DATE ISSUED: _____

_____
AUTHORIZED REPRESENTATIVE SIGNATURE
Licensed Insurance Agent

END

TEXAS SALES AND USE TAX EXEMPTION CERTIFICATE

Section 00670

City of Austin, Texas

P.O. Box 1088

Austin, Texas 78767

CONTRACTOR/PURCHASER:

Street Address:

City, State, ZIP Code:

Project:

Project Manager:

FDU No.:

CIP ID No.:

Description of items to be purchased or as described on the attached order or invoice:

_____

_____

The Contractor may purchase all labor, materials, supplies, and equipment to be incorporated in the City of Austin realty, including easements, or completely consumed at the Project jobsite and services required by or integral to the performance of the contract for the Project without paying sales or use tax in accordance with State Comptroller Rule 3.291.

Contractor/Purchaser claims this exemption for the following reason: This contract is to be performed for the City of Austin, a tax exempt entity under the Texas Tax Code.

I understand that I will be liable for payment of sales and use taxes which may become due for failure to comply with the provisions of the Tax Code. I also understand that it is a criminal offense to give an exemption certificate to the contractor for taxable items that I know, at the time of purchase, will be used in a manner other than that expressed in this certificate and depending on the amount of tax evaded, the offense may range from a Class B misdemeanor to a felony of the second degree.

City of Austin, Texas	Title
Mark Dombroski	Chief Financial Officer

CONTRACTOR/PURCHASER: _____

By: _____

Title: _____

Date: _____

NOTE: This certificate cannot be issued for the purchase, lease, or rental of a motor vehicle.

THIS CERTIFICATE DOES NOT REQUIRE A NUMBER TO BE VALID. Sales and Use Tax "Exemption Numbers" or "Tax Exempt" Numbers do not exist. This certificate should be furnished to the supplier. Do not send the completed certificate to the Comptroller of Public Accounts.

End

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NON-USE OF ASBESTOS AFFIDAVIT (CONTRACTOR PRIOR TO CONSTRUCTION)

Section 00680

STATE OF TEXAS
COUNTY OF TRAVIS

BEFORE ME, the undersigned authority, personally appeared the Affiant who, being by me first duly sworn, upon oath deposed and stated:

"My name is _____, hereinafter known as Affiant. "I am over the age of 18 years and I have never been convicted of a crime. I am the _____of_____ hereinafter known as CONTRACTOR.

"I am fully competent to make this affidavit. I have personal knowledge of the facts set forth below and they are all true and correct.

"WHEREAS CONTRACTOR has submitted a bid to the City of Austin as the Prime CONTRACTOR and anticipates being awarded a contract for the construction of _____located at_____, Austin, Texas, hereinafter known as Project, for the City of Austin, Texas, hereinafter known as OWNER, and "WHEREAS asbestos in a dust form is a recognized health hazard, and "WHEREAS the OWNER desires not to have any asbestos containing materials used or incorporated into the construction of the Project; "THEREFORE the CONTRACTOR affirms and understands the following:

1. The CONTRACTOR, any person, firm or organization representing or represented by the CONTRACTOR, or employed by the CONTRACTOR shall not cause or allow any material to be incorporated into the construction of the project, or allow any building material on the project site that is an asbestos containing material or any other material defined as containing asbestos by any laws, rules or regulations promulgated by the United States Government, the State of Texas or any governmental organization or agency operating under the authority of either of those entities.

2. Realizing that there might be some materials in which a satisfactory non-asbestos containing material could not be obtained, the Consultant has received prior approval from the OWNER before specifying any such asbestos containing material. Those approved materials are the only asbestos containing materials that are exempt from the above prohibition.

3. The CONTRACTOR certifies and affirms their understanding that if any asbestos containing materials not approved by the City of Austin for inclusion into the Project, are determined, as a result of any inspection and sample analysis performed by an individual(s) and/or firm(s) certified and/or licensed to perform such inspection by the United States Government and/or the State of Texas, to have been incorporated into the construction of the Project, or brought onto the site of the Project, the OWNER shall look to the CONTRACTOR for reimbursement of any and all costs incurred in the removal and/or other abatement of said asbestos containing materials.

4. CONTRACTOR further understands that OWNER shall also look to the CONTRACTOR for any and all damages to OWNER which result from the inability of the OWNER to use any portion or all of the Project due to the incorporation of asbestos containing materials that have not been approved by OWNER.

5. CONTRACTOR further understands that OWNER will pursue reimbursement of any said cost and compensation for any said damages from the CONTRACTOR by any and every means within OWNER's right and power.

Signature of Affiant: _____

STATE OF TEXAS
COUNTY OF TRAVIS

ON _____, 20___, personally appeared_____ and been duly sworn by me, subscribed to the foregoing affidavit and has stated that the facts stated therein are true and correct.

_____
Notary Public, State of Texas

_____
Printed Name of Notary

My Commission Expires:_____

END

NON-USE OF ASBESTOS AFFIDAVIT (CONTRACTOR AFTER CONSTRUCTION)

Section 00681

STATE OF TEXAS
COUNTY OF TRAVIS

BEFORE ME, the undersigned authority, personally appeared the Affiant who, being by me first duly sworn, upon oath deposed and stated:

"My name is _____, hereinafter known as Affiant. "I am over the age of 18 years and I have never been convicted of a crime. I am the _____of_____ hereinafter known as CONTRACTOR.

"I am fully competent to make this affidavit. I have personal knowledge of the facts set forth below and they are all true and correct.

"WHEREAS CONTRACTOR was awarded a Contract for, and was the Prime CONTRACTOR for the construction of _____ located at _____, Austin, Texas, hereinafter known as Project, for the City of Austin, Texas, hereinafter known as OWNER, and "WHEREAS asbestos in a dust form is a recognized health hazard, and "WHEREAS the OWNER desires not to have any asbestos containing materials used or incorporated into the construction of the Project; "THEREFORE the CONTRACTOR affirms and understands the following:

1. The CONTRACTOR, any person, firm or organization representing or represented by the CONTRACTOR, or employed by the CONTRACTOR has not caused or allowed any material to be incorporated into the construction of the project, or allowed any building material on the project site that is an asbestos containing material or any other material defined as containing asbestos by any laws, rules or regulation promulgated by the United States Government, the State of Texas or any governmental organization or agency operating under the authority of either of those entities.

2. Realizing that there were some materials in which a satisfactory non-asbestos containing material could not be obtained, the Consultant received prior approval from the OWNER before specifying any such asbestos containing material. Those approved materials were the only asbestos containing materials incorporated into the construction of the Project and are listed below, with their locations:

_____

_____

_____

3. The CONTRACTOR certifies and affirms their understanding that if any asbestos containing materials not approved by the City of Austin for inclusion into the Project, are determined, as a result of any inspection and sample analysis performed by an individual(s) and/or firm(s) certified and/or licensed to perform such inspection by the United States Government and/or the State of Texas, to have been incorporated into the construction of the Project, or brought onto the site of the Project, the OWNER shall look to the CONTRACTOR for reimbursement of any and all costs incurred in the removal and/or other abatement of said asbestos containing materials.

4. CONTRACTOR further understands that OWNER shall also look to the CONTRACTOR for any and all damages to OWNER which result from the inability of the OWNER to use any portion or all of the Project due to the incorporation of asbestos containing materials that have not been approved by OWNER.

5. CONTRACTOR further understands that OWNER will pursue reimbursement of any said cost and compensation for any said damages from the CONTRACTOR by any and every means within OWNER's right and power.

Signature of Affiant:_____

STATE OF TEXAS
COUNTY OF TRAVIS

On _____, 20___, personally appeared_____ and been duly sworn by me, subscribed to the foregoing affidavit and has stated that the facts stated therein are true and correct.

_____
Notary Public, State of Texas

_____
Printed Name of Notary

My Commission Expires: _____

END

Bidding Requirements, Contract Forms and Conditions of the Contract

GENERAL CONDITIONS OF THE CONTRACT

Section 00700

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ARTICLE 1 – DEFINITIONS

Whenever used in these General Conditions or in the other Contract Documents the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

1.1 Addendum - Written instruments issued by the Contract Awarding Authority which clarify, correct or change the bidding requirements or the Contract Documents prior to the Due Date. "Addenda" is the plural form of Addendum.

1.2 Agreement - Prescribed form, Section 00500.

1.3 Alternative Dispute Resolution - The process by which a disputed Claim may be settled if the OWNER and the CONTRACTOR cannot reach an agreement between themselves, as an alternative to litigation.

1.4 Bid - A complete, properly signed response to an Invitation for Bid that, if accepted, would bind the Bidder to perform the resultant Contract.

1.5 Bidder - A person, firm, or entity that submits a Bid in response to a Solicitation. Any Bidder may be represented by an agent after submitting evidence demonstrating the agent's authority. The agent cannot certify as to his own agency status.

1.6 Bid Documents - The advertisement or Invitation for Bids, instructions to Bidders, the Bid form, the Contract Documents and Addenda.

1.7 Calendar Day - Any day of the week; no days being excepted. Work on Saturdays, Sundays, and/or Legal Holidays shall be coordinated with OWNER.

1.8 Change Directive - A written directive to CONTRACTOR, signed by OWNER, ordering a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Amount or Contract Time, or both. A Change Directive may be used in the absence of total agreement on the terms of a Change Order. A Change Directive does not change the Contract Amount or Contract Time, but is evidence that the parties expect that the change directed or documented by a Change Directive will be incorporated in a subsequently issued Change Order.

1.9 Change Orders - Written agreements entered into between CONTRACTOR and OWNER authorizing an addition, deletion, or revision to the Contract, issued on or after the Execution Date of the Agreement.

1.10 Claim - A written demand seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract.

1.11 Contract - The binding legal agreement between the OWNER and the CONTRACTOR. The Contract represents the entire and integrated agreement between OWNER and CONTRACTOR for performance of the Work, as evidenced by the Contract Documents.

1.12 Contract Amount - The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents.

1.13 Contract Awarding Authority - A City department authorized to enter into Contracts on behalf of the City.

1.14 Contract Documents - Project Manual, Drawings, Addenda and Change Orders.

1.15 Contract Time - The number of days allowed for completion of the Work as defined by the Contract. When any period is referred to in days, it will be computed to exclude the first and include the last day of such period. A day of twenty-four hours measured from midnight to the next midnight will constitute a day.

1.16 CONTRACTOR - The individual, firm, corporation, or other business entity with whom OWNER has entered into the Contract for performance of the Work.

1.17 Critical Path - The longest series of tasks that runs consecutively from the beginning to the end of the project, as determined by duration and workflow sequence. This longest path sets the managerial standard for how quickly a project can be completed, given appropriate resources.

1.18 Drawings - Those portions of the Contract Documents which are graphic representations of the scope, extent and character of the Work to be furnished and performed by CONTRACTOR and which have been approved by OWNER. Drawings may include plans, elevations, sections, details, schedules and diagrams. Shop Drawings are not Drawings as so defined.

1.19 Due Date - The date and time specified for receipt of Bids.

1.20 Engineer/Architect (E/A) - The OWNER's design professional identified as such in the Contract. The titles of "Architect/Engineer," "Architect" and "Engineer" used in the Contract Documents shall read the same as Engineer/Architect (E/A). Nothing contained in the Contract Documents shall create any contractual or agency relationship between E/A and CONTRACTOR.

1.21 Equal - The terms "equal" or "approved equal" shall have the same meaning.

1.22 Execution Date - Date of last signature of the parties to the Agreement.

1.23 Field Order - A written order issued by Owner's Representative which orders minor changes in the Work and which does not involve a change in the Contract Amount or the Contract Time.

1.24 Final Completion - The point in time when OWNER determines that all Work has been completed and final payment to CONTRACTOR will be made in accordance with the Contract Documents.

1.25 Force Account - a basis of payment for the direct performance of Work with payment based on the actual cost of the labor, equipment and materials furnished and consideration for overhead and profit as set forth in Section 11.5.

1.26 Inspector - The authorized representative of any regulatory agency that has jurisdiction over any portion of the Work.

1.27 Invitation for Bid (IFB) - a Solicitation requesting pricing for a specified Good or Service which has been advertised for Bid in a newspaper and/or the Internet.

1.28 Legal Holidays

1.28.1 The following are recognized by the OWNER:

Holiday	Date Observed
New Year's Day	January 1
Martin Luther King, Jr.'s Birthday	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday in May
Juneteenth	June 19
Independence Day	July 4
Labor Day	First Monday in September
Veteran's Day	November 11
Thanksgiving Day	Fourth Thursday in November
Friday after Thanksgiving	Friday after Thanksgiving

Christmas Eve	December 24
Christmas Day	December 25

1.28.2 If a Legal Holiday falls on Saturday, it will be observed on the preceding Friday. If a Legal Holiday falls on Sunday, it will be observed on the following Monday.

1.28.3 Christmas Eve is observed only if it falls on a Monday through Thursday. If Christmas Eve falls on a Friday, that day is observed as the Christmas Day holiday.

1.29 Milestones - A significant event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

1.30 Notice to Proceed - A Written Notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR's obligations under the Contract Documents.

1.31 OWNER - City of Austin, Texas, a municipal corporation, home rule city and political subdivision organized and existing under the laws of the State of Texas, acting through the City Manager or his/her designee, officers, agents or employees to administer design and construction of the Project.

1.32 Owner's Representative - The designated representative of the OWNER. The Owner's Representative will be identified at the pre-construction conference.

1.33 Partial Occupancy or Use - Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work, provided OWNER and CONTRACTOR have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, utilities, corrective work, insurance and warranties.

1.34 Project - The subject of the Work and its intended result.

1.35 Project Manual - That portion of the Contract Documents which may include the following: introductory information; bidding requirements, Contract forms and General and Supplemental General Conditions; General Requirements; Specifications; Drawings; MBE/WBE or DBE Procurement Program Package; Project Safety Manual; and Addenda.

1.36 Resident Project Representative - The authorized representative of E/A who may be assigned to the site or any part thereof.

1.37 Shop Drawings - All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR as required by the Contract Documents.

1.38 Specifications - Those portions of the Contract Documents consisting of written technical descriptions as applied to the Work, which set forth to CONTRACTOR, in detail, the requirements which must be met by all materials, equipment, construction systems, standards, workmanship, equipment and services in order to render a completed and useful project.

1.39 Solicitation - Solicitation means, as applicable, an Invitation for Bid or a Request for Proposal.

1.40 Substantial Completion - The stage in the progress of the Work when the Work, or designated portion thereof, is sufficiently complete in accordance with the Contract Documents so OWNER can occupy or utilize the Work for its intended use, as evidenced by a Certificate of Substantial Completion approved by OWNER.

1.41 Subcontractor - An individual, firm, corporation, or other business entity having a direct contract with CONTRACTOR for the performance of a portion of the Work under the Contract.

1.42 Sub-Subcontractor - A person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the work.

1.43 Superintendent - The representative of CONTRACTOR authorized in writing to receive and fulfill instructions from the Owner's Representative, and who shall supervise and direct construction of the Work.

1.44 Supplemental General Conditions - The part of the Contract Documents which amends or supplements the General Conditions. All General Conditions which are not so amended or supplemented remain in full force and effect.

1.45 Supplier - An individual or entity having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.

1.46 Time Extension Request - An approved request for time extension on a form acceptable to OWNER.

1.47 Work - The entire completed construction, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents.

1.48 Working Day - Any day of the week, not including Saturdays, Sundays, or Legal Holidays in which conditions under the CONTRACTOR's control will permit work for a continuous period of not less than seven (7) hours between 7:00 a.m. and 6:00 p.m. If other contract documents reduce the continuous period available for work to less than seven (7) hours, those reduced hours shall be considered a Working Day. Upon agreement with Owner's Representative, work on Saturdays, Sundays, and/or Legal Holidays may be allowed and will be considered a Working Day.

1.49 Working Hours

1.49.1 Working Day Contract: All Work shall be done between 7:00 a.m. and 6:00 p.m. unless otherwise authorized by Owner's Representative. However, emergency work may be done without prior permission as indicated in paragraph 6.11.5. If night Work is authorized and conditions under CONTRACTOR's control will permit Work for a continuous period of not less than seven (7) hours between 12:00 a.m. and 11:59 p.m. it will be considered a Working Day. Night Work may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for the prosecution and control of the night Work.

1.49.2 Calendar Day Contract: All Work shall be done between 7:00 a.m. and 6:00 p.m. unless authorized by Owner’s Representative. However, emergency work may be done without prior permission as indicated in paragraph 6.11.5. Night Work may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for the prosecution and control of the night Work.

1.50 Written Notice - Written communication between OWNER and CONTRACTOR. Written Notice shall be deemed to have been duly served if delivered in person to Owner's Representative or CONTRACTOR's duly authorized representative, or if delivered at or sent by registered or certified mail to the attention of Owner's Representative or CONTRACTOR's duly authorized representative at the last business address known to the party giving notice.

ARTICLE 2 - PRELIMINARY MATTERS

2.1 Delivery of Agreement, Bonds, Insurance, etc.: Within five (5) Working Days after written notification of award of Contract, CONTRACTOR shall deliver to OWNER signed Agreement, Bond(s), Insurance Certificate(s) and other documentation required for execution of Contract.

2.2 Copies of Documents: OWNER shall furnish to CONTRACTOR (1) copy of the executed Project Manual, one (1) set of Drawings and one (1) copy of the Contract Documents in .pdf format. Additional copies will be furnished, upon request, at the cost specified in the Supplemental General Conditions."

2.3 Commencement of Contract Times; Notice to Proceed: The Contract Time(s) will begin to run on the day indicated in the Notice to Proceed. Notice to Proceed will be given at any time within sixty (60) calendar days after the Execution Date of the Agreement, unless extended by written agreement of the parties.

2.4 Before Starting Construction:

2.4.1 No Work shall be done at the site prior to the preconstruction conference without OWNER's approval. Before undertaking each part of the Work, CONTRACTOR shall carefully study the Contract Documents to check and verify pertinent figures shown thereon compare accurately to all applicable field measurements. CONTRACTOR shall promptly report in writing to Owner's Representative any conflict, error, ambiguity or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from Owner's Representative before proceeding with any Work affected thereby. CONTRACTOR shall be liable to OWNER for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents of which CONTRACTOR knew or reasonably should have known.

2.4.2 It is mutually agreed between CONTRACTOR and OWNER that successful completion of the Work within the Contract completion date is of primary importance. Therefore, the CONTRACTOR hereby agrees to submit to the Owner's Representative for review and approval, or acceptance, as appropriate, all information requested within this section, including a Baseline Schedule, no later than five working days prior to the preconstruction conference. The Owner's Representative will schedule the preconstruction conference upon the timely submittal of the required documents, unless time is extended by written mutual agreement. CONTRACTOR will submit the following:

.1 A proposed Baseline Schedule developed using Microsoft Project software, unless otherwise approved by Owner's Representative ("Baseline Schedule") to confirm that all Work will be completed within the Contract time. The Baseline Schedule must (i) indicate the times (number of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents, (ii) identify the Critical Path for completing the Work, (iii) identify when all Subcontractors will be utilized, and (iv) take into consideration any limitations on Working Hours, including baseline Rain Days on Calendar Day Contracts, and (v) be prepared accordance with Section 01310, Schedules and Reports, if applicable; otherwise in accordance with Section 01300, Submittals. This Baseline Schedule, a copy of which shall be made available at the job site(s), must contain sufficient detail to indicate that the CONTRACTOR has properly identified required Work elements and tasks, has provided for a sufficient and proper workforce and integration of Subcontractors, has provided sufficient

resources and has considered the proper sequencing of the Work required to result in a successful Project that can be completed within the Contract time;

.2 An organizational chart showing the principals and management personnel who will be involved with the Work, including each one's responsibilities for the Work;

.3 To the extent not set forth in the Section 00400 Statement of Contractor's Experience, a complete listing of the CONTRACTOR's employees proposed for the Work. List each one by name and job title, and show length of employment with CONTRACTOR;

.4 To the extent not set forth in the Section 00410 Statement of Bidder's Safety Experience, a discussion and confirmation of the CONTRACTOR's commitment to safety by providing a copy of its employee's safety handbook and the safety records for the past three years of CONTRACTOR's proposed project manager and Superintendent;

.5 A preliminary schedule of Shop Drawing and sample submittals;

.6 A preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will be deemed to include an appropriate amount of overhead and profit applicable to each item of Work;

.7 To the extent not set forth in the Section 00400 Statement of Contractor's Experience, a letter designating CONTRACTOR's Superintendent and project manager, and a confirmation of past project experience for the CONTRACTOR's Superintendent and project manager specifically intended for the Work;

.8 A letter from CONTRACTOR and Subcontractor(s) listing salaried specialists. A salaried specialist is anyone except an hourly worker whose wage rate is governed by Section 00830 of this agreement;

.9 A letter designating the project's Safety Representative along with a copy of their Department of Labor-issued OSHA card proving completion of the OSHA 30-hour Construction Safety and Health training class in the OSHA Outreach Training Program;

.10 If applicable, an excavation safety system plan;

.11 If applicable, a plan illustrating proposed locations of temporary facilities;

.12 A completed Non-Use of Asbestos Affidavit (Prior to Construction);

.13 A letter designating the Texas Registered Professional Land Surveyor for layout of the Work, if the Work requires the services of a surveyor; and

.14 Copies of the Department of Labor-issued OSHA cards proving completion of the OSHA 10-hour Construction Safety and Health training class in the OSHA Outreach Training Program for each worker (defined as a person covered by a prevailing wage determination) that will initially be on site. Note that workers must possess other OSHA-required training as the work dictates in accordance with the OSHA Act; and specifically, the contractor must meet the required provisions in 509S Excavation Safety Systems required prior to commencing excavation;

.15 A certificate of worker's compensation insurance coverage for all persons providing services on the Project (refer to 5.2.1.3 in Section 00700 for definition of persons providing services on the Project);

.16 A Construction Equipment Emissions Reduction Plan.

2.4.3 Neither the acceptance nor the approval of any of the submittals required in paragraph 2.4.2, above, will constitute the adoption, affirmation, or direction of the CONTRACTOR'S means and methods.

2.5 Preconstruction Conference: Prior to commencement of Work at the site, CONTRACTOR must attend a preconstruction conference with Owner's Representative and others, as set forth in Division 1. Additionally, prior to commencement of work, the CONTRACTOR shall host a preconstruction conference for the Subcontractors identified on the originally approved compliance plan, Owner's Representative and others, as set forth in Division 1. The CONTRACTOR shall notify all Subcontractors five (5) working days prior to the preconstruction conference. If the CONTRACTOR has included Subcontractors in the initial preconstruction conference, the additional Subcontractor preconstruction conference will not be required.

2.6 Initially Acceptable Schedules: Unless otherwise provided in the Contract Documents, CONTRACTOR shall obtain approval of Owner's Representative on the Baseline Schedule submitted in accordance with paragraph 2.4.2.1 and Division 1 before the first progress payment will be made to CONTRACTOR. The Baseline Schedule must provide for an orderly progression of the designated portion of the Work to completion within any specified Milestones and Contract Times. Acceptance of the schedule by Owner's Representative will neither impose on Owner's Representative responsibility or liability for the sequencing, scheduling or progress of the Work nor interfere with or relieve CONTRACTOR from CONTRACTOR's full responsibility for such Work. CONTRACTOR's schedule of Shop Drawings and sample submissions must provide an acceptable basis for reviewing and processing the required submittals. CONTRACTOR's schedule of values must conform to the requirements set forth in Division 1.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.1 Intent:

3.1.1 The intent of the Contract Documents is to include all information necessary for the proper execution and timely completion of the Work by CONTRACTOR. The CONTRACTOR will execute the Work described in and reasonably inferable from the Contract Documents as necessary to produce the results indicated by the Contract Documents. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all. In cases of disagreement, the following order of precedence shall generally govern (top item receiving priority of interpretation):

Signed Agreement
Addendum to the Contract Documents, including approved changes
Supplemental General Conditions
General Conditions
Other Bidding Requirements and Contract Forms
Special Provisions to the Standard Technical Specifications
Special Specifications
Standard Technical Specifications

Drawings (figured dimensions shall govern over scaled dimensions)
Project Safety Manual (if applicable),

with the understanding that a common sense approach will be utilized as necessary so that the Contract Documents produce the intended response.

3.1.2 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

3.2 Reporting and Resolving Discrepancies: If, during the performance of the Work, CONTRACTOR discovers any conflict, error, ambiguity or discrepancy within the Contract Documents or between the Contract Documents and any provisions of any such law or regulation applicable to the performance of the Work or of any such standard, specification, manual or code or instructions of any Supplier, CONTRACTOR shall report it to Owner's Representative in writing at once, and CONTRACTOR shall not proceed with the Work affected thereby until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in paragraph 3.3.1 or 3.3.2. CONTRACTOR shall be liable to OWNER for failure to report any such conflict, error, ambiguity or discrepancy of which CONTRACTOR knew or reasonably should have known.

3.3 Modifying and Supplementing Contract Documents:

3.3.1 The Contract Documents may be modified to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions by change order or contract amendment.

3.3.2 In addition, the requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, in one or more of the following ways:

.1 Field Order.

.2 Review of a Shop Drawing or sample.

.3 Written interpretation or clarification.

3.4 Reuse of Documents Prohibited: CONTRACTOR and any Subcontractor or Supplier or other person or organization performing or furnishing any of the Work under a direct or indirect contract with OWNER: (i) shall not have or acquire any title to or ownership rights in any of the Drawings, Specifications or other documents (or copies of any thereof) prepared by or bearing the seal of E/A or E/A's consultant, and (ii) shall not reuse any of such Drawings, Specifications, other documents or copies on extensions of the Project or any other project without written consent of OWNER and E/A.

3.5 In the event of the breach by the OWNER or CONTRACTOR of any of its obligations under the Contract, so as to support a claim by the other party, the provisions of this Contract will be equitably construed to allow the resolution of such a claim and all of the other provisions of this Contract shall continue in full force and effect as to the rights, responsibilities, and remedies of the OWNER and CONTRACTOR.

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.1 Availability of Lands: The OWNER will provide access to all land and interests in land required for the Work and will notify CONTRACTOR of any restrictions in such access. CONTRACTOR may make a claim if OWNER fails to provide timely access to the Work.

CONTRACTOR must obtain any additional temporary construction facilities, stockpiling or storage sites not otherwise provided.

4.2 Subsurface and Physical Conditions:

4.2.1 CONTRACTOR specifically represents that it has carefully examined the plans, the geotechnical report, if any, and the site of the proposed Work and is thoroughly familiar with all of the conditions surrounding construction of the Project, having had the opportunity to conduct any and all additional inquiry, tests and investigation that he/she deems necessary and proper. CONTRACTOR acknowledges the receipt of the geotechnical report, if any, and agrees that the report, while it is an accurate record of the geotechnical conditions at the boring locations, is not a guarantee of specific site conditions which may vary between boring locations.

4.2.2 CONTRACTOR must notify OWNER in writing as soon as reasonably possible, but no later than three (3) calendar days, if unforeseen conditions are encountered at the site which are (i) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (ii) unknown physical conditions of an unusual nature, that differ materially from those normally encountered in the type of work being performed under this Contract. CONTRACTOR may not disturb the conditions until OWNER conducts an investigation. Owner's Representative and E/A will promptly investigate such conditions with E/A. If it is determined that such conditions differ materially and cause an increase or decrease in the CONTRACTOR's cost of or time required for performance of any part of the Work, Owner's Representative will recommend an equitable adjustment in the Contract Amount or Contract Time, or both. If it is determined that such conditions are not materially different from those indicated in the Contract Documents, Owner's Representative will notify CONTRACTOR in writing of such findings and the Contract will not be adjusted. CONTRACTOR may dispute such a determination in accordance with Article 16.

4.2.3 Notwithstanding any other provision of this Contract, CONTRACTOR is solely responsible for the location and protection of any and all public utility lines and utility customer service lines in the Work area. "Public utility lines" means the utility distribution and supply system, and "utility customer service lines" means the utility lines connecting customers to the utility distribution and collection system. Generally, existing utility customer service line connections are not shown on the Drawings. CONTRACTOR shall notify "One Call" and exercise due care to locate, mark, uncover and otherwise protect all such lines in the construction zone and any of CONTRACTOR's work or storage areas. CONTRACTOR's responsibility for the location and protection of utilities is primary and nondelegable. **CONTRACTOR shall indemnify or reimburse such expenses or costs (including fines that may be levied against OWNER) that may result from unauthorized or accidental damage to all public lines and utility customer service lines in the work area. OWNER reserves the right to repair any damage CONTRACTOR causes to such utilities at CONTRACTOR's expense. If a public line and/or customer service line is damaged by CONTRACTOR, CONTRACTOR shall give verbal notice within one (1) hour and written notice within twenty-four (24) hours to the Owner's Representative.**

4.2.4 CONTRACTOR shall take reasonable precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological or historical significance. No objects of this nature shall be disturbed without written permission of OWNER and Texas Historical Commission. When such objects are uncovered unexpectedly, CONTRACTOR shall stop all Work in close proximity and notify Owner's Representative and Texas Historical Commission of their presence and shall not disturb them until written permission and permit to do so is granted. All primitive rights and antiquities uncovered on OWNER's property shall remain property of State of Texas, Texas Historical Commission conforming to Texas Natural Resources Code. If it is determined by OWNER, in consultation with Texas Historical Commission, that exploration or excavation of primitive records or antiquities on Project site is necessary to avoid loss, CONTRACTOR shall cooperate in salvage work attendant to preservation. If the Work stoppage or salvage work causes an increase in CONTRACTOR's cost of, or time required for, performance of the Work, the Contract Amount and/or Contract Time will be equitably adjusted.

4.3 Reference Points: Unless otherwise specified, all control lines and bench marks suitable for use in layout will be furnished by OWNER. Lay out of the Work shall be performed in accordance with Division 1. Controls, bench marks and property boundary markers shall be carefully preserved by CONTRACTOR by use of flags, staffs or other visible devices and in case of destruction or removal by CONTRACTOR or its employees, such controls and bench marks shall be replaced by a Registered Professional Land Surveyor at CONTRACTOR's expense. City of Austin survey monuments damaged by CONTRACTOR will be reestablished by OWNER at CONTRACTOR's expense.

4.4 Hazardous Materials:

4.4.1 To the extent provided by applicable law, OWNER shall be responsible for any hazardous material uncovered or revealed at the site which was not shown, indicated or identified in the Contract Documents to be within the scope of the Work and which may present a substantial danger to persons or property exposed thereto in connection with the Work at the site. CONTRACTOR shall immediately notify Owner's Representative of any suspected hazardous materials encountered before or during performance of the Work and shall take all necessary precautions to avoid further disturbance of the materials.

4.4.2 CONTRACTOR shall be responsible for any hazardous materials brought to the site by CONTRACTOR, Subcontractor, Suppliers or anyone else for whom CONTRACTOR is responsible.

4.4.3 No asbestos-containing materials shall be incorporated into the Work or brought on Project site without prior approval of OWNER. The CONTRACTOR shall not knowingly use, specify, request or approve for use any asbestos containing materials or lead-based paint without the OWNER'S written approval. When a specific product is specified, the CONTRACTOR shall endeavor to verify that the product does not include asbestos containing material.

4.4.4 Refer to Division 1 for hazardous material definitions and procedures.

.1 Unless otherwise expressly provided in the Contract Documents to be part of the Work, CONTRACTOR is not responsible for any unexpected Hazardous Materials encountered at the site. Upon encountering any Hazardous Conditions, CONTRACTOR must stop Work immediately in the affected area and duly notify OWNER and, if required by applicable law or regulations, all government or quasi-government entities with jurisdiction over the Project or site.

.2 Upon receiving notice of the presence of suspected Hazardous Materials, OWNER shall take the necessary measures required to ensure that the Hazardous Materials are remediated or rendered harmless. Such necessary measures shall include OWNER retaining qualified independent experts to (i) ascertain whether Hazardous Materials have actually been encountered, and, if they have been encountered, (ii) prescribe the remedial measures that OWNER must take either to remove the Hazardous Materials or render the Hazardous Materials harmless.

.3 CONTRACTOR shall be obligated to resume Work at the affected area of the Project only after OWNER's Representative provides written certification that (i) the Hazardous Materials have been removed or rendered harmless and (ii) all necessary approvals have been obtained from all government and quasi-government entities having jurisdiction over the Project or site. The CONTRACTOR shall be responsible for continuing the Work in the unaffected portion of the Project and site.

.4 CONTRACTOR will be entitled, in accordance with these General Conditions, to an adjustment in its Contract Amount and/or Contract Time(s) to the extent CONTRACTOR's cost and/or time of performance have been adversely impacted by the presence of Hazardous Materials.

.5 Notwithstanding the preceding provisions of this Section 4.1, OWNER is not responsible for Hazardous Materials introduced to the Site by CONTRACTOR, Subcontractors or anyone for whose acts they may be liable. **CONTRACTOR shall indemnify, defend and hold harmless OWNER and OWNER's officers, directors, employees and agents from and against all claims, losses, damages, liabilities and expenses, including attorneys' fees and expenses, arising out of or resulting from those hazardous materials introduced to the site by CONTRACTOR, Subcontractors or anyone for whose acts they may be liable.**

4.4.5 CONTRACTOR shall be responsible for use, storage and remediation of any hazardous materials brought to the Site by CONTRACTOR, Subcontractors, Suppliers or anyone else for whom CONTRACTOR is responsible.

ARTICLE 5 - BONDS AND INSURANCE

5.1 Surety and Insurance Companies: All bonds and insurance required by the Contract Documents shall be obtained from solvent surety or insurance companies that are duly licensed by the State of Texas and authorized to issue bonds or insurance policies for the limits and coverages required by the Contract Documents. The bonds shall be in a form acceptable to OWNER and shall be issued by a surety which complies with the requirements of Texas Insurance Code, Title 12, Chapter 3503. The surety must obtain reinsurance for any portion of the risk that exceeds 10% of the surety's capital and surplus. For bonds exceeding $100,000, the surety must also hold a certificate of authority from the U.S. Secretary of the Treasury or have obtained reinsurance for any liability in excess of $1,000,000 from a reinsurer that is authorized as a reinsurer in Texas or holds a certificate of authority from the U.S. Secretary of the Treasury. In the event that the proposed surety for a contract award in excess of $100,000 does not hold a certificate of authority from the

U.S. Secretary of the Treasury and/or its proposed reinsurer does not hold a certificate of authority from the U.S. Secretary of the Treasury, the OWNER may require additional financial solvency information from the Bidder/Contractor and the proposed surety company and/or reinsurer as part of the 00400 Statement of Bidders Experience and determination of bidder responsibility in the award of the Contract.

5.2 Workers' Compensation Insurance Coverage:

5.2.1 Definitions:

.1 Certificate of coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (DWC-81, DCW-82, DCW-83, or DCW84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on the Project, for the duration of the Project.

.2 Duration of the Project - includes the time from the beginning of the Work on the Project until the CONTRACTOR's/ person's Work on the Project has been completed and accepted by OWNER.

.3 Persons providing services on the Project ("subcontractor" in Texas Labor Code, Section 406.096) - includes all persons or entities performing all or part of the services the CONTRACTOR has undertaken to perform on the Project, regardless of whether that person contracted directly with the CONTRACTOR and regardless of whether that person has employees. This includes, without limitation, independent contractors, Subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the Project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

5.2.2 CONTRACTOR shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the CONTRACTOR providing services on the Project, for the duration of the Project.

5.2.3 CONTRACTOR must provide a certificate of coverage to OWNER prior to being awarded the Contract.

5.2.4 If the coverage period shown on the CONTRACTOR's current certificate of coverage ends during the duration of the Project, the CONTRACTOR must, prior to the end of the coverage period, file a new certificate of coverage with OWNER showing that coverage has been extended.

5.2.5 CONTRACTOR shall obtain from each person providing services on the Project, and provide to OWNER:

.1 A certificate of coverage, prior to that person beginning Work on the Project, so OWNER will have on file certificates of coverage showing coverage for all persons providing services on the Project; and

.2 No later than seven (7) days after receipt by CONTRACTOR, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project.

5.2.6 CONTRACTOR shall retain all required certificates of coverage for the duration of the Project and for one (1) year thereafter.

5.2.7 CONTRACTOR shall notify OWNER in writing by certified mail or personal delivery, within ten (10) days after CONTRACTOR knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project.

5.2.8 CONTRACTOR shall post on each Project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the Project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.

5.2.9 CONTRACTOR shall contractually require each person with whom it contracts to provide services on a Project, to:

.1 Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the Project, for the duration of the Project;

.2 Provide to CONTRACTOR, prior to that person beginning Work on the Project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the Project, for the duration of the Project;

.3 Provide CONTRACTOR, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

.4 Obtain from each other person with whom it contracts, and provide to CONTRACTOR: a) a certificate of coverage, prior to the other person beginning Work on the Project; and b) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

.5 Retain all required certificates of coverage on file for the duration of the Project and for one (1) year thereafter;

.6 Notify OWNER in writing by certified mail or personal delivery, within ten (10) days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project; and

.7 Contractually require each person with whom it contracts, to perform as required by paragraphs 5.2.9.1 - 5.2.9.7, with the certificates of coverage to be provided to the person for whom they are providing services.

5.2.10 By signing this Contract or providing or causing to be provided a certificate of coverage, CONTRACTOR is representing to OWNER that all employees of the CONTRACTOR who will provide services on the Project will be covered by workers' compensation coverage for the duration of the Project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the Texas Worker’s Compensation Commission's Division of Self- Insurance Regulation. Providing false or misleading information

may subject CONTRACTOR to administrative penalties, criminal penalties, civil penalties, or other civil actions.

5.2.11 CONTRACTOR's failure to comply with any of these provisions is a breach of Contract by CONTRACTOR which entitles OWNER to declare the Contract void if CONTRACTOR does not remedy the breach within ten (10) days after receipt of notice of breach from OWNER.

5.3 Other Bond and Insurance Requirements: For additional insurance requirements, refer to the Supplemental General Conditions.

5.4 Bonds:

5.4.1 General.

.1 Bonds, when required, shall be executed on forms furnished by or acceptable to OWNER. All bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.

.2 If the surety on any bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Texas or it ceases to meet the requirements of the preceding paragraph, CONTRACTOR shall within ten (10) days thereafter substitute another bond and surety, both of which must be acceptable to OWNER.

.3 When Performance Bonds and/or Payment Bonds are required, each shall be issued in an amount of one hundred percent (100%) of the Contract Amount as security for the faithful performance and/or payment of all CONTRACTOR's obligations under the Contract Documents. Performance Bonds and Payment Bonds shall be issued by a solvent surety company authorized to do business in the State of Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law. Any surety duly authorized to do business in Texas may write Performance and Payment Bonds on a project without reinsurance to the limit of ten percent (10%) of its capital and surplus. Such a surety must reinsure any obligations over ten percent (10%).

5.4.2 Performance Bond.

.1 If the Contract Amount exceeds $100,000, CONTRACTOR shall furnish OWNER with a Performance Bond in the form set out in Section 00610.

.2 If the Contract Amount exceeds $25,000 but is less than or equal to $100,000, CONTRACTOR shall furnish OWNER with a Performance Bond in the form set out in Section 00610, unless the original Contract Time is 60 Calendar Days/40 Working Days or less, in which case CONTRACTOR can agree to the following terms and conditions for payment in lieu of providing a Performance Bond: no moneys will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER; CONTRACTOR shall be entitled to receive 95% of the Contract Amount following Final Completion, and the remaining 5% of the Contract Amount following the one (1) year warranty period.

.3 If the Contract Amount is less than or equal to $25,000, CONTRACTOR will not be required to furnish a Performance Bond; provided that no moneys will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER under the following terms and conditions: CONTRACTOR shall be entitled to receive 95% of the Contract Amount following Final Completion, and the remaining 5% of the Contract Amount following the one (1) year warranty period.

.4 If a Performance Bond is required to be furnished, it shall extend for the one (1) year warranty period.

5.4.3 Payment Bond.

.1 If the Contract Amount exceeds $50,000, CONTRACTOR shall furnish OWNER with a Payment Bond in the form set out in Section 00620.

.2 If the Contract Amount is less than or equal to $50,000, CONTRACTOR will not be required to furnish a Payment Bond; provided that no moneys will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER under the terms and conditions specified in paragraph 5.4.2.3.

5.4.4 **Maintenance Bond:** If the Contract Documents contemplate a period of maintenance beyond the one (1) year contractual warranty period, OWNER agrees that any bond to be required for such maintenance work will be in the amount of the maintenance work during any extended maintenance period.

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.1 Supervision and Superintendence:

6.1.1 CONTRACTOR shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.

6.1.2 CONTRACTOR shall have a competent, qualified Superintendent on the Work at all times that work is in progress. To be qualified, at a minimum, the Superintendent must be effective at (a) communicating both verbally and in writing with the OWNER's representative; (b) receiving and fulfilling instructions from the Owner's Representative; (c) supervising and directing the construction of the Work; (d) reading and interpreting the plans and specifications; (e) writing, preparing and submitting necessary paperwork; and (f) understanding work sequencing and scheduling. The Superintendent will be CONTRACTOR's representative on the Work and shall have the authority to act on the behalf of CONTRACTOR. All communications given to the Superintendent shall be as binding as if given to CONTRACTOR. Either CONTRACTOR or the Superintendent shall provide a cellular telephone number and an emergency and home telephone number at which one or the other may be reached if necessary when work is not in progress. The Superintendent must be an employee of the CONTRACTOR, unless such requirement is waived in writing by the Owner's Representative. If the CONTRACTOR proposes a management structure with a Project Manager supervising, directing, and managing construction of the work in addition to or in substitution of a Superintendent, the requirements of these Construction Documents with respect to the Superintendent shall likewise apply to any such Project Manager.

.1 CONTRACTOR shall present the resume of the proposed Superintendent to the Owner's Representative showing evidence of experience and successful superintendence and direction of work of a similar scale and complexity. If, in the opinion of the Owner's Representative, the proposed Superintendent does

not indicate sufficient experience in line with the Work, he/she will not be allowed to be the designated Superintendent for the Work.

.2 The Superintendent shall not be replaced without Written Notice to Owner's Representative. If CONTRACTOR deems it necessary to replace the Superintendent, CONTRACTOR shall provide the necessary information for approval, as stated above, on the proposed new Superintendent.

.3 A qualified substitute Superintendent may be designated in the event that the designated Superintendent is temporarily away from the Work, but not to exceed a time limit acceptable to the Owner's Representative. CONTRACTOR shall replace the Superintendent upon OWNER's request in the event the Superintendent is unable to perform to OWNER's satisfaction.

6.2 Labor, Materials and Equipment:

6.2.1 CONTRACTOR shall maintain a work force adequate to accomplish the Work within the Contract Time. CONTRACTOR agrees to employ only orderly and competent workers, skillful in performance of the type of Work required under this Contract. CONTRACTOR, Subcontractors, Sub-subcontractors, and their employees may not use or possess any alcoholic or other intoxicating beverages, illegal drugs or controlled substances while on the job or on OWNER's property, nor may such workers be intoxicated, or under the influence of alcohol or drugs, on the job. Subject to the applicable provisions of Texas law, CONTRACTOR, Subcontractors, Sub-subcontractors, and their employees may not use or possess any firearms or other weapons while on the job or on OWNER'S property. If OWNER or Owner's Representative notifies CONTRACTOR that any worker or representative of Contractor is incompetent, disorderly, abusive, or disobedient, has knowingly or repeatedly violated safety regulations, has possessed any firearms in contravention of the applicable provisions of Texas law, or has possessed or was under the influence of alcohol or drugs on the job, CONTRACTOR shall immediately remove such worker or representative, including an officer or owner of CONTRACTOR, from performing Contract Work, and may not employ such worker or representative again on Contract Work without OWNER's prior written consent. CONTRACTOR shall at all times maintain good discipline and order on or off the site in all matters pertaining to the Project. Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) for Building Construction and Heavy and Highway Trades "AS APPLICABLE" and/or the minimum wage required by City of Austin Ordinance No. 20160324-015, whichever is higher. The Total Minimum Wage required can be met using any combination of cash and non-cash qualified fringe benefits provided the cash component meets or exceeds the minimum wage required.

6.2.2 Unless otherwise specified in Division 1, CONTRACTOR shall provide and pay for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

6.2.3 All materials and equipment shall be of good quality and new (including new products made of recycled materials, pursuant to Section 361.426 of the Texas Health & Safety Code), except as otherwise provided in the Contract Documents. If required by Owner's Representative, CONTRACTOR shall furnish satisfactory evidence (reports of required tests, manufacturer's certificates of compliance with material requirements, mill reports, etc.) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected,

erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.

6.2.4 Substitutes and "Approved Equal" Items:

.1 Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function and quality required. Unless the specification or description contains words reading that no like, equivalent or "approved equal" item or no substitution is permitted, other items of material or equipment of other Suppliers may be submitted by CONTRACTOR, at CONTRACTOR'S sole risk, including disruptions to the Critical Path of the Progress Schedule, to E/A through Owner's Representative under the following circumstances:

.1.1 "Approved Equal": If in E/A's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by E/A as an "approved equal" item, in which case review of the proposed item may, in E/A's sole discretion, be accomplished without compliance with some or all of the requirements for evaluation of proposed substitute items. CONTRACTOR shall provide E/A with the documentation required for E/A to make its determination.

.1.2 Substitute Items: If in E/A's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "approved equal" item under subparagraph 6.2.4.1.1, it will be considered a proposed substitute item. CONTRACTOR shall submit sufficient information as provided in Division 1 to allow E/A to determine that the item of material or equipment proposed is essentially equivalent to that named and a substitute therefor.

.2 Substitute Construction Methods and Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may, at CONTRACTOR'S sole risk, including disruptions to the Critical Path of the Progress Schedule, with prior approval of E/A furnish or utilize a substitute means, method, technique, sequence, or procedure of construction. CONTRACTOR shall submit sufficient information to Owner's Representative to allow E/A, in E/A's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by E/A will be same as that provided for substitute items in Division 1.

.3 E/A's Evaluation: E/A will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to subparagraphs 6.2.4.1.1 and 6.2.4.1.2. E/A will be the sole judge of acceptability. No "approved equal" or substitute shall be ordered, installed, or utilized until E/A's review is complete, which will be evidenced by either a Change Order or completion of the Shop Drawing review procedure. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety bond with respect to any "approved equal" or substitute or for any other delay or disruption to the Critical Path of the Project Schedule attributable to any such substitution. OWNER shall not be responsible for any delay due to review time for any "approved equal" or substitute.

.4 CONTRACTOR's Expense: All data and documentation to be provided by CONTRACTOR in support of any proposed "approved equal" or substitute item will be at CONTRACTOR's expense.

.5 The approval of the E/A will not relieve the CONTRACTOR from primary responsibility and liability for the suitability and performance of any proposed substitute item, method or procedure and will not relieve CONTRACTOR from its primary responsibility and liability for curing defective Work and performing warranty work, which the CONTRACTOR shall cure and perform, regardless of any claim the CONTRACTOR may choose to advance against the E/A or manufacturer.

6.2.5 CONTRACTOR agrees to assign to OWNER any rights it may have to bring antitrust suits against its Suppliers for overcharges on materials incorporated in the Project growing out of illegal price fixing agreements. CONTRACTOR further agrees to cooperate with OWNER should OWNER wish to prosecute suits against Suppliers for illegal price fixing.

6.3 Progress Schedule: Unless otherwise provided in Division 1, CONTRACTOR shall adhere to the Baseline Schedule established in accordance with paragraph 2.6 as it may be adjusted from time to time as provided below:

6.3.1 CONTRACTOR shall submit to Owner's Representative for review and approval any proposed adjustments in the Progress Schedule that will not change the Contract Times or Milestones on a monthly basis. Any such proposed adjustments must be substantiated with documentation of any changes to the underlying logic of the Progress Schedule. CONTRACTOR's Progress Schedule must show how the CONTRACTOR will consistently advance the progress of the Work in accordance with the Critical Path of the Work and the Contract Time or Milestones. Such adjustments will conform generally to the Progress Schedule then in effect and additionally will comply with any provisions of Division 1 applicable thereto.

6.3.2 Proposed adjustments in the Progress Schedule that will change the Contract Times or Milestones shall be submitted in accordance with the requirements of Article 12. Any such proposed adjustments must be substantiated with documentation of any changes to the underlying logic of the Progress Schedule. Such adjustments may only be made by a Change Order or Time Extension Request in accordance with Article 12.

6.4 Concerning Subcontractors, Suppliers and Others:

6.4.1 Assignment: CONTRACTOR agrees to retain direct control of and give direct attention to the fulfillment of this Contract. CONTRACTOR agrees not to, by Power of Attorney, or otherwise, assign said Contract without the prior written consent of OWNER. In addition, without OWNER'S written consent, the CONTRACTOR will not subcontract the performance of the entire Work or the supervision and direction of the Work.

6.4.2 Award of Subcontracts for Portions of the Work: CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization, whether initially or as a substitute, against whom OWNER may have reasonable objection. OWNER will communicate such objections by Written Notice. If OWNER requires a change without good cause of any Subcontractor, person or organization previously accepted by OWNER, the Contract Amount shall be increased or decreased by the difference in the cost occasioned by any such change, and appropriate Change Order shall be issued. CONTRACTOR shall not substitute any Subcontractor, person or

organization that has been accepted by OWNER, unless the substitute has been accepted in writing by OWNER. No acceptance by OWNER of any Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of OWNER to reject defective Work.

6.4.3 CONTRACTOR shall enter into written agreements with all Subcontractors and Suppliers which specifically binds the Subcontractors or Suppliers to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and E/A. The OWNER reserves the right to specify that certain requirements shall be adhered to by all Subcontractors and Sub-subcontractors as indicated in other portions of the Contract Documents and these requirements shall be made a part of the agreement between CONTRACTOR and Subcontractor or Supplier. Subject to and in accordance with the above requirements, the CONTRACTOR must provide and will be deemed for all purposes to have provided in its contracts with major Subcontractors or Suppliers on the Project (those contracts of more than $10,000) the following specific provision: alternative dispute resolution (paragraphs 16.2 and 16.3), which shall be mandatory in the event of a subcontractor or supplier claim and a prerequisite for the submission of any derivative claim. The CONTRACTOR's standard subcontract form is subject to the OWNER's review and approval. The OWNER may request and the CONTRACTOR will provide within five (5) working days a copy of any subcontract requested by the OWNER.

6.4.4 CONTRACTOR shall be fully responsible to OWNER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between OWNER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or E/A to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by laws and regulations.

6.4.5 CONTRACTOR shall be solely responsible for efficiently scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR in order to avoid any delays or inefficiencies in the prosecution of the Work. CONTRACTOR shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with Owner's Representative through CONTRACTOR.

6.4.6 The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing or delineating the Work to be performed by any specific trade.

6.4.7 CONTRACTOR shall pay each Subcontractor and Supplier their appropriate share of payments made to CONTRACTOR not later than ten (10) Calendar Days of CONTRACTOR's receipt of payment from OWNER. Upon request from Owner, the CONTRACTOR has two (2) Working Days to provide documentation verifying Payment to Subcontractor(s). The CONTRACTOR is required to notify the Subcontractor(s) in writing of rejection of Application for Payment within two (2) Working Days following notification by Owner. Failure of CONTRACTOR to make payments to Subcontractors or for labor, materials or equipment in accordance to this contract, may be cause to reject future Bids by the CONTRACTOR in accordance

with Section 00100 9.B.4 and may be cause to reject payment in accordance with 00700 14.4.1.3.

6.4.8 To the extent allowed by Texas law, the OWNER shall be deemed to be a third party beneficiary to each subcontract and may, if OWNER elects, following a termination of the CONTRACTOR, require that the Subcontractor(s) perform all or a portion of unperformed duties and obligations under its subcontract(s) for the benefit of the OWNER, rather than the CONTRACTOR; however, if the OWNER requires any such performance by a Subcontractor for the OWNER's direct benefit, then the OWNER shall be bound and obligated to pay such Subcontractor the reasonable value for all Work performed by such Subcontractor to the date of the termination of the CONTRACTOR, less previous payments, and for all Work performed thereafter. In the event that the OWNER elects to invoke its right under this section, OWNER will provide notice of such election to the CONTRACTOR and the affected Subcontractor(s).

6.5 Patent Fees and Royalties:

6.5.1 CONTRACTOR shall be responsible at all times for compliance with applicable patents or copyrights encompassing, in whole or in part, any design, device, material, or process utilized, directly or indirectly, in the performance of the Work or the formulation or presentation of its Bid.

6.5.2 CONTRACTOR shall pay all royalties and license fees and shall provide, prior to commencement of Work hereunder and at all times during the performance of same, for lawful use of any design, device, material or process covered by letters, patent or copyright by suitable legal agreement with the patentee, copyright holder, or their duly authorized representative whether or not a particular design, device, material, or process is specified by OWNER.

6.5.3 CONTRACTOR shall defend all suits or claims for infringement of any patent or copyright and shall save OWNER harmless from any loss or liability, direct or indirect, arising with respect to CONTRACTOR's process in the formulation of its Bid or the performance of the Work or otherwise arising in connection therewith. OWNER reserves the right to provide its own defense to any suit or claim of infringement of any patent or copyright in which event CONTRACTOR shall indemnify and save harmless OWNER from all costs and expenses of such defense as well as satisfaction of all judgments entered against OWNER.

6.5.4 OWNER shall have the right to stop the Work and/or terminate this Agreement at any time in the event CONTRACTOR fails to disclose to OWNER that CONTRACTOR's work methodology includes the use of any infringing design, device, material or process.

6.6 Permits, Fees: Unless otherwise provided in the Supplemental General Conditions, CONTRACTOR shall obtain and pay for all construction permits, licenses and fees required for prosecution of the Work.

6.7 Laws and Regulations:

6.7.1 CONTRACTOR shall give all notices and comply with all laws and regulations applicable to furnishing and performing the Work, including arranging for and

obtaining any required inspections, tests, approvals or certifications from any public body having jurisdiction over the Work or any part thereof. Except where otherwise expressly required by applicable laws and regulations, neither OWNER nor E/A shall be responsible for monitoring CONTRACTOR's compliance with any laws and regulations.

6.7.2 Maintaining clean water, air and earth or improving thereon shall be regarded as of prime importance. CONTRACTOR shall plan and execute its operations in compliance with all applicable Federal, State and local laws and regulations concerning control and abatement of water pollution and prevention and control of air pollution.

6.7.3 If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to laws or regulations, CONTRACTOR shall bear all claims, costs, losses and damages arising therefrom; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance with laws and regulations, but this does not relieve CONTRACTOR of CONTRACTOR's obligations under Article 3.

6.8 Taxes:

6.8.1 CONTRACTOR shall pay only those sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the laws and regulations of the State of Texas in the performance of this public works contract.

6.8.2 OWNER is an exempt organization as defined by Chapter 11 of the Property Tax Code of Texas and is thereby exempt from payment of Sales Tax under Chapter 151, Limited Use Sales, Excise and Use Tax, Texas Tax Code, and Article 1066 (C), Local Sales and Use Tax Act, Revised Civil Statutes of Texas.

6.9 Use of Premises:

6.9.1 CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by laws and regulations, right-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of or in connection with the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. **CONTRACTOR shall indemnify, defend and hold harmless OWNER, E/A, E/A'S Consultants and anyone directly or indirectly employed by any of them from and against all claims, costs, losses and damages (including court costs and reasonable attorney's fees) arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, E/A or any other party indemnified hereunder to the extent caused by or based upon performance of the work or failure to perform the Work.**

6.9.2 During the progress of the Work and on a daily basis, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. CONTRACTOR shall leave the site clean and ready for occupancy by OWNER at Substantial Completion of the Work. CONTRACTOR shall, at a minimum, restore to original condition all property not designated for alteration by the Contact Documents. If the CONTRACTOR fails to clean up at the completion of the Work, OWNER may do so and the cost thereof will be charged against the CONTRACTOR.

6.9.3 CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.10 Record Documents: CONTRACTOR shall maintain in a safe place at the site, or other location acceptable to OWNER, one (1) record copy of all Drawings, Specifications, Addenda, Change Orders, Change Directives, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.5) in good order and annotated to show all changes made during construction. These record documents together with all final samples and all final Shop Drawings will be available to OWNER and E/A for reference during performance of the Work. Upon Substantial Completion of the Work, these record documents, samples and Shop Drawings shall be promptly delivered to Owner's Representative.

6.11 Safety and Protection:

6.11.1 CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Upon request, and prior to installation of measures, CONTRACTOR shall submit a site security plan for approval by OWNER. By reviewing the plan or making recommendations or comments, OWNER will not assume liability nor will CONTRACTOR be relieved of liability for damage, injury or loss. CONTRACTOR shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

.1 all persons on the Work site or who may be affected by the Work;

.2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

.3 other property at the site or adjacent thereto, including, but not limited to, trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

6.11.2 CONTRACTOR shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of underground facilities, and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.11.1.2 and 6.11.1.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, Subcontractor, Supplier or any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or

Specifications or to the acts or omissions of OWNER, or E/A, or E/A's consultant or anyone employed by any of them or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the faults or negligence of CONTRACTOR or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and Owner's Representative has issued a notice to OWNER and CONTRACTOR in accordance with Article 14 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion). Without limitation, CONTRACTOR shall comply with the following specific provisions:

It shall be the duty and responsibility of CONTRACTOR and all of its subcontractors to be familiar with and comply with 29 USC Section 651, et seq., the Occupational Safety and Health Act of 1970, as amended ("OSHA") and to enforce and comply with all provisions of this Act.

The CONTRACTOR and all of its subcontractors shall comply with all applicable requirements of Subpart P of Part 1926 of 29 C.F.R, OSHA Safety and Health Standards, Texas Health and Safety Code Section 756.023, as amended, and shall submit a unit price for the particular excavation safety systems to be utilized by the Contractor for all excavations which exceed a depth of five feet (5').

Before commencing any excavation which will exceed a depth of five feet (5'), the CONTRACTOR shall provide the Owner with detailed plans and specifications regarding the safety systems to be utilized. Said plans and specifications shall include a certification from a Texas licensed professional engineer indicating full compliance with the OSHA provisions cited above.

6.11.3 Safety Representative: CONTRACTOR shall designate in writing a qualified and experienced safety representative (the "Safety Representative") at the site whose duties and responsibilities shall include safety training; identifying and mitigating hazardous conditions and unsafe work practices; and developing, maintaining and supervising the implementation of safe work practices and safety programs as deemed necessary and appropriate for the Project. The term "Safety Representative" includes any designated Safety Supervisor, Superintendent or Safety Manager. The Safety Representative shall exercise due diligence in the execution of all Project related safety duties. Upon request of OWNER, CONTRACTOR shall provide certifications or other acceptable documentation of the Safety Representative's qualifications. The following requirements will be effective as of September 1, 2010:

.1 The Safety Representative shall present certification of completion of the OSHA 30-hour Construction Industry Training Outreach Program described at: http://www.osha.gov/dte/outreach/construction_generalindustry/construction.html

.2 The Safety Representative shall verify that all construction workers (defined as persons covered by a prevailing wage determination) on the job site, whether employed by the CONTRACTOR or subcontractors, have completed the OSHA 10-hour Construction Industry Training Outreach Program described at: http://www.osha.gov/dte/outreach/construction_generalindustry/construction.html. The Safety Representative must receive a certificate of training completion before allowing a worker on site and shall have all such certificates available for inspection by the OWNER.

.3 The Safety Representative shall ensure that workers, including designated competent persons, have completed all applicable OSHA specific or other training needed to perform their job assignments. Training topics applicable

to the scope of the current Project may include, but are not limited to, scaffolds, fall protection, cranes, excavations, electrical safety, tools, concrete and masonry construction, steel erection, operation of motor vehicles and mechanized equipment.

.4 The Safety Representative shall post notice on the site of the Work stating that all workers shall have completed OSHA Construction Industry Training. The Owner may require, and the Safety Representative should consider providing a means of readily identifying workers who have completed the required training to monitor compliance with these requirements.

.5 The Safety Representative shall ensure that all required OSHA and Workers Compensation notices to workers are posted in English and Spanish at one or more conspicuous locations on the work site.

6.11.4 Hazard Communication Programs: CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with laws and regulations.

6.11.5 Emergencies:

.1 In emergencies affecting the safety or protection of persons or the Work at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from OWNER or E/A, is obligated to act reasonably to prevent threatened damage, injury or loss and to mitigate damage or loss to the Work. CONTRACTOR shall give Owner's Representative telephone notification as soon as reasonably practical and a prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Owner's Representative determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Change Directive or Change Order will be issued to document the consequences of such action; otherwise OWNER will not be responsible for CONTRACTOR's emergency action.

.2 Authorized agents of CONTRACTOR shall respond immediately to call-out at any time of any day or night when circumstances warrant the presence on Project site of CONTRACTOR or his agent to protect the Work or adjacent property from damage, restriction or limitation or to take such action or measures pertaining to the Work as may be necessary to provide for the safety of the public. Should CONTRACTOR and/or their agent fail to respond and take action to alleviate such an emergency situation, OWNER may direct other forces to take action as necessary to remedy the emergency condition, and OWNER will deduct any cost of such remedial action from the funds due CONTRACTOR under this Contract.

.3 In the event there is an accident involving injury to any individual or damage to any property on or near the Work, CONTRACTOR shall provide to Owner's Representative verbal notification within one (1) hour and written notification within twenty-four (24) hours of the event and shall be responsible for recording the location of the event and the circumstances surrounding the event through photographs, interviewing witnesses, obtaining medical reports, police accident reports and other documentation that describes the event. Copies of such documentation shall be provided to Owner's Representative, for OWNER's and E/A's records, within forty-eight (48) hours of the event.

Contractor shall cooperate with OWNER on any OWNER investigation of any such incident.

6.11.6 Rest Breaks:

.1 Except as provided in subsection 6.11.6.2 below, an employee performing construction activity at a construction site is entitled to a rest break of not less than ten (10) minutes for every four (4) hours worked. No employee may be required to work more than 3.5 hours without a rest break. A rest break means a break from work within working hours, excluding meal breaks, during which an employee may not work. A rest break shall be scheduled as near as possible to the midpoint of the work period.

.2 An employee is not entitled to a rest break under subsection 6.11.6.1 on any day the employee works less than 3.5 hours or spends more than half of his or her work time engaged in non-strenuous labor in a climate controlled environment.

.3 A sign describing the requirements of this Section 6.11.6 in English and Spanish shall be posted by the employer in each establishment subject to the requirement of a rest break in a conspicuous place or places where notices to employees are customarily posted, in accordance with the OWNER's then current rules for size, content, and location of such signage.

.4 The violation of Ordinance No. 20100729-047, enacted July 29, 2010, which establishes the rest break requirements set forth above, may be enforced with criminal penalties and civil remedies, as set forth in the Ordinance.

6.11.7 If the Contractor fails to carry out the Work in accordance with the Contract Documents so that a safety violation has occurred, the Owner may order the Contractor to stop the Work or any portion thereof, until the cause for such order has been eliminated. However, the right of the Owner to stop the Work under this paragraph shall not give rise to a duty on the part of the Owner to supervise the Contractor's Work or to control the Contractor's means and methods or to exercise this right for the benefit of the Contractor or any other person or entity. All time lost due to Project shut down will be the Contractor's sole responsibility, will be charged against the Contract Time, and the Contractor will be responsible for any and all expenses incurred. This provision is in addition to and supplemental to the applicable provisions of the Project's ROCIP Safety Manual.

6.11.8 Confined Space Program

.1 Contractor acknowledges and agrees that the Owner is temporarily transferring management and control of the site of the Work to the Contractor for the purpose of constructing the Project. The Contractor's responsibilities to manage the Work includes the responsibility to manage the property for purposes of compliance with 29 CFR 1926 subpart AA. To the best of Owner's knowledge and belief, Owner has provided the following information in the plans and specifications and other Contract Documents: (i) the location of each known permit space, (ii) the hazards or potential hazards in each space or the reason it is a permit space; and (iii) any precautions that the Owner or any previous contractor has implemented for the protection of employees in the permit space. This transfer will result in the Contractor being both the host employer and the controlling contractor for this portion of the Work.

6.12 Continuing the Work: CONTRACTOR shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as OWNER and CONTRACTOR may otherwise agree in writing.

6.13 CONTRACTOR's General Warranty and Guarantee:

6.13.1 CONTRACTOR warrants and guarantees to OWNER that all Work will conform to the plans and specifications, be performed in a good and workmanlike manner in accordance with the Contract Documents and will not be defective. This warranty will survive the termination or expiration of the Contract. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

.1 abuse, modification or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors or Suppliers; or

.2 normal wear and tear under normal usage.

6.13.2 CONTRACTOR's obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

.1 observations by Owner's Representative and/or E/A;

.2 recommendation of any progress or final payment by Owner's Representative;

.3 the issuance of a certificate of Substantial Completion or any payment by OWNER to CONTRACTOR under the Contract Documents;

.4 use or occupancy of the Work or any part thereof by OWNER;

.5 any acceptance by OWNER or any failure to do so;

.6 any review of a Shop Drawing or sample submittal;

.7 any inspection, test or approval by others; or

.8 any correction of defective Work by OWNER.

6.14 INDEMNIFICATION:

6.14.1 CONTRACTOR shall defend, indemnify and hold harmless OWNER, E/A, E/A'S Consultants and Sub consultants and their respective officers, directors, partners, employees, agents and other Consultants and any of them (the "INDEMNIFIED PARTIES") from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage:

.1 Is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself), including the loss of use resulting therefrom, and

.2 Is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of the INDEMNIFIED PARTIES hereunder or whether liability is imposed upon such INDEMNIFIED PARTY by laws and regulations regardless of the negligence of any such person or entity.

In the event that indemnification of the INDEMNIFIED PARTIES is prohibited by law, CONTRACTOR shall nonetheless be solely responsible for any liability arising out of or resulting from the performance of the Work, subject to the limitations set forth above, and shall indemnify and hold harmless the remaining INDEMNIFIED PARTIES, who may be legally indemnified, from such liability of the CONTRACTOR and the associated costs described above.

6.14.2 The indemnification obligation under paragraph 6.14.1 shall not be limited in any way by any limitation on the amount or type of damages, or compensation or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

6.14.3 The obligations of CONTRACTOR under paragraph 6.14.1 shall not extend to the liability of OWNER, E/A, E/A's consultants, and their officers, directors, partners, employees or agents caused primarily by negligent preparation of maps, drawings, surveys, designs or specifications upon which is placed the applicable state-authorized design professional seal of OWNER's, E/A's or E/A's consultant's officers, directors, partners, employees or agents.

6.14.4 In the event CONTRACTOR fails to follow OWNER's directives concerning use of the site, scheduling or course of construction, or engages in other conduct which proximately causes damage to property based on inverse condemnation or otherwise, then and in that event, CONTRACTOR shall indemnify OWNER against all costs resulting from such claims.

6.14.5 In the event CONTRACTOR unreasonably delays progress of the work being done by others on the site so as to cause loss for

which OWNER becomes liable, then CONTRACTOR shall indemnify OWNER from and reimburse OWNER for such loss.

6.15 Survival of Obligations: All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

6.16 **Losses from Natural Causes:** Unless otherwise specified, all loss or damage to CONTRACTOR arising out of the nature of the Work to be done or from action of the elements, floods or from unforeseeable circumstances in prosecution of the Work or from unusual obstructions or difficulties which may be encountered in prosecution of the Work, shall be sustained and borne by CONTRACTOR at its own cost and expense.

6.17 **Notice of Claim:** Should CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of OWNER or of any of OWNER's employees or agents or others for whose acts OWNER is liable, a Claim must be made to the other party within thirty (30) calendar days of the event giving rise to such injury or damage. The provisions of this paragraph 6.17 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

6.18 **Liquidated Damages:** CONTRACTOR or its Surety shall be liable for liquidated damages for the failure of the CONTRACTOR to timely complete the Work or any portion thereof within the Contract Time.

ARTICLE 7 - OTHER WORK

7.1 OWNER may perform other work related to the Project at the site by OWNER's own forces, or let other contracts therefor, or have other work performed by utility owners. CONTRACTOR and OWNER agree to and shall use best efforts to cooperate and coordinate the Work with others performing work and other work related to the Project in order to avoid conflicts and delays in the Work. If CONTRACTOR believes that delay or additional cost is involved because of such action by OWNER, CONTRACTOR may make a Claim as provided in Article 11 or 12.

7.2 CONTRACTOR shall afford other contractors who are in a contract with OWNER and each utility owner (and OWNER, if OWNER is performing the additional work with OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Owner's Representative and the other contractors whose work will be affected. CONTRACTOR shall promptly remedy damage wrongfully caused by CONTRACTOR to completed or partially completed construction or to property of the OWNER or separate contractors.

7.3 If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to Owner's Representative in writing any delays, defects or deficiencies in

such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent or non-apparent defects and deficiencies in such other work.

7.4 OWNER shall provide for coordination of the activities of the OWNER's own forces and of each separate contractor with the Work of CONTRACTOR, who shall cooperate with them. CONTRACTOR shall participate with other separate contractors and Owner's Representative in reviewing their construction Progress Schedules when directed to do so. On the basis of such review, CONTRACTOR shall make any revisions to the construction Progress Schedule deemed necessary after a joint review and mutual agreement. The agreed upon construction Progress Schedules shall then constitute the Progress Schedules to be used by CONTRACTOR, separate contractors and OWNER until subsequently revised.

7.5 Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.1 Prior to the start of construction, OWNER will designate in writing a person or entity to act as Owner's Representative during construction. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through Owner's Representative.

8.2 OWNER will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto. OWNER is not responsible for any failure of CONTRACTOR to comply with laws and regulations applicable to furnishing or performing the Work. OWNER is not responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of OWNER to discover, or object to or condemn any defective Work or material shall not release CONTRACTOR from the obligation to properly and fully perform the Contract.

8.3 OWNER is not responsible for the acts or omissions of CONTRACTOR, or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work. CONTRACTOR acknowledges and agrees that OWNER'S direction to perform Work in accordance with the approved Progress Schedule is not a demand for acceleration or a dictation of CONTRACTOR'S means or methods.

8.4 Information or services under the OWNER's control shall be furnished by the OWNER with reasonable promptness to avoid delay in orderly progress of the Work. The OWNER shall have a reasonable amount of time to investigate site conditions, review submittals, analyze requests for changes, and to make other decisions in the orderly administration of the Contract. CONTRACTOR must notify the OWNER in writing, if the time for the investigation, review, analysis of any submittals, required for changes or otherwise required for OWNER'S decision, impacts in any way the Critical Path of the approved Progress Schedule.

8.5 The foregoing are in addition to other duties and responsibilities of the OWNER enumerated herein and especially those in respect to Article 4 (Availability of Lands; Subsurface and Physical Conditions; Reference Points), Article 7 (Other Work) and Article 14 (Payments to CONTRACTOR and Completion).

8.6 **Notice of Claim:** Should OWNER suffer injury or damage to person or property because of any error, omission or act of CONTRACTOR or of any of CONTRACTOR's employees or agents or others for whose acts CONTRACTOR is liable, a Claim will be made to the other

party within thirty (30) calendar days of receipt of actual or constructive notice of the event giving rise to such injury or damage. The provisions of this paragraph 8.6 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

ARTICLE 9 - ENGINEER/ARCHITECT'S STATUS DURING CONSTRUCTION

9.1 E/A's Authority and Responsibilities:

9.1.1 The duties and responsibilities and the limitations of authority of E/A during construction, as set forth in the Contract Documents, may be assigned or assumed by the OWNER, but shall not be extended without written consent of OWNER and/or E/A. The assignment of any authority, duties or responsibilities to E/A under the Contract Documents, or under any agreement between OWNER and E/A, or any undertaking, exercise or performance thereof by E/A, is intended to be for the sole and exclusive benefit of OWNER and not for the benefit of CONTRACTOR, Subcontractor, Supplier, or any other person or organization, or for any surety or employee or agent of any of them.

9.1.2 E/A will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto. E/A is not responsible for any failure of CONTRACTOR to comply with laws and regulations applicable to the furnishing or performing the Work. E/A is not responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of E/A to discover, or object to or condemn any defective Work or material shall not release CONTRACTOR from the obligation to properly and fully perform the Contract.

9.1.3 E/A is not responsible for the acts or omissions of CONTRACTOR, or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

9.1.4 If OWNER and E/A agree, E/A will review the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by Article 14, but only to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with, the Contract Documents.

9.1.5 The limitations upon authority and responsibility set forth in this paragraph 9.1 shall also apply to E/A's Consultants, Resident Project Representative and assistants.

9.2 E/A as Owner's Representative: E/A may be designated as the Owner's Representative under paragraph 8.1.

9.3 Visits to Site: If OWNER and E/A agree, E/A will make visits to the site at intervals appropriate to the various stages of construction as E/A deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, E/A will endeavor for the benefit of OWNER to determine, in general, if the Work is proceeding in accordance with the Contract Documents. E/A will not be required to make exhaustive or continuous on-site

inspections to check the quality or quantity of the Work. E/A's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and on-site observations, E/A will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work. E/A's visits and on-site observations are subject to all the limitations on E/A's authority and responsibility set forth in paragraph 9.1.

9.4 Resident Project Representative: If OWNER and E/A agree, E/A will furnish a Resident Project Representative to assist E/A in providing more continuous observation of the Work. The responsibilities and authority and limitations of any such Resident Project Representative and assistants will be as provided in paragraph 9.1 and in the Supplemental General Conditions. OWNER may designate another representative or agent to represent OWNER at the site who is not E/A, E/A's consultant, agent or employee.

9.5 Clarifications and Interpretations: E/A may determine that written clarifications or interpretations of the requirements of the Contract Documents (in the form of drawings or otherwise) are necessary. Such written clarifications or interpretations will be consistent with the intent of and reasonably inferable from the Contract Documents, will be issued with reasonable promptness by Owner's Representative and will be binding on OWNER and CONTRACTOR. If OWNER or CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Amount or the Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in Article 11 or 12.

9.6 Rejecting Defective Work: E/A will recommend that OWNER disapprove or reject Work which E/A believes to be defective, or believes will not produce a completed Project that conforms to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

9.7 Shop Drawings: Refer to Division 1 for E/A's authority concerning Shop Drawings.

ARTICLE 10 - CHANGES IN THE WORK

10.1 Changes:

10.1.1 Without invalidating the Contract and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work. Such changes in the Work will be authorized by Change Order, Change Directive or Field Order. In the event that the OWNER and the CONRACTOR are unable to negotiate the terms of a Change Order for the performance of additional Work, the OWNER may, at its election, perform such additional Work with its own forces or with another contractor and such work will be considered "Other Work" in accordance with Article 7.

10.1.2 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and CONTRACTOR shall proceed promptly, unless otherwise provided in the Change Order, Change Directive or Field Order. CONTRACTOR's proposals for changes in the Contract Amount and/or Contract Time shall be submitted within ten (10) Calendar Days of request by Owner's Representative, including impacts to the approved Progress Schedule, unless Owner's Representative grants an extension. OWNER will review each proposal and respond to CONTRACTOR within ten (10) Calendar Days. After review by OWNER, CONTRACTOR shall provide any supporting data requested by Owner's Representative within seven (7) Calendar Days, unless Owner's Representative grants an extension. OWNER will determine within seven (7) Calendar Days whether to pursue the change in Work.

10.1.3 CONTRACTOR shall not be entitled to an increase in the Contract Amount or an extension of the Contract Times with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraphs 3.3.1 and 3.3.2, except in the case of an emergency as provided in paragraph 6.11.5 or in the case of uncovering Work as provided in paragraph 13.4.

10.1.4 Except in the case of an emergency as provided in paragraph 6.11.5, a Change Order or Change Directive is required before CONTRACTOR commences any activities associated with a change in the Work which, in CONTRACTOR 's opinion, will result in a change in the Contract Amount and/or Contract Times.

10.1.5 If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Amount or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

10.2 Change Orders:

10.2.1 OWNER and CONTRACTOR shall execute appropriate written Change Orders covering:

.1 a change in the Work;

.2 the amount of the adjustment in the Contract Amount, if any; and

.3 the extent of the adjustment in the Contract Time, if any.

10.2.2 An executed Change Order shall represent the complete, equitable, and final amount of adjustment in the Contract Amount and/or Contract Time owed to CONTRACTOR or OWNER as a result of the occurrence or event causing the change in the Work encompassed by the Change Order.

10.3 Change Directives:

10.3.1 Without invalidating the Contract, OWNER may, by written Change Directive, using the Force Account method, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Amount and Contract Time being adjusted as necessary. "Force Account" means a basis of payment for the direct performance of Work with payment based on the actual cost of the labor, equipment and materials furnished and consideration for overhead and profit as set forth in Section 11.5, below. A Change Directive shall be used in the absence of complete and prompt agreement on the terms of a Change Order. Where practicable, any items of Work that may be agreed upon, prior to the performance of Work under this Section, will be included in a separate Change Order. For example, the cost of the installation of additional asphalt may be agreed upon based on the unit prices in the Bid.

10.3.2 If the Change Directive provides for an adjustment to the Contract Amount, the adjustment shall be based on the method provided in paragraph 11.5.

10.3.3 A Change Directive shall be effective immediately and shall be recorded later by preparation and execution of an appropriate Change Order.

10.3.4 Upon receipt of a Change Directive, CONTRACTOR shall promptly proceed with the change in the Work involved, provided, prior to the commencement of any Work under this section, the CONTRACTOR must submit its proposed Work plan, anticipated schedule, and a list of its work force and equipment proposed to be

used in the Work for OWNER'S approval. Upon such approval, CONTRACTOR must promptly commence and make continuous progress in the Work. The OWNER reserves the right to withhold payment for low production or lack of progress.

10.4 Field Order:

10.4.1 Owner's Representative may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Amount or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These shall be accomplished by written Field Order and shall be binding on OWNER and on CONTRACTOR who shall perform the Work involved promptly.

10.4.2 If CONTRACTOR believes that a Field Order would require an adjustment in the Contract Amount and/or Contract Times, CONTRACTOR shall make a prompt written request to Owner's Representative for a Change Order. Any request by CONTRACTOR for an adjustment in Contract Amount and/or Contract Times must be made in writing prior to beginning the work covered by the Field Order.

10.5 No Damages for Delay: CONTRACTOR shall receive no compensation for delays or hindrances to the Work, except when direct and unavoidable extra cost to CONTRACTOR is caused by failure of OWNER to provide information or material, if any, which is to be furnished by OWNER or access to the Work and only to the extent that such acts continue after the CONTRACTOR furnishes OWNER with written notice of such failure. When such extra compensation is claimed a written statement thereof shall be presented by CONTRACTOR to OWNER and if by OWNER found correct shall be approved. If delay is caused by specific orders given by OWNER to stop work or by performance of extra Work or by failure of OWNER to provide material or necessary instructions for carrying on the Work, then such delay will entitle CONTRACTOR to an equivalent extension of time, CONTRACTOR's application for which shall, however, be subject to approval of OWNER. No such extension of time shall release CONTRACTOR or surety on its performance bond from all CONTRACTOR's obligations hereunder which shall remain in full force until discharge of the Contract. In no event shall the CONTRACTOR be entitled to any compensation or recovery of any special damages in connection with any delays, including without limitation: consequential damages, lost opportunity costs, impact damages, or other similar damages. The OWNER'S exercise of any of its rights or remedies under the Contract Documents (including without limitation ordering changes in the Work, or directing suspension, rescheduling, or correction of the Work), regardless of the extent or frequency of the OWNER'S exercise of such rights or remedies, shall not be construed as active interference in the CONTRACTOR'S performance of the Work. Except as otherwise provided herein, an extension of Contract Time, to the extent permitted under Article 12, shall be the sole remedy of the CONTRACTOR for any acknowledged delays.

ARTICLE 11 - CHANGE OF CONTRACT AMOUNT

11.1 The Contract Amount is stated in the Agreement and, including authorized adjustments, is the total amount payable by OWNER to CONTRACTOR for performance of the Work under the Contract Documents.

11.2 The original Contract Amount may not be increased by more than twenty-five percent (25%) and it may not be decreased more than twenty-five percent (25%) without the consent of the CONTRACTOR to such decrease, except in the event of a termination for convenience under paragraph 15.2 or the failure of the City Council to appropriate sufficient

funding for the Project, in which events it is agreed that the consent of the CONTRACTOR will not be required.

11.3 The Contract Amount shall only be changed by a Change Order. Any claim for an adjustment in the Contract Amount shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than thirty (30) calendar days) after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant, and shall represent that the adjustment claimed covers all known amounts to which claimant is entitled as a result of said occurrence or event. If OWNER and CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Amount shall be determined as set out in Article 16.

11.4 Determination of Value of Work:

11.4.1 The value of any Work covered by a Change Order for an adjustment in the Contract Amount will be determined by one or more of the following methods:

.1 by application of unit prices contained in the Contract Documents to the quantities of the items involved.

.2 by a mutually agreed unit price, or lump sum properly itemized and supported by sufficient substantiating data, including documentation by subcontractors performing the work, to permit evaluation.

.3 by cost of Work plus CONTRACTOR's fee for all overhead costs and profit (determined as provided in paragraph 11.5).

.4 No cost will be included in the change order for time spent preparing the change order, nor will costs be included for an estimate of time to negotiate the change order costs for machinery, tools, or equipment as described in subparagraph 11.5.3

11.4.2 Before using the method described in paragraph 11.4.1.3, OWNER and CONTRACTOR agree to negotiate a Change Order using the methods identified in paragraphs 11.4.1.1 and 11.4.1.2, as appropriate, to determine the adjustment in the Contract Amount.

11.5 Cost of Work: If neither of the methods defined in paragraphs 11.4.1.1 nor 11.4.1.2 can be agreed upon before a change in the Work is commenced which will result in an adjustment in the Contract Amount, then the change in the Work will be performed by Change Directive, using the Force Account method, and payment will be made as follows:

11.5.1 For all personnel, CONTRACTOR will receive actual field cost wage rates for each hour that said personnel are actually engaged in such Work, as substantiated by its certified payroll, to which will be added an amount equal to twenty-five percent (25%) of the sum thereof as compensation for CONTRACTOR's total overhead, profit, and small tools. No separate charge will be made by CONTRACTOR or its Subcontractor(s) for organization or overhead expenses. In no case will the rate of wage be less than the minimum shown in the Contract for a particular category. CONTRACTOR will also receive an amount equal to 55% of the wages paid personnel, excluding the 25% compensation provided above, for CONTRACTOR's and any effected Subcontractor's cost of premiums on public liability insurance, workers' compensation insurance, social security and unemployment insurance. The cost for superintendence, project management, and other salaried employees are considered as included in the twenty five percent (25%) total overhead, profit, and small tools mark-up unless considered necessary and ordered by Owner.

11.5.2 CONTRACTOR will receive the actual cost, including freight charges, of the materials used and installed on such Work, to which costs will be added a sum equal to twenty-five percent (25%) thereof as compensation for CONTRACTOR's and any affected Subcontractor's total overhead and profit. In case material invoices indicate a discount may be taken, the actual cost will be the invoice price minus the discount.

11.5.3 For machinery, trucks, power tools, or other similar equipment (the "equipment") agreed to be necessary by OWNER and CONTRACTOR, OWNER will allow CONTRACTOR the Regional and Model Year adjusted Monthly Ownership Cost divided by 176 plus the Hourly Estimated Operating Costs as given in the latest edition of the "Rental Rate Blue Book" as published by EquipmentWatch (1-800-669-3282) for each hour that said equipment is in use on such work. The established equipment rates will be paid for each hour that the equipment is utilized in the Work. In the event that the equipment is used intermittently during the Work, full payment for an eight-hour day will be made if the equipment is not idle more than four (4) hours of the day. If the equipment is idle more than four (4) hours in a day, then payment will be made only for the actual hours worked. No additional compensation will be allowed on the equipment for CONTRACTOR's or any affected Subcontractor's overhead and profit. OWNER may accept an actual rental invoice in lieu of the method of calculation set forth in paragraph 11.5.3 for equipment rented exclusively for Force Account Work or for equipment not included in the Rental Rate Blue Book.

11.5.4 For Subcontractors, CONTRACTOR will receive the approved actual invoice cost plus 5% as compensation for CONTRACTOR's total overhead and profit.

11.5.5 CONTRACTOR will receive an additional 1% of the total of 11.5.1, 11.5.2, 11.5.3, and 11.5.4 as compensation for increased bond costs.

11.5.6 The compensation, as herein provided for, shall be received by CONTRACTOR and any affected Subcontractor as payment in full for work done by Change Directive and will include use of small tools, and total overhead expense and profit. CONTRACTOR and Owner's Representative shall compare records of work done by Change Directive at the end of each day. Copies of these records will be made upon forms provided for this purpose by OWNER and signed by both Owner's Representative and CONTRACTOR, with one copy being retained by OWNER and one by CONTRACTOR. Refusal by CONTRACTOR to sign these records within two (2) working days of presentation does not invalidate the accuracy of the record.

11.6 Unit Price Work:

11.6.1 Where the Contract Documents provide that all or part of the Work is to be unit price Work, initially the Contract Amount will be deemed to include for all unit price work an amount equal to the sum of the established unit price for each separately identified item of unit price work times the estimated quantity of each item as indicated in the Bid. The estimated quantities of items of unit price work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Amount. Determinations of the actual quantities and classifications of unit price work performed by CONTRACTOR will be made by Owner's Representative. Owner's Representative will review with CONTRACTOR the preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise).

11.6.2 When "plan quantity" is indicated for a Bid item, CONTRACTOR shall be paid amount specified in the Contract Documents without any measurements.

11.6.3 Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.

11.6.4 A Major Item is any individual Bid item in the Bid that has a total cost equal to or greater than five percent (5%) of the original Contract Amount or $50,000, whichever is greater, computed on the basis of Bid quantities and Contract unit prices.

11.6.5 OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Amount in accordance with Article 11 if:

.1 the actual quantity of any Major Item should become as much as twenty percent (20%) more than or twenty percent (20%) less than that in the Bid; or

.2 CONTRACTOR presents documentation contesting accuracy of "plan quantity" and Owner's Representative verifies quantity and determines original value is in error by five percent (5%) or more;

Provided, however, in the event a Major Item is reduced by twenty percent (20%) or more of the amount in the Bid, no additional Article 11 profit or overhead will be added, if, due to other additions in the Work, the net value of the Contract Amount is not reduced.

ARTICLE 12 - CHANGE OF CONTRACT TIMES

12.1 Working Day and Calendar Day Contracts:

12.1.1 The Contract Times (or Milestones) may only be changed by Change Order or Time Extension Request duly executed by both CONTRACTOR and Owner's Representative. Any claim for an adjustment of the Contract Times (or Milestones) shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than thirty (30) calendar days after the start of the occurrence or event giving rise to the delay) and stating the general nature of the delay. Notice of the extent of the delay with supporting data shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant, and shall represent that the adjustment claimed is the entire adjustment to which claimant is entitled as a result of said occurrence or event. If OWNER and CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Times (or Milestones) shall be determined as set out in Article 16. No Claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph.

12.1.2 When CONTRACTOR is at fault and OWNER stops the Work, so that corrections in the Work can be made by CONTRACTOR, no extension in time will be allowed.

12.1.3 When CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay. If performance by the CONTRACTOR or OWNER is interrupted by any occurrence not occasioned by its own conduct, whether such occurrence be an act of god or the result of war, riot, civil commotion, sovereign conduct, or the conduct of a third party, then such performance will be excused for a period of time necessary to remedy its effects, provided, however, in such an

event, a conference will be held within three (3) business days to establish a proposed new Progress Schedule for the Project.

12.1.4 OWNER will consider time extension requests and may grant CONTRACTOR an extension of time because of:

.1 Changes ordered in the work which justify additional time.

.2 Failure of materials or products being at the Project site due to delays in transportation or failures of Suppliers, which are not the result of CONTRACTOR's, Subcontractor's or Supplier's negligence. The request for an extension of time shall be supported by a citation of acts demonstrating that the delays are beyond CONTRACTOR's control, including, but not limited to, CONTRACTOR's efforts to overcome such delays documented as follows:

a) Copy of purchase order for delayed item(s) indicating date ordered by CONTRACTOR/ Subcontractor and date purchase order received by Supplier.

b) If item(s) require Shop Drawings or other submittal information in accordance with the Contract Documents, provide record of date submittal(s) forwarded to Owner's Representative, date submittal(s) returned to CONTRACTOR, and date submittal(s) forwarded to Supplier.

c) Copy of document(s) from Supplier, on Supplier's letterhead, indicating date(s) item(s) would be ready for shipment and/or actual shipment date(s).

d) Copies of all correspondence between CONTRACTOR / Subcontractor and Supplier indicating CONTRACTOR / Subcontractor's efforts to expedite item(s).

e) If item(s) are being purchased by a Subcontractor, provide correspondence, meeting notes, etc., that reflect CONTRACTOR's efforts with the Subcontractor to expedite delivery of the item(s).

.3 When acts of OWNER, E/A, utility owners or other contractors employed by OWNER delay progress of work through no fault of CONTRACTOR. The CONTRACTOR will only be entitled to an extension of time for delays that affect the Critical Path of the Work and that are not caused by the CONTRACTOR.

.4 When CONTRACTOR is delayed by strikes, lockouts, fires, losses from natural causes, or other unavoidable cause or causes beyond CONTRACTOR's control.

12.2 Calendar Day Contracts:

12.2.1 Under a Calendar Day Contract, CONTRACTOR may be granted an extension of time because of unusual inclement weather, including but not limited to unusual rainfall events, which are beyond the normal rainfall recorded and expected for Austin, Texas. However, the CONTRACTOR will not be granted an extension of time for "normal rainfall", as described below.

12.2.2 "Unusual Inclement Weather" is defined as a rain event or other weather related event which occurs at the site and is of sufficient magnitude to prevent CONTRACTOR from performing units of Work critical to maintaining the Progress Schedule.

12.2.3 Baseline Rain Day Determination. "Normal rainfall" compiled by the State climatologist, based on U.S. Weather Bureau Records for Austin, Texas, is considered a part of the Calendar Day Contract, and is not a justification for an extension of time. Listed below are the number of days in each month for which no compensatory days for rainfall events ("Rain Days") in such months may be claimed:

January..... 8 days

February..... 8 days

March..... 7 days

April..... 7 days

May..... 9 days

June..... 6 days

July..... 5 days

August..... 5 days

September..... 7 days

October..... 7 days

November..... 7 days

December..... 7 days

Rain Days in addition to the baseline Rain Day determination described above will be measured with the Owner's Representative's approval at the nearest operational public weather data collection facility to the site, including but not limited to the OWNER's early warning flood gauge system.

12.2.4 CONTRACTOR may receive credit in any month for Unusual Inclement Weather, and specifically for any Rain Days in that month which exceed the number of Rain Days allocated to that month, if a Claim is made in accordance with paragraph 12.1.1 and the weather event meets the definition for "Unusual Inclement Weather", and as applicable, "Rain Day" and such claimed day is a day on which Work critical to maintaining the Progress Schedule is scheduled to be performed and is otherwise capable of being performed.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.1 **Notice of Defects:** Prompt notice of all defective Work of which OWNER or E/A has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected or accepted as provided in Article 13. CONTRACTOR must give OWNER and E/A prompt notice of any defective Work of which CONTRACTOR has actual knowledge.

13.2 **Access to Work:** OWNER, E/A, E/A's Consultants, other representatives and personnel of OWNER, independent testing laboratories and governmental agencies having jurisdiction will have access to the Work at reasonable times for observing, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access, and advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.

13.3 Tests and Inspections:

13.3.1 CONTRACTOR shall give timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.3.2 OWNER shall employ and pay for services of an independent testing laboratory to perform all inspections, tests or approvals required by the Contract Documents except:

.1 for inspections, tests or approvals covered by paragraphs 13.3.3 and 13.3.4 below;

.2 that costs incurred for tests or inspections conducted pursuant to paragraph 13.4.3 shall be paid as provided in paragraph 13.4.3;

.3 for reinspecting or retesting defective Work, including any associated costs incurred by the testing laboratory for cancelled tests or standby time; and

.4 as otherwise specifically provided in the Contract Documents.

13.3.3 If laws or regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith and furnish Owner's Representative the required certificates of inspection or approval.

13.3.4 CONTRACTOR shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for OWNER's and E/A's review of submittals covering materials, equipment, and mix designs to be incorporated in the Work.

13.3.5 All testing laboratories shall meet the requirements of ASTM E-329.

13.4 Uncovering Work:

13.4.1 If any Work (or the work of others) that is to be inspected, tested or approved is covered by CONTRACTOR without written concurrence of Owner's Representative, or if any Work is covered contrary to the written request of Owner's Representative, it must, if requested by Owner's Representative, be uncovered and recovered at CONTRACTOR's expense.

13.4.2 Uncovering Work as provided in paragraph 13.4.1 shall be at CONTRACTOR's expense unless CONTRACTOR has given Owner's Representative timely notice of CONTRACTOR's intention to cover the same and Owner's Representative has not acted within five (5) working days to such notice.

13.4.3 If Owner's Representative considers it necessary or advisable that covered Work be observed, inspected or tested, CONTRACTOR shall uncover, expose or otherwise make available for observation, inspection or testing that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Amount, and may make a Claim therefor as provided in Article 11. If,

however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Amount or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and CONTRACTOR may make a Claim therefor as provided in Articles 11 and 12.

13.5 OWNER May Stop the Work:

13.5.1 If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers, suitable materials, and/or equipment; or fails to furnish or perform the Work in such a way that the Work in progress or the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any surety or other party.

13.5.2 If CONTRACTOR fails to correct defective Work or submit a satisfactory plan to take corrective action, with procedure and time schedule, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until cause for such order has been eliminated, or take any other action permitted by this Contract. A notice to stop the Work, based on defects, shall not stop calendar or working days charged to the Project.

13.6 Correction or Removal of Defective Work: If required by OWNER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Owner's Representative, remove it from the site and replace it with Work that is not defective. CONTRACTOR shall correct or remove and replace defective Work, or submit a plan of action detailing how the deficiency will be corrected, within the time frame identified in the notice of defective Work. CONTRACTOR shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.7 Warranty period:

13.7.1 If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by laws or regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents (e.g. paragraph 14.11.2), any Work, including work performed after the Substantial Completion date, is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions:

(i) correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with Work that is not defective, and

(ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom.

If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR. The warranty period will be deemed to be renewed and recommenced in connection with the completed items of Work requiring correction.

13.7.2 In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the warranty period for that item may start to run from an earlier date if so provided in the Contract Documents.

13.7.3 If correction of defective Work will affect the function or use of the facility CONTRACTOR shall not proceed with correction of defective Work without prior coordination and approval of OWNER.

13.7.4 The obligations of the CONTRACTOR to perform warranty work will survive the acceptance of the Work and any termination of the Contract.

13.8 Acceptance of Defective Work: If, instead of requiring correction or removal and replacement of defective Work, OWNER decides to accept it, OWNER may do so. CONTRACTOR shall pay all claims, costs, losses and damages attributable to OWNER's evaluation of and determination to accept such defective Work. If any such acceptance occurs prior to recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents and compensating OWNER for the diminished value of the defective Work. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER after a calculation by OWNER of the diminution in value of the defective Work.

13.9 OWNER May Correct Defective Work: If CONTRACTOR fails within a reasonable time after Written Notice of OWNER to correct defective Work, or to remove and replace rejected Work, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven (7) calendar days' Written Notice to CONTRACTOR, correct and remedy any such deficiency. If, in the opinion of the Owner's Representative, significant progress has not been made during this seven (7) calendar day period to correct the deficiency, the OWNER may exercise any actions necessary to remedy the deficiency. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, its agents and employees, OWNER's other contractors, E/A and E/A's consultants access to the site to enable OWNER to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by OWNER in exercising such rights and remedies will be charged against CONTRACTOR and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's defective Work. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones), or claims of damage because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies hereunder.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 Application for Progress Payment:

14.1.1 Within 45 days from when the work was performed by the Contractor and Subcontractors, but not more often than once a month, CONTRACTOR shall submit to Owner's Representative for review an Application for Payment, in a form

acceptable to OWNER, filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

14.1.2 Such applications shall not include requests for payment on account of changes in the Work which have been properly authorized by Change Directives but not yet included in Change Orders.

14.1.3 Such applications shall not include requests for payment of amounts the CONTRACTOR does not intend to pay to a Subcontractor or Supplier because of a dispute or other reason.

14.1.4 If payment is requested on the basis of materials or equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall be accompanied by such bills of sale, data and other procedures satisfactory to OWNER substantiating OWNER's title to such materials or equipment or otherwise protecting OWNER's interest. Payment on account of such materials or equipment will not include any amount for CONTRACTOR's overhead or profit or relieve CONTRACTOR of its obligation to protect and install such materials or equipment in accordance with the requirements of the Contract and to restore damaged or defective Work. If materials or equipment are stored at another location, at the direction of the OWNER they shall be stored in a bonded and insured facility, accessible to E/A and OWNER, and shall be clearly marked as property of OWNER. Title to materials delivered to the site of the Work or a staging area will pass to OWNER upon payment by OWNER without the necessity for further documentation. Risk of loss will not pass to OWNER until acceptance.

14.1.5 Where the original Contract Amount is less than $400,000, OWNER will pay CONTRACTOR total amount of approved Application for Payment, less ten percent (10%) of amount thereof, which ten percent (10%) will be retained until final payment, less all previous payments and less all other sums that may be retained by OWNER under the terms of this Agreement. Where the original Contract Amount is $400,000 or more, OWNER will pay CONTRACTOR total amount of approved Application for Payment, less five percent (5%) of amount thereof, which five percent (5%) will be retained until final payment, less all previous payments and less all other sums that may be retained by OWNER under the terms of this Agreement. In either case, if the Work is near completion and delay occurs due to no fault or neglect of CONTRACTOR, OWNER may pay a portion of the retained amount to CONTRACTOR. CONTRACTOR, at OWNER's option, may be relieved of the obligation to complete the Work and, thereupon, CONTRACTOR shall receive payment of the balance due under the Contract subject to the conditions stated under paragraph 15.2. A Subcontractor may submit a written request to the CONTRACTOR and Project Manager requesting release of retainage for work by the Subcontractor that has been completed and approved. The Project Manager will evaluate the request and if it is approved, the Project Manager will request the CONTRACTOR to include the request for release of an appropriate amount of retainage in the next Pay Application.

14.1.6 Applications for Payment shall include the following documentation:

.1 updated Progress Schedule;

.2 monthly subcontractor report;

.3 any other documentation required under the Supplemental General Conditions.

14.2 CONTRACTOR's Warranty of Title: CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER free and clear of all Liens no later than the time of payment to CONTRACTOR.

14.3 Review of Applications for Progress Payment:

14.3.1 Owner's Representative will, within seven (7) calendar days after receipt of each Application for Payment, either indicate a recommendation for payment and forward the Application for processing by OWNER, or return the Application to CONTRACTOR indicating Owner's Representative's reasons for refusing to recommend payment. In the latter case, CONTRACTOR shall make the necessary corrections and resubmit the Application.

14.3.2 Owner's Representative's recommendation of any payment requested in an Application for Payment will constitute a representation by Owner's Representative, based upon Owner's Representative's on-site observations of the executed Work and on Owner's Representative's review of the Application for Payment and the accompanying data and schedules, that to the best of Owner's Representative's knowledge, information and belief:

.1 the Work has progressed to the point indicated; and

.2 the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for unit price Work, and to any other qualifications stated in the recommendation).

14.3.3 By recommending any such payment, Owner's Representative will not thereby be deemed to have represented that:

.1 exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work;

.2 examination has been made to ascertain how or for what purpose CONTRACTOR has used money previously paid on account of the Contract Amount;

.3 CONTRACTOR's construction means, methods, techniques, sequences or procedures have been reviewed; or

.4 that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

14.4 Decisions to Withhold Payment:

14.4.1 OWNER may withhold or nullify the whole or part of any payment to such extent as may be necessary on account of:

.1 defective Work not remedied;

.2 third party Claims filed or reasonable evidence indicating probable filing of such Claims;

.3 failure of CONTRACTOR to make payments properly to Subcontractors for labor, materials or equipment;

.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Amount;

.5 damage to OWNER or another contractor;

.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;

.7 failure of CONTRACTOR to submit a schedule of values in accordance with the Contract Documents;

.8 failure of CONTRACTOR to submit a submittal schedule in accordance with the Contract Documents;

.9 failure of CONTRACTOR to submit and update a construction Progress Schedule in accordance with the Contract Documents;

.10 failure of CONTRACTOR to maintain a record of changes on drawings and documents;

.11 failure of CONTRACTOR to maintain weekly payroll reports and, as applicable, provide copies of reports in a timely manner upon request of OWNER;

.12 failure of CONTRACTOR to submit monthly subcontractor reports;

.13 CONTRACTOR's neglect or unsatisfactory prosecution of the Work, including failure to clean up;

.14 failure of CONTRACTOR to comply with the Austin City Code, Chapter 2-9-A, as amended, "Minority-Owned and Women-Owned Business Enterprise Procurement Program;" or

.15 failure of CONTRACTOR to comply with any provision of the Contract Documents.

14.4.2 When the above reasons for withholding payment are removed, CONTRACTOR shall resubmit a statement for the value of Work performed. Payment will be made within thirty (30) calendar days of receipt of approved Application for Payment.

14.4.3 Subcontractors may request Partial Payment when the OWNER withholds payment of an invoice to the CONTRACTOR for any reason listed in Section 14.4.1. If payment is withheld by the OWNER, the CONTRACTOR shall notify all affected Subcontractors within two (2) working days of notice that payment is being withheld. Upon notification, Subcontractors may submit a formal written request for Partial Payment to the CONTRACTOR and OWNER. If directed by the OWNER, the CONTRACTOR shall within three (3) working days resubmit to the OWNER an invoice for the same period that includes only the work performed by the requesting Subcontractors during this period. The OWNER will review this resubmitted invoice in accordance with Section 14.3.1. Upon receipt of payment for the resubmitted invoice, CONTRACTOR shall pay the subcontractor within ten (10) Calendar Days in accordance with Section 6.4.7.

14.5 Delayed Payments: Should OWNER fail to make payment to CONTRACTOR of sum named in any Application for Payment within thirty (30) calendar days after the day on which OWNER received the mutually acceptable Application for Payment, then OWNER will pay to CONTRACTOR, in addition to sum shown as due by such Application for Payment, interest thereon at the rate specified in Government Code, Section 2251.025(b) from date due until fully paid, which shall fully liquidate any injury to CONTRACTOR growing out of such delay in payment.

14.6 Arrears: No money shall be paid by OWNER upon any claim, debt, demand or account whatsoever, to any person, firm or corporation who is in arrears to City for taxes; and City shall be entitled to counterclaim and automatically offset against any such debt, claim, demand or account in the amount of taxes so in arrears and no assignment or transfer of such debt, claim, demand or account after said taxes are due, shall affect the right of OWNER to so offset said taxes, and associated penalties and interest if applicable, against the same.

14.7 Substantial Completion:

14.7.1 When the CONTRACTOR considers that the Work, or a portion thereof which the OWNER agrees to accept separately, is substantially complete, the CONTRACTOR shall notify Owner's Representative and request a determination as to whether the Work or designated portion thereof is substantially complete. If Owner's Representative does not consider the Work substantially complete, Owner's Representative will notify CONTRACTOR giving reasons therefor. After performing any required Work, CONTRACTOR shall then submit another request for Owner's Representative to determine Substantial Completion. If Owner's Representative considers the Work substantially complete, Owner's Representative will prepare and deliver a certificate of Substantial Completion which shall establish the date of Substantial Completion, shall include a punch list of items to be completed or corrected before final payment, shall establish the time within which CONTRACTOR shall finish the punch list, and shall establish responsibilities of the OWNER and CONTRACTOR for security, maintenance, heat, utilities, damage to the Work, warranty and insurance. Failure to include an item on the punch list does not alter the responsibility of CONTRACTOR to complete all Work in accordance with the Contract Documents. If a Certificate of Occupancy is required by public authorities having jurisdiction over the Work, said certificate shall be issued before the Work or any portion thereof is considered substantially complete. The certificate of Substantial Completion shall be signed by OWNER and CONTRACTOR to evidence acceptance of the responsibilities assigned to them in such certificate.

14.7.2 OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER will allow CONTRACTOR reasonable access to complete or correct items on the punch list and complete warranty work.

14.8 Partial Utilization: Use by OWNER, at OWNER's option, of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) OWNER and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work in accordance with the following:

14.8.1 OWNER at any time may request CONTRACTOR to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR shall certify to Owner's Representative that such part of the Work is substantially complete and request Owner's Representative to issue a certificate of substantial Completion for that part of the Work. CONTRACTOR at any time may notify Owner's Representative that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. The provisions of paragraphs 14.7.1 and 14.7.2 will apply with respect to certification of Substantial Completion

of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.8.2 Such partial utilization is authorized by public authorities having jurisdiction over the Work.

14.9 Final Inspection: Upon Written Notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, Owner's Representative will make a final inspection with CONTRACTOR and provide Written Notice of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.10 Final Application for Payment: CONTRACTOR may make application for final payment following the procedure for progress payments after CONTRACTOR has completed all such corrections to the satisfaction of Owner's Representative and delivered the following documents:

14.10.1 Affidavit by CONTRACTOR certifying the payment of all debts and claims;

14.10.2 Three (3) complete operating and maintenance manuals, each containing maintenance and operating instructions, schedules, guarantees, and other documentation required by the Contract Documents;

14.10.3 Record documents (as provided in paragraph 6.10);

14.10.4 Consent of surety, if any, to final payment. If surety is not provided, complete and legally effective releases or waivers (satisfactory to OWNER) of all claims arising out of or filed in connection with the Work;

14.10.5 Certificate evidencing that insurance required by the Supplemental General Conditions will remain in force after final payment and through the warranty period;

14.10.6 Non-Use of Asbestos Affidavit (After Construction);

14.10.7 Subcontractor report and all other documentation necessary for evaluation of CONTRACTOR’s fulfillment of the Contract MBE/WBE or DBE goals;

14.10.8 Documentation of notice to claimants, to the extent applicable and subject to subparagraph 14.11.4;

14.10.9 Proof of performance Bond extension through warranty period, if a performance Bond was required; and

14.10.10 Any other documentation called for in the Contract Documents.

14.11 Final Payment and Acceptance:

14.11.1 If, on the basis of observation of the Work during construction, final inspection, and review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Owner's Representative is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled and there are no outstanding claims, Owner's Representative will recommend the final Application for Payment and thereby notify the OWNER, who will pay to CONTRACTOR the balance due CONTRACTOR under the terms of the Contract. If the sole remaining unfinished item to complete the Work is the reestablishment of vegetation, CONTRACTOR may execute a revegetation letter with fiscal posted (letter of credit) to ensure completion of this item. This Work must be accomplished within one hundred twenty (120) Calendar Days of the date of Final Completion of the Work. When

the permanent erosion control has been established, OWNER will initiate an inspection for final acceptance of the erosion controls. If the revegetation is not completed within the one hundred twenty (120) Calendar Days, OWNER, at its option, may complete the Work using the posted fiscal.

14.11.2 If the Contract measures Contract Time to Final Completion, rather than Substantial Completion, Owner's Representative will issue a letter of final acceptance to CONTRACTOR which establishes the Final Completion date and initiates the one-year warranty period. If the sole remaining unfinished item to complete the Work is the reestablishment of vegetation and CONTRACTOR has executed a revegetation letter with fiscal posted (letter of credit) to ensure completion of this item, the Owner's Representative will issue a letter of conditional acceptance to CONTRACTOR which established the Final Completion date and initiates the one-year warranty period.

14.11.3 Final payment is considered to have taken place when CONTRACTOR or any of its representatives negotiates OWNER's final payment check, whether labeled final or not, for cash or deposits check in any financial institution for its monetary return.

14.11.4 The OWNER will withhold funds sufficient to cover the amount of any unresolved contract claims from final payment for six months under the following limited conditions:

.1 CONTRACTOR must provide written notice to the claimant (via certified mail or hand delivery) that (i) OWNER will hold funds in the amount of the disputed claim for six (6) months from the date of the receipt of the notice and (ii) CONTRACTOR and the claimant have certain alternative dispute resolution rights; and

.2 CONTRACTOR must provide OWNER with a copy of the receipted notice.

Provided the claimant has received notice under this section, OWNER will release the withheld funds, if the CONTRACTOR provides a bond in substantial compliance with the provisions of Section 52.231 of the Texas Property Code; when the OWNER receives a settlement or release of the claim with accompanying instructions regarding payment; upon resolution of the claim in litigation, if suit is filed within such six (6) month period and the OWNER receives written notice of such filing; or when such six (6) month period has passed, if no such bond, settlement, release, or notice of filing of suit have been received. The above provisions notwithstanding, if efforts to timely resolve a disputed claim are not being made to OWNER'S reasonable satisfaction, OWNER may, in its complete discretion, file an interpleader action and deposit the withheld funds in the registry of a court of competent jurisdiction. In addition, CONTRACTOR must include a provision in each of its subcontracts that the prevailing party in any litigation arising thereunder will be entitled to recover its costs of court and reasonable attorney's fees.

14.12 Waiver of Claims: The making and acceptance of final payment will constitute:

14.12.1 a waiver of claims by OWNER against CONTRACTOR, except claims arising from unsettled claims, from defective Work appearing after final inspection, from failure to comply with the Contract Documents or the terms of any warranty specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and

14.12.2 a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.1 OWNER May Suspend Work Without Cause: At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than ninety (90) calendar days by Written Notice to CONTRACTOR which will fix the date on which the Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Amount or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes an approved Claim therefor as provided in Articles 11 and 12.

15.2 OWNER May Terminate Without Cause: Upon seven (7) calendar days' Written Notice to CONTRACTOR, OWNER may, without cause and without prejudice to any right or remedy of OWNER, elect to terminate the Agreement. In such case, CONTRACTOR shall be paid (without duplication of any items):

15.2.1 for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;

15.2.2 for reasonable demobilization costs; and

15.2.3 for anticipated profits on completed and accepted Work not previously paid and not included in separate pay items calculated to date of termination but not for anticipated profit on the entire Contract not previously paid, unabsorbed overhead, or lost opportunity.

15.3 OWNER May Terminate With Cause:

15.3.1 Upon the occurrence of any one or more of the following events:

.1 if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents;

.2 if CONTRACTOR disregards laws or regulations of any public body having jurisdiction;

.3 if CONTRACTOR disregards the authority of Owner's Representative;

.4 if CONTRACTOR makes fraudulent statements;

.5 if CONTRACTOR fails to maintain a work force adequate to accomplish the Work within the Contract Time;

.6 if CONTRACTOR fails to make adequate progress and endangers successful completion of the Contract; or

.7 if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

OWNER may, after giving CONTRACTOR (and the surety, if any) seven (7) calendar days Written Notice terminate the services of CONTRACTOR. OWNER, at its option, may proceed with negotiation with surety for completion of the Work. Alternatively, OWNER may under these circumstances exclude CONTRACTOR from the site and take possession of the Work (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Amount exceeds all claims, costs,

losses and damages sustained by OWNER arising out of or resulting from completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses and damage exceed such unpaid balance, CONTRACTOR or surety shall pay the difference to OWNER. In the event that a termination for cause is found to be wrongful, the termination shall be converted to a termination without cause as set forth in Section 15.2 and CONTRACTOR'S remedy for wrongful termination is limited to the recovery of the payments permitted for termination without cause as set forth in Section 15.2.

15.3.2 Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR and surety then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability. In the event OWNER terminates Contract with cause, OWNER may reject any and all Bids submitted by CONTRACTOR for up to three (3) years after the date of such termination. These sanctions will be administered in accordance with the City of Austin Purchasing Office Probation, Suspension, and Debarment Procedures for Vendors, which include notice and an opportunity for a hearing.

15.4 CONTRACTOR May Stop Work or Terminate: If through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety (90) calendar days by OWNER or under an order of court or other public authority, or (except during disputes) Owner's Representative fails to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) OWNER fails for sixty (60) calendar days after it is submitted to pay CONTRACTOR any sum finally determined by OWNER to be due, then CONTRACTOR may, upon seven (7) calendar days' Written Notice to OWNER, and provided OWNER does not remedy such suspension or failure within that time, terminate the Agreement and recover from OWNER payment on the same terms as provided in paragraph 15.2. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if (except during disputes) Owner's Representative has failed to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) OWNER has failed for sixty (60) calendar days after it is submitted to pay CONTRACTOR any sum finally determined by OWNER to be due, CONTRACTOR may upon seven (7) calendar days' Written Notice to OWNER stop the Work until payment of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.4 are not intended to preclude CONTRACTOR from making a Claim under Articles 11 and 12 for an increase in Contract Amount or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping Work as permitted by this paragraph.

15.5 Discretionary Notice to Cure: In its complete discretion, OWNER may, but is not required to, provide a Notice to Cure to CONTRACTOR and its surety to cure an event of default described above and/or an anticipatory breach of contract and, if required by OWNER, to attend a meeting with OWNER, regarding the Notice to Cure, the event of default, and/or the anticipatory breach of contract. The Notice to Cure will set forth the time limit in which the cure is to be completed or commenced and diligently prosecuted. Upon receipt of any Notice to Cure, CONTRACTOR shall prepare a report describing its program and measures to affect the cure of the event of default and/or anticipatory breach of contract within the time required by the Notice to Cure. The CONTRACTOR'S report must be delivered to OWNER at least three (3) days prior to any requested meeting with the OWNER and surety.

15.6 Bankruptcy: If CONTRACTOR declares bankruptcy or is adjudged bankrupt or makes an assignment for the benefit of creditors or if a receiver is appointed for the benefit of creditors or if a receiver is appointed by reason of CONTRACTOR'S insolvency, CONTRACTOR may be unable to perform this Contract in accordance with the Contract

requirements. In such an event, OWNER may demand CONTRACTOR or its successor in interest provide OWNER with adequate assurance of CONTRACTOR'S future performance in accordance with the terms and conditions of the Contract. If CONTRACTOR fails to provide adequate assurance of future performance to OWNER'S reasonable satisfaction within ten (10) days of such a request, OWNER may terminate the CONTRACTOR'S services for cause or without cause, as set forth above. If CONTRACTOR fails to provide timely adequate assurance of its performance and actual performance, OWNER may prosecute the Work with its own forces or with other contractors on a time and material or other appropriate basis and the cost of which will be charged against the Contract balance.

15.7 Duty to Mitigate: In the event of any termination or suspension under this Contract, the CONTRACTOR agrees to and shall take all reasonable actions to mitigate its damages and any and all claims which may be asserted against the OWNER.

15.8 Responsibility during Demobilization: While demobilizing, the CONTRACTOR will take all necessary and reasonable actions to preserve and protect the Work, the site and other property of the OWNER or others at the site.

ARTICLE 16 - DISPUTE RESOLUTION

16.1 Filing of Claims:

16.1.1 Claims arising from the circumstances identified in paragraphs 3.2, 4.1, 4.2.2, 4.2.4, 6.4.2, 6.11.5.2, 6.17, 7.5, 8.6, 9.5, 10.4.2, 13.4.3, 13.8, 13.9, 15.1, 15.2, 15.3, or 15.4, or other occurrences or events, shall be made by Written Notice delivered by the party making the Claim to the other party within thirty (30) calendar days after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data shall be delivered in writing within thirty (30) calendar days after Written Notice of Claim is delivered by claimant and shall represent that the adjustment claimed covers all known amounts and/or extensions of time to which claimant is entitled.

16.1.2 Within thirty (30) calendar days of receipt of notice of the amount of the Claim with supporting data, Owner's Representative and CONTRACTOR shall meet to discuss the Claim, after which an offer of settlement or notification of no settlement offer will be made to claimant. If claimant is not satisfied with the proposal presented, claimant shall have thirty (30) calendar days in which to: (i) submit additional supporting data requested by the other party; (ii) modify the initial Claim; or (iii) request Alternative Dispute Resolution.

16.2 Alternative Dispute Resolution:

16.2.1 If a dispute exists concerning a Claim, the parties agree to use the following procedure prior to pursuing any other available remedies. OWNER reserves the right to include the E/A as a party.

16.2.2 Negotiating with Previously Uninvolved Personnel: Either party may make a written request for a meeting to be held between representatives of each party within fourteen (14) Calendar Days of the request or such later period that the parties may agree to. Each party shall endeavor to include, at a minimum, one (1) previously uninvolved senior level decision maker (an owner, officer, or employee of each organization) empowered to negotiate on behalf of their organization. If a previously uninvolved senior level decision maker is unavailable due to the size of the CONTRACTOR'S organization or any other reason, the

CONTRACTOR shall nonetheless provide an appropriate senior level decision maker for the meeting. The purpose of this and any subsequent meetings will be good faith negotiations of the matters constituting the dispute. Negotiations shall be concluded within thirty (30) Calendar Days of the first meeting, unless mutually agreed otherwise. This step may be waived by a written agreement signed by both parties, in which event the parties may proceed directly to mediation as described below.

16.2.3 Mediation:

.1 If the procedure described in 16.2.2 proves unsuccessful or is waived pursuant to its terms, the parties shall initiate the mediation process. OWNER and CONTRACTOR agree to select within thirty (30) calendar days a mediator trained in mediation skills, to assist with resolution of the dispute. OWNER and CONTRACTOR agree to act in good faith in the selection of the mediator and to give consideration to qualified individuals nominated to act as mediator. Nothing in this agreement prevents the parties from relying on the skills of a person who also is trained in the subject matter of the dispute and/or a contract interpretation expert. Should the parties fail to agree on a mediator within thirty (30) calendar days of initiation of the mediation process, the parties agree to ask the Travis County Dispute Resolution Center to select a qualified individual, which selection shall be binding on the parties.

.2 Mediation is a forum in which an impartial person, the mediator, facilitates communication between parties to promote reconciliation, settlement, or understanding among them. The parties hereby agree that mediation, at a minimum, shall provide for (i) conducting an on-site investigation, if appropriate, by the mediator for fact gathering purposes, (ii) a meeting of all parties for the exchange of points of view and (iii) separate meetings between the mediator and each party to the dispute for the formulation of resolution alternatives. The parties agree to participate in mediation in good faith for up to thirty (30) calendar days from the date of the first mediation session, unless mutually agreed otherwise. Should the parties fail to reach a resolution of the dispute through mediation, then each party is released to pursue other remedies available to them.

16.3 Resolution of Disputes between Contractor and Subcontractor or Supplier: If a dispute exists concerning a claim between a CONTRACTOR and a Subcontractor or Supplier, the CONTRACTOR agrees to participate with such Subcontractor and/or Supplier in a process substantially paralleling the steps set out in paragraphs 16.1 and 16.2 above, including the delivery of written notices, submission of supporting data, negotiation with previously uninvolved personnel, and, if such alternative dispute resolution process is unsuccessful, mediation between the parties to the claim. If the CONTRACTOR and Subcontractor or Supplier agreement provides an alternative dispute resolution process, which provides substantially equivalent rights to those set forth herein, it may be followed, unless the CONTRACTOR and affected Subcontractor or Supplier agree to follow the process outlined above. The OWNER is not a party to the alternative dispute resolution process between the CONTRACTOR and Subcontractor or Supplier and will not pay any costs incurred in the process. Each party will be responsible for its own expenses incurred in the process, which will include an equal share of the mediation expenses, unless otherwise determined by the mediator. NOTICE: THE PROCESS SET FORTH HEREIN IS NOT A SUBSTITUTE FOR THE STATUTORY PAYMENT BOND CLAIM PROCESS.

16.4 Claim Calculation:

16.4.1 Delay Claims: The intent of paying for delay damages is to reimburse the CONTRACTOR for actual expense arising out of a compensable delay. No profit or force account markups, other than labor burden, will be allowed for delay claims by the CONTRACTOR seeking reimbursement for expenses arising out of an alleged event of delay. No consequential damages will be allowed to the CONTRACTOR in connection with any claimed delays. If the CONTRACTOR requests compensation for delay damages and the delay is determined to be compensable, then standby equipment costs and project overhead compensation will be based on the duration of the compensable delay and the following:

.1 Standby equipment costs will not be allowed during periods when the equipment would have otherwise been idle. Standby equipment time will not exceed more than eight (8) hours per twenty-four (24) hour day, forty (40) hours per week, and one hundred seventy-six (176) hours per month. Standby equipment costs will be paid at 50 percent (50%) of the applicable Rental Rate Blue Book rates and calculated by dividing the monthly rate by one hundred seventy-six (176), multiplying the result by the number of standby hours and multiplying that number by the regional adjustment factor and the rate adjustment factor contained in the Blue Book. Operating costs will not be allowed.

.2 Project overhead will be determined from actual costs that the CONTRACTOR will be required to document. Project overhead is defined as the administrative and supervisory expenses incurred at the work site and will not include home office overhead.

16.4.2 General: Except as limited with respect to delay claims, as set forth above, the criteria set forth in Section 11.4.1 may be used as a basis to calculate an adjustment in the Contract Amount in the resolution of a claim, provided that there will be no compensation for home office overhead.

16.5 MBE/WBE Program Progressive Sanctions: CONTRACTOR is subject to progressive sanctions for failure of CONTRACTOR to comply with Austin City Code, Chapter 2-9A, as amended: "Minority-owned and Women-owned Business Enterprise Procurement Program." Available sanctions for Program violations are set forth in Program rules adopted by the Small and Minority Business Resources Department (SMBR), as amended, and may include the following progressive sanctions for Program violations within a rolling 24-month period: (i) a period of probation for up to six (6) months for the first violation (ii) a period of suspension from bidding for up to 24 months for the second violation, and (iii) a period of debarment for up to five (5) years for the third violation. If the CONTRACTOR engages in more than one of the violations listed below at any given time, OWNER has the discretion to determine whether such actions should be counted as multiple violations of the MBE/WBE Ordinance. Program violations include:

.1 providing false or misleading information to the OWNER in connection with the submission of a Bid, responses to request for qualifications or Proposals, Good Faith Efforts documentation, post award compliance or other Program operations;

.2 substituting M/WBE Subcontractors without first receiving approval for such substitutions;

.3 failure to comply with the approved Compliance Plan without an approved request for a change, an approved Change Order or other approved change to the Contract;

.4 violation of any other provision of the "Minority-owned and Women-owned Business Enterprise Procurement Program";

.5 providing false or misleading information to the OWNER in connection with an application for or challenge to certification, recertification or decertification as a MBE/WBE; and

.6 bid shopping.

The Progressive Sanctions will be administered in accordance with the City of Austin Purchasing Office Probation, Suspension, and Debarment Procedures for Vendors, which includes notice and an opportunity for a hearing.

ARTICLE 17 – MISCELLANEOUS

17.1 Venue: In the event of any suit at law or in equity involving the Contract, venue shall be exclusively in Travis County, Texas and the laws of the State of Texas shall apply to the interpretation and enforcement of the Contract.

17.2 Extent of Agreement: This Contract represents the entire and integrated agreement between the OWNER and CONTRACTOR with respect to the subject matter hereof and supersedes all prior negotiations, representations or agreements, either written or oral.

17.3 Cumulative Remedies: The rights and remedies available to the parties are not to be construed in any way as a limitation of any rights and remedies available to any or all of them which are otherwise imposed or available by laws or regulations, by special warranty or guarantees or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. Specifically, the OWNER is not required to only assess liquidated damages, and OWNER may elect to pursue its actual damages resulting from the failure of the CONTRACTOR to complete the Work in accordance with the requirements of the Contract Documents.

17.4 Severability: If any word, phrase, clause, sentence or provision of the Contract, or the application of same to any person or set of circumstances is for any reason held to be unconstitutional, invalid or unenforceable, that finding shall only effect such word, phrase, clause, sentence or provision, and such finding shall not affect the remaining portions of this Contract; this being the intent of the parties in entering into the Contract; and all provisions of the Contract are declared to be severable for this purpose.

17.5 Independent Contractor: The Contract shall not be construed as creating an employer/employee relationship, a partnership, or a joint venture. CONTRACTOR is an independent contractor and CONTRACTOR's services shall be those of an independent contractor. CONTRACTOR agrees and understands that the Contract does not grant any rights or privileges established for employees of OWNER.

17.6 Prohibition of Gratuities: OWNER may, by Written Notice to CONTRACTOR, terminate the Contract without liability if is determined by OWNER that gratuities were offered or given by CONTRACTOR or any agent or representative of CONTRACTOR to any officer or employee of OWNER with a view toward securing the Contract or securing favorable treatment with respect to the awarding or amending or the making of any determinations with respect to the performing of such Contract. In the event the Contract is terminated by OWNER pursuant to this provision, OWNER shall be entitled, in addition to any other rights

and remedies, to recover or withhold the amount of the cost incurred by CONTRACTOR in providing such gratuities.

17.7 Prohibition Against Personal Interest in Contracts: No officer, employee, independent consultant, or elected official of OWNER who is involved in the development, evaluation, or decision-making process of the performance of any solicitation shall have a financial interest, direct or indirect, in the Contract resulting from that solicitation. Any violation of this provision, with the knowledge, expressed or implied, of CONTRACTOR shall render the Contract voidable by OWNER.

17.8 OWNER'S Right to Audit:

17.8.1 Records means all records generated by or on behalf of CONTRACTOR and each Subcontractor and Supplier of CONTRACTOR, whether paper, electronic, or other media, which are in any way related to performance of or compliance with this Contract, including, without limitation:

.1 accounting records;

.2 written policies and procedures;

.3 subcontract files (including proposals of successful and unsuccessful Bidders, Bid recaps, etc.);

.4 original estimates and estimating work sheets;

.5 correspondence;

.6 Change Order files (including documentation covering negotiated settlements);

.7 back charge logs and supporting documentation;

.8 general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends;

.9 lump sum agreements between CONTRACTOR and any Subcontractor or Supplier;

.10 records necessary to evaluate: Contract compliance, Change Order pricing, and any Claim submitted by CONTRACTOR or any of its payees; and

.11 any other CONTRACTOR record that may substantiate any charge related to this Contract.

17.8.2 CONTRACTOR shall allow OWNER'S agent or its authorized representative to inspect, audit, and/or reproduce, or all three, all Records generated by or on behalf of CONTRACTOR and each Subcontractor and Supplier, upon OWNER'S written request. Further, CONTRACTOR shall allow OWNER'S agent or authorized representative to interview any of CONTRACTOR'S employees, all Subcontractors and all Suppliers, and all their respective employees.

17.8.3 CONTRACTOR shall retain all its Records, and require all its Subcontractors and Suppliers to retain their respective Records, during this Contract and for three (3) years after final payment, until all audit and litigation matters that OWNER has brought to the attention of CONTRACTOR are resolved, or as otherwise required by law, whichever is longer. OWNER'S right to inspect, audit, or reproduce Records, or interview employees of CONTRACTOR or its respective Subcontractors or Suppliers exists during this Contract, and for three (3) years after final payment, until all audit and litigation matters that OWNER has brought to CONTRACTOR'S attention are resolved, or as otherwise required by law, whichever is longer, and at

no cost to OWNER, either from CONTRACTOR or any of its Subcontractors or Suppliers that may furnish Records or make employees available for interviewing.

17.8.4 CONTRACTOR must provide sufficient and accessible facilities during its normal business hours for OWNER to inspect, audit, or reproduce Records, or all three, and to interview any person about the Records.

17.8.5 CONTRACTOR shall insert these requirements in each written contract between CONTRACTOR and any Subcontractor or Supplier and require each Subcontractor and Supplier to comply with these provisions.

17.9 Survival: The terms and conditions of this Contract, which contemplate a period of time beyond completion or termination will survive such completion or termination and not be merged therein or otherwise terminated.

17.10 No Waiver: The waiver of any provision of this Contract will not be deemed to be a waiver of any other provision of this Contract. No waiver of any provision of this Contract will be deemed to constitute a continuing waiver unless expressly provided in writing, nor will a waiver of any default be deemed a waiver of any subsequent defaults of the same type. The failure at any time to enforce this Contract, whether the default is known or not, shall not constitute a waiver or estoppel of the right to do so.

17.11 Conditions Precedent to Right to Sue: Notwithstanding anything herein to the contrary, the CONTRACTOR will have at least 90 days to give notice of a claim for damages as a condition precedent to the right to sue on the Contract, subject to the contractual claim and alternative dispute resolution processes set forth herein.

17.12 Waiver of Trial by Jury: OWNER and CONTRACTOR agree that they have knowingly waived the right to trial by jury and have instead agreed that, in the event of any litigation arising out of or connected to this Contract, to proceed with a trial before the court, unless both parties subsequently agree otherwise in writing.

17.13 Contractor Evaluation: The Owner will review and evaluate the Contractor's Work and performance on the Project and provide the Contractor with a written Contractor Evaluation Report in accordance with City of Austin Administrative Rule R161-13.37. Rule R161-13.37 provides an appeal process.

http://www.austintexas.gov/department/contract-management

End

SUPPLEMENTAL GENERAL CONDITIONS
Section 00810

The Supplemental General Conditions contained herein amend or supplement the General Conditions, Section 00700.

ARTICLE 1 – DEFINITIONS

Add to the following definition:

1.20 Engineer/Architect (E/A): The OWNER's design professional for this contract is:

Name: **GSC Architects, Inc.**
Bonita Tice Gray, AIA, LEED AP BD+C, Associate Principal
Address: **3100 Alvin DeVane Blvd. Building A, Suite 200-B**
Austin, Texas, 78741

ARTICLE 2 - PRELIMINARY MATTERS

2.4 Before Starting Construction:

Delete 2.4.2.6 and replace with the following (changes to the original text are identified by underlining):

.6 A preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. At a minimum, the schedule of values shall be broken out by trade and split between materials and labor. Prices will include an appropriate amount of overhead and profit applicable to each item of Work;

ARTICLE 4 - AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; REFERENCE POINTS

4.1 Availability of Lands: *Add the following to the end of the paragraph*:

CONTRACTOR shall contact OWNER's Transportation Department to obtain a Temporary Use of Right-of-Way Permit prior to beginning construction on any sidewalk/driveway or occupying any parking area/meters within the public right-of-ways.

4.1 Availability of Lands: *Add the following as a second paragraph to 4.1*:

Field Notes and Special Provisions to Easements, where applicable, are attached to Section 00810. All Work associated with Special Provisions to Easements shall be subsidiary to the entire Bid, unless otherwise specified. Should the actions of the CONTRACTOR, or its Subcontractors, Vendors, or Suppliers, cause the Work to be delayed to the point that the ending date of an easement has been exceeded, the CONTRACTOR shall be responsible to reimburse the OWNER for any additional costs required to extend the period of rights to the easement in order to complete the Work. This delay shall be considered to be any period of time required by the CONTRACTOR to fully and satisfactorily execute the Work that is in addition to the original Contract duration, as modified by any executed Contract change orders.

ARTICLE 5 - BONDS AND INSURANCE

5.3 Other Bond and Insurance Requirements:

5.3.1 CONTRACTOR Provided Insurance

5.3.1.1 General Requirements.

.1 CONTRACTOR shall carry insurance in the types and amounts indicated below for the duration of the Contract, which shall include items owned by OWNER in the care, custody and control of CONTRACTOR prior to and during construction and warranty period.

.2 CONTRACTOR must complete and forward the Certificate of Insurance, Section 00650, to OWNER before the Contract is executed as verification of coverage required below. CONTRACTOR shall not commence Work until the required insurance is obtained and until such insurance has been reviewed by OWNER. Approval of insurance by OWNER shall not relieve or decrease the liability of CONTRACTOR hereunder and shall not be construed to be a limitation of liability on the part of CONTRACTOR. CONTRACTOR must also complete and forward the Certificate of Insurance, Section 00650, to OWNER whenever a previously identified policy period has expired as verification of continuing coverage.

.3 CONTRACTOR's insurance coverage is to be written by companies authorized to do business in the State of Texas at the time the policies are issued and shall be written by companies with A.M. Best ratings of B+VII or better, except for hazardous material insurance which shall be written by companies with A.M. Best ratings of A- or better.

.4 All endorsements naming the OWNER as additional insured, waivers, and notices of cancellation endorsements as well as the Certificate of Insurance shall indicate: City of Austin, Capital Contracting Office, P.O. Box 1088, Austin, Texas 78767.

.5 The "other" insurance clause shall not apply to the OWNER where the OWNER is an additional insured shown on any policy. It is intended that policies required in the Contract, covering both OWNER and CONTRACTOR, shall be considered primary coverage as applicable.

.6 If insurance policies are not written for amounts specified below, CONTRACTOR shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage.

.7 OWNER shall be entitled, upon request and without expense, to receive certified copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification of particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties hereto or the underwriter on any such policies.

.8 OWNER reserves the right to review the insurance requirements set forth during the effective period of this Contract and to make reasonable adjustments to insurance coverage, limits, and exclusions when deemed necessary and prudent by OWNER based upon changes in statutory law, court decisions, the claims history of the industry or financial condition of the insurance company as well as CONTRACTOR.

.9 CONTRACTOR shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the Contract or as required in the Contract.

.10 CONTRACTOR shall be responsible for premiums, deductibles and self-insured retentions, if any, stated in policies. All deductibles or self-insured retentions shall be disclosed on the Certificate of Insurance.

.11 CONTRACTOR shall provide OWNER thirty (30) days written notice of erosion of the aggregate limits below occurrence limits for all applicable coverages indicated within the Contract.

.12 If OWNER owned property is being transported or stored off-site by CONTRACTOR, then the appropriate property policy will be endorsed for transit and storage in an amount sufficient to protect OWNER's property.

.13 The insurance coverages required under this contract are required minimums and are not intended to limit the responsibility or liability of CONTRACTOR.

5.3.1.2 Business Automobile Liability Insurance. Provide coverage for all owned, non-owned and hired vehicles. The policy shall contain the following endorsements in favor of OWNER:

a) Waiver of Subrogation endorsement CA 0444;
b) 30-day Notice of Cancellation endorsement CA 0244; and
c) Additional Insured endorsement CA 2048.

Provide coverage in the following types and amounts:

.1 A minimum combined single limit of $500,000 per occurrence for bodily injury and property damage. Alternate acceptable limits are $250,000 bodily injury per person, $500,000 bodily injury per occurrence and at least $100,000 property damage liability each accident.

5.3.1.3 Workers' Compensation And Employers' Liability Insurance. Coverage shall be consistent with statutory benefits outlined in the Texas Workers' Compensation Act (Section 401). CONTRACTOR shall assure compliance with this Statute by submitting two (2) copies of a standard certificate of coverage (e.g. ACCORD form) to Owner's Representative for every person providing services on the Project as acceptable proof of coverage. The Certificate of Insurance, Section 00650, must be presented as evidence of coverage for CONTRACTOR. CONTRACTOR's policy shall apply to the State of Texas and include these endorsements in favor of OWNER:

a) Waiver of Subrogation, form WC 420304; and
b) 30-day Notice of Cancellation, form WC 420601.

The minimum policy limits for Employers' Liability Insurance coverage shall be as follows:

.1 $100,000 bodily injury per accident, $500,000 bodily injury by disease policy limit and $100,000 bodily injury by disease each employee.

5.3.1.4 Commercial General Liability Insurance. The Policy shall contain the following provisions:

a) Contractual liability coverage for liability assumed under the Contract and all contracts relative to this Project.
b) Completed Operations/Products Liability for the duration of the warranty period.
c) Explosion, Collapse and Underground (X, C & U) coverage.
d) Independent Contractors coverage (Contractors/ Subcontractors work).
e) Aggregate limits of insurance per project, endorsement CG 2503.
f) OWNER listed as an additional insured, endorsements CG 2010 and CG 2037 or equivalent.
g) 30 day notice of cancellation in favor of OWNER, endorsement CG 0205.
h) Waiver of Transfer of Recovery Against Others in favor of OWNER, endorsement CG 2404.

Provide coverages A&B with minimum limits as follows:

.1 A combined bodily injury and property damage limit of $500,000 per occurrence.

5.3.1.5 Professional Liability Insurance. For Work which requires professional engineering or professional survey services to meet the requirements of the Contract, including but not limited to excavation safety systems, traffic control plans, and construction surveying, the CONTRACTOR or Subcontractors, responsible for performing the professional services shall provide Professional Liability Insurance with a minimum limit of $500,000 per claim and in the aggregate to pay on behalf of the assured all sums which the assured shall become legally obligated to pay as damages by reason of any negligent act, error, or omission committed with respect to all professional services provided in due course of the Work of this Contract. CONTRACTOR's policy shall include the following endorsement in favor of the OWNER:

a) 30-day Notice of Cancellation endorsement CA 0244

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.6 Permits, Fees: *Add the following*:

OWNER will obtain and pay for the following permits, licenses and/or fees:

6.6.1 Site Development Permit.

6.6.2 Building Permit(s). OWNER's responsibility for obtaining and paying for the Building Permit(s) shall be limited to the following where applicable: the required Electrical Service (Aid of Construction) Fee, Water and Wastewater Tap Fees, Water and Wastewater Capital Recovery Fees, and Septic Permit Fee. The OWNER's responsibility for obtaining and paying for the Building Permit(s) excludes securing and paying for the following where applicable: Driveway Permit (Concrete) Fee, Electrical Permit, Mechanical Permit, Plumbing Permit, Water Engineering Inspection Fee, Temporary Use of Right-of Way Permit, the gas company's Gas Yard Line Contribution Fee, and any other permits/fees not listed above. CONTRACTOR will be responsible for paying for the Building Permit, and all Trade Permits under it.

6.7 Laws and Regulations: *Add the following*:

6.7.4 This Work is subject to the Texas Pollution Discharge Elimination System (TPDES) permitting requirements for the installation and maintenance of temporary and permanent erosion and sediment controls and storm water pollution prevention measures throughout the construction period.

OWNER has prepared a Storm Water Pollution Prevention Plan (SWPPP). Reference Section 01096 for this SWPPP.

CONTRACTOR's responsibilities are as follows:

.1 Obtain a signed certification statement from all Subcontractors responsible for implementing the erosion / sedimentation controls and other best management practices that are part of the SWPPP. This statement shall indicate that the Subcontractor understands the permit requirements. The certified statement forms shall be attached to and become part of the SWPPP.

.2 Fill out the TCEQ's "Construction Site Notice" form, which is Attachment 2 to the TPDES General Permit TXR150000 (form available from OWNER or on the Internet at http://www.tceq.state.tx.us/assets/public/permitting/waterquality/attachments/stormwater/txr152d2.pdf and post it near the main entrance of the Work, or at multiple postings if the Work is linear. Mail a copy of the completed Construction Site Notice form to the local Municipal Separate Storm Sewer Systems (MS4) representative:

TPDES Program Coordinator
City of Austin – WPD – ERM
P.O. Box 1088
Austin, TX 78767

.3 Maintain all erosion/sedimentation controls and other protective measures identified in the SWPPP in effective operating condition.

.4 Perform inspections every five (5) working days and after every ½ inch rainfall event, noting the following observations on an inspection form provided by OWNER:

a) Locations of discharges of sediment or other pollutants from the site.
b) Locations of storm water / erosion / sedimentation controls that are in need of maintenance.
c) Locations of storm water / erosion / sedimentation controls that are not performing, failing to operate, or are inadequate.
d) Locations where additional storm water / erosion / sedimentation controls are needed.

.5 Maintain at Work site at all times a copy of the SWPPP (with all updates, as described below) and inspection reports.

.6 Update the SWPPP as necessary to comply with TPDES permitting requirements, which includes noting changes in erosion / sedimentation controls and other best management practices that are part of the SWPPP and which may be necessary due to the results of inspection reports. Any SWPPP revisions or updates must be signed and certified by a Certified Professional in Erosion and Sedimentation Control (CPESC) or a Registered Professional Engineer. If the SWPPP includes engineering calculations, then SWPPP must be sealed and signed by a Registered Professional Engineer.

.7 Upon completion of the Work, provide TPDES records to OWNER.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.7 Warranty Period: *Add the following*:

13.7.5 OWNER will utilize a "Warranty Item Form" (attached at the end of this Section) for the purpose of providing Written Notice of warranty defects to CONTRACTOR. CONTRACTOR shall date, sign, complete and return the form to OWNER when the defect is corrected, including such information on or attached to the form to describe the nature of the repairs or corrections that were made. If the defect cannot be corrected in seven (7) Calendar Days, CONTRACTOR shall provide a written explanation to the Owner's Representative describing the repairs needed and the time required to complete the repairs.

ARTICLE 17 - MISCELLANEOUS

17.1.1 Notice of Building Project Defect and Right to Cure.

.1 Pursuant to Texas Government Code Chapter 2272, before the OWNER brings a court proceeding with respect to alleged defective Work, the OWNER shall: (a) provide each party with whom the OWNER has a contract for the construction of a building a written report by certified mail, return receipt requested, describing with reasonable clarity: (i) the defective Work or related condition; (ii) the present physical condition of the building; and (iii) any modification, maintenance, or

repairs to the building made by the OWNER or others since the building was initially occupied or used (the "Report"); b) allow each party against whom the OWNER has claimed and any known subcontractor or supplier, who is subject to the claim: (i) a reasonable opportunity to inspect the alleged defective Work or related condition identified in the Report for a period of 30 days after OWNER sends the Report; and (ii) at least 120 days after the inspection to: (A) correct the defective Work or related condition identified in the Report; or (B) enter into a separate agreement with the OWNER to correct the defective Work or related condition.

.2 The CONTRACTOR must provide bonds and insurance in accordance with Contract requirements to cover the correction of the defective Work or related condition.

.3 The right to correct the defective Work or related condition is unavailable, if the CONTRACTOR has been previously terminated for cause by the OWNER; or has been convicted of a felony.

.4 In addition, the right to correct defective Work or related condition terminates, if OWNER complies with the Report, inspection, and cure period process and a) the defective Work or condition was not corrected within 120 days or as otherwise agreed; or b) the attempt to correct the defective Work or condition resulted in new defective Work or condition.

.5 The CONTRACTOR shall provide a copy of the Report to its insurers and sureties and each subcontractor and supplier whose Work is subject to the claim not later than the fifth day after its receipt. The insurer shall treat the received Report as the filing of a suit asserting a claim against its insured for purposes of the relevant policy terms, but only with respect to an insurance policy delivered, issued, or renewed on or after January 1, 2020.

.6 This section does not prohibit or limit the OWNER from making emergency repairs to the property in question as necessary to protect the health, safety, and welfare of the public or building occupants.

.7 This section does not apply to an action for personal injury, survival or wrongful death, residential construction, a project with TxDOT or federal highway funding, or a "civil works" project as defined by Texas Government Code Section 2269.351.

WARRANTY ITEM NO. _____ (PROJECT NAME)

The General Conditions of the Contract require that Warranty Defects be corrected within 7 days after written notice is received.

TO: _____
contractor name address / telephone / fax / email

ATTENTION OF: _____

FROM: _____
project manager name / address / telephone / fax / email

PROJECT: _____
name / location / CIP ID number

END OF ONE YEAR WARRANTY:_____

SUBJECT:_____
[ ] If checked, the damage requires immediate attention. The Contractor has been called.
[ ] If checked, the Consultant has been asked to consult with the Contractor on the problem.

PLEASE CORRECT OR REPAIR THE FOLLOWING ITEM(S):

DATE OF REQUEST_____ **SIGNATURE** _____
Project Manager

xc:
[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____

RESPONSE FROM CONTRACTOR: DATE CORRECTION WAS MADE:_____

The Contractor must endeavor to correct the defect within 7 calendar days after written notice is given. If the defect cannot be corrected in that time, Contractor shall provide a written explanation to the Owner's Representative describing the repairs needed and the time required to complete the repairs.

Description of corrections made:

DATE OF REPLY_____SIGNATURE_____
When the repair is complete, the contractor should return a copy to each of the following:
[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____
[ ] _____Phone No._____

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WAGE RATES AND PAYROLL REPORTING
Section 00830

1. PAYMENT

1.1 Classification Definitions, Building and Heavy and Highway

1.1.1 Definitions for Building Construction and Heavy and Highway classifications shall conform to the current "Occupational Information Network (O*NET)" as approved by the U.S. Department of Labor. For interpretive guidance, the Core Task list in O*NET will be used to make prevailing wage determinations. Final classification of workers will be made by the OWNER.

1.2 Minimum Wages

1.2.1 Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) or the $15.00 minimum wage required by City of Austin Ordinance No. 20160324-015, whichever is higher. The Total Minimum Wage required can be met using any combination of cash and non-cash qualified fringe benefits provided the cash component meets or exceeds the $15.00 minimum wage required.

1.2.2 Such wage rates shall be used throughout the Contract. If a classification is to be used, which is not listed in the attached wage rates, CONTRACTOR shall submit to OWNER rates and classification proposed for use, for approval, prior to performance of the Work.

1.2.3 All laborers and mechanics working upon the Work for this Project shall be paid unconditionally and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by Secretary of Labor under the Copeland Act, Title 29 CFR, Part 3) full wages accrued and when due, computed at rates not less than wage rates bound herein pertaining to type of Work being performed. When Work is of such a nature that both Building and Heavy and Highway wage scales are incorporated into contract, CONTRACTOR shall pay wage rates to mechanics or laborers performing Work in more than one classification at the rate indicated for each classification for time actually worked as determined by area practice applicable to type (Site Construction Crafts or Building Construction Crafts) of Work being performed without regards to skill. Salaried specialists (project superintendent and administrative personnel only) in the permanent employment of CONTRACTOR do not fall under any Wage Classification. A supervisor/foreman who is not exempt under 29 CFR Part 541 and who spends more than a substantial amount of time (20 percent) in a given workweek as a laborer or mechanic must be paid the applicable Wage Rate for the classification of work performed for all hours engaged in such work as a laborer or mechanic.

1.2.4 Wage rates shall be posted by CONTRACTOR at site(s) of Work in prominent, easily accessible places where they can be seen by all workers. The following shall also be posted by the CONTRACTOR: City of Austin wage contact posters (English and Spanish), City of Austin Equal Employment Opportunity posters (English and Spanish), Workers' Compensation Notice (English and Spanish), Texas Payday Law (English and Spanish), City Rest Break Ordinance

(English and Spanish), City of Austin Non-Discrimination Statement (related to Title VI of the Civil Rights Act), and Federal Notices, as appropriate.

1.3 Overtime Requirements

1.3.1 No CONTRACTOR, Subcontractor, or Sub-subcontractor contracting for any part of contract Work which may require or involve the employment of laborers or mechanics shall require or permit any laborer or mechanic in any workweek in which he is employed on such Work, to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times their basic rate of pay for all hours in excess of forty hours in such workweek.

1.3.2 Overtime wages must be calculated using the Adjusted Wage Rate specified in the Wage Rate Determination or the actual basic rate of pay, whichever is higher.

2. APPRENTICES

2.1 Locally and Federally Funded Projects

2.1.1 The terms journeyman and apprentice apply to both union and independent workers, and are not intended to imply that these positions are union workers only.

2.1.2 Apprentices and Trainees will be permitted to work as such only when they are registered, individually, under a bonafide Apprenticeship or Trainee program registered with the Bureau of Apprenticeship and Training, United States Department of Labor. The allowable ratio of Apprentices or Trainees to journeymen in any craft classification shall not be greater than the ratio permitted to CONTRACTOR as stated in the registered apprenticeship program standards. Any employee listed on a payroll at an Apprentice or Trainee wage rate, who is not registered as above, shall be paid the wage rate provided in Contract for Work employee actually performed. CONTRACTOR, Subcontractor, or Subsubcontractor shall furnish to OWNER written evidence of registration of his program for Apprentices and Trainees as well as of the appropriate ratios and wage rates, for the area of construction prior to using any Apprentices or Trainees on this Contract.

3. WITHHOLDING PAYMENTS

3.1 OWNER may withhold or cause to be withheld from CONTRACTOR as much of the accrued payments as necessary to pay laborers and mechanics employed by CONTRACTOR, Subcontractors, or Sub-subcontractors the amount of wages required to comply with the Contract. In the event of nonpayment of wages to laborers or mechanics working on the site of the Work of this Contract, OWNER may, after Written Notice to CONTRACTOR, take such action as may be necessary to cause suspension of any further payments or advance of funds to CONTRACTOR until such violations have ceased and until restitution has been made. Payments may also be withheld if CONTRACTOR fails to maintain weekly payroll reports or fails to provide copies in a timely manner upon request of Owner.

4. PAYROLLS

4.1 CONTRACTOR shall keep records showing:

4.1.1 The name, address and occupation of each worker employed by the CONTRACTOR or subcontractor(s) in the construction of the public work.

4.1.2 The actual per diem wages paid to each worker

4.1.3 Employee Certification. CONTRACTOR, all levels of Subcontractors shall identify in writing, the classification agreed to by all laborers and mechanics employed by them in the execution of the Contract, and pay not less than rates specified in the attached Wage Rate Determination(s). Contractor shall prepare a completed form for the signature of Employee and a witness shall sign the form in the presence of Employee. If work performed by worker is different than the trade classification agreed upon, the worker shall be paid for that work no less than the minimum prevailing wage for that specified trade.

4.1.4 Payroll Deduction Authorization Form. CONTRACTOR, Subcontractor, and Sub subcontractor shall prepare for employee signature a payroll deduction authorization form to identify all payroll deductions excluding those required by statute, such as federal income taxes, Medicare and social security.

4.2 The record shall be open at all reasonable hours to inspection by the officers and agents of the Owner as requested. CONTRACTOR will be responsible to provide copies of records as requested by the Owner within two (2) working days. Payrolls relating to this Work shall be maintained during term of Contract and preserved for a period of three (3) years thereafter by CONTRACTOR for all laborers and mechanics working on the Work.

4.3 A Statement of Compliance, a letter signed and dated by party responsible for supervising the payment of persons employed by CONTRACTOR or subcontractor shall accompany payrolls required by Owner. The Statement of Compliance letter shall identify but is not limited to:

4.3.1 Name of signatory party and title

4.3.2 Name of project, payroll period and

4.3.3 Name of CONTRACTOR or Subcontractor

4.4 The signed letter attests that the payroll complies with 29CFR issued by the Secretary of Labor.

4.5 Federal Funding. In the event that federal funding is used:

4.5.1 Contractor and all levels of Subcontractors shall submit weekly certified payroll reports and signed wage compliance statements to the Owner's designated office no later than seven (7) calendar days after the scheduled payday.

4.5.2 Contractors and all levels of Subcontractors shall pay all "mechanics and laborers" not less often than once per week, for work performed the previous week.

4.5.3 Submit to the Owner's designated office Standard Form 1413, Statement and Acknowledgement, from each subcontractor prior to the subcontractor performing work on the project.

5. NONCOMPLIANCE

5.1 According to Chapter 2258 Texas Government Code Title 10A, a CONTRACTOR or subcontractor(s) who violates this section shall pay to the political subdivision on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.

5.2 Confirmed Disciplinary action taken by CONTRACTOR against employees who provide information during an interview or investigation by the Owner on wages received, may result in suspension or debarment from consideration of award of City contracts.

6. AREA PRACTICE

6.1 Heavy and Highway Construction Rates shall be used on this Project, unless the Project consists primarily of Building Construction and Building Construction Rates are to be used.

6.1.1 Building Construction consists generally of all aspects of construction of buildings, which are sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment or supplies, including without limitation the installation of utilities and equipment, both above and below grade level, as well as incidental demolition, grading, utilities, paving and other site work. Buildings need not be "habitable" to be classified as Building Construction and the installation of heavy machinery and/or equipment will not generally change a Building Construction project's classification.

6.1.2 The determination of Building Construction Wage Rates includes all construction trades and work necessary to complete a building, regardless of the number of contracts involved, so long as all such contracts are closely related in purpose, time and place.

6.2 For projects that involve both Building Construction and Heavy and Highway trades, the following classifications shall be used:

6.2.1 A multiple classification shall be used if Building Construction items are more than 20% of the Heavy and Highway project cost.

6.2.2 A multiple classification shall be used if Heavy and Highway Construction items are more than 20% of the Building Construction Project cost.

6.3 Split classifications/multiple wage rate schedules: When construction work requires that an employee perform work under multiple classifications or multiple wage scales, the employer must pay that worker (at least) the highest prevailing wage or the employer payroll records must accurately set forth the times spent performing the work of each classification and under each scale. For those projects that involve both Building Construction and Heavy and Highway trades, the Heavy and Highway wage rates may only be applied to workers when engaged in site work at least five (5) feet beyond the building.

7. TEXAS OPEN RECORDS ACT

7.1 Unless covered by an exception to mandatory disclosure under the Texas Public Information Act, Chapter 552, Texas Government Code, any and all documents submitted to the City of Austin become Public Records and are, therefore, subject to public disclosure.

Wage Rates for This Project Are Attached

END

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WAGE RATE DETERMINATION

Building Construction Type
County Name: TRAVIS

Wages based on DOL Prevailing Wage Rate General Decision: TX20200271 03/12/2021 TX271 and City of Austin Ordinance #20160324-015

DOL Rate column is for information only. The Total Minimum Wage Rate is derived from the Adjusted Wage Rate Required pursuant to City Ordinance plus the DOL Fringes and can be met using any combination of cash and non-cash qualified fringe benefits, provided the cash component is at least $15.00/hour.

Classification	DOL Rate For info Only	Adjusted Wage Rate Required Pursuant to City Ordinance	DOL Fringes	Total Minimum Wage Rate Required
Asbestos Worker/Heat & Frost Insulator (Duct, Pipe, and Mechanical System Insulation)	$ 23.97	$ 23.97	$ 10.79	$ 34.76
Boilermaker	$ 28.00	$ 28.00	$ 22.35	$ 50.35
Bricklayer	$ 20.07	$ 20.07	$ -	$ 20.07
Carpenter	$ 21.96	$ 21.96	$ 7.90	$ 29.86
Carpenter (Acoustical Ceiling Installation only)	$ 14.00	$ 15.00	$ -	$ 15.00
Carpenter (Form Work Only)	$ 15.62	$ 15.62	$ 0.05	$ 15.67
Cement Mason/Concrete Finisher	$ 15.71	$ 15.71	$ -	$ 15.71
Drywall Finisher/Taper	$ 17.06	$ 17.06	$ 4.43	$ 21.49
Drywall Hanger and Metal Stud Installer	$ 17.47	$ 17.47	$ 3.45	$ 20.92
Electrical Installer (Sound and Communication Systems, Excluding Wiring)	$ 18.00	$ 18.00	$ 2.30	$ 20.30
** Electrician (Excludes Installation of Sound and Communication Systems	$ 29.44	$ 29.44	$ 8.97	$ 38.41
***Elevator Mechanic <5 years' experience	$ 43.72	$ 43.72	$ 36.85	$ 80.57
***Elevator Mechanic >5 years' experience	$ 43.72	$ 43.72	$ 38.43	$ 82.15
Floor Layer (Carpet)	$ 21.88	$ 21.88	$ -	$ 21.88
Glazier	$ 12.83	$ 15.00	$ -	$ 15.00
HVAC Mechanic (HVAC Unit Installation Only)	$ 23.78	$ 23.78	$ 6.89	$ 30.67
Ironworker, Ornamental	$ 25.26	$ 25.26	$ 7.13	$ 32.39
Ironworker, Reinforcing	$ 12.27	$ 15.00	$ -	$ 15.00
Ironworker, Structural	$ 20.73	$ 20.73	$ 5.24	$ 25.97
*Lead Paint or Asbestos Abatement Worker	*	$ 15.00	$ -	$ 15.00
Laborer, Common or General	$ 11.44	$ 15.00	$ -	$ 15.00
Laborer, Mason Tender - Brick	$ 12.22	$ 15.00	$ -	$ 15.00
Laborer, Mason Tender - Cement/Concrete	$ 11.85	$ 15.00	$ -	$ 15.00

Laborer, Pipelayer	$ 12.45	$ 15.00	$ -	$ 15.00
Laborer, Roof Tearoff	$ 11.28	$ 15.00	$ -	$ 15.00
Operator, Backhoe/Excavator/Trackhoe	$ 19.43	$ 19.43	$ 3.49	$ 22.92
Operator, Bobcat/Skid Steer/Skid Loader	$ 13.00	$ 15.00	$ -	$ 15.00
Operator, Bulldozer	$ 14.00	$ 15.00	$ -	$ 15.00
Operator, Crane	$ 34.85	$ 34.85	$ 9.85	$ 44.70
Operator, Drill	$ 14.50	$ 15.00	-	$ 15.00
Operator, Forklift	$ 16.64	$ 16.64	$ 6.26	$ 22.90
Operator, Grader/Blade	$ 19.30	$ 19.30	$ -	$ 19.30
Operator, Loader	$ 14.00	$ 15.00	$ -	$ 15.00
Operator, Mechanic	$ 18.75	$ 18.75	$ 5.12	$ 23.87
Operator, Paver (Asphalt, Aggregate, and	$ 16.03	$ 16.03	$ -	$ 16.03
Operator, Roller	$ 11.25	$ 15.00	$ -	$ 15.00
Painter (Brush, Roller, and Spray, Excludes	$ 18.76	$ 18.76	$ 6.35	$ 25.11
Pipefitter (Including HVAC Pipe Installation)	$ 31.00	$ 31.00	$ 14.37	$ 45.37
Plumber, Excludes HVAC Pipe Installation	$ 23.57	$ 23.57	$ 6.37	$ 29.94
Roofer	$ 12.00	$ 15.00	$ -	$ 15.00
*Roofer, Metal	$ 14.05	$ 15.00	$ -	$ 15.00
Sheet Metal Worker (Excluding HVAC, Including HVAC Duct Installation)	$ 27.29	$ 27.29	$ 15.08	$ 42.37
HVAC Duct Installation Only	$ 27.29	$ 27.29	$ 15.08	$ 42.37
Sprinkler Fitter (Fire Sprinklers)	$ 30.64	$ 30.64	$ 22.20	$ 52.84
Tile Finisher	$ 11.32	$ 15.00	$ -	$ 15.00
Tile Setter	$ 16.35	$ 16.35	$ -	$ 16.35
Truck Driver, Dump Truck	$ 12.39	$ 15.00	$ 1.18	$ 16.18
Truck Driver, Flatbed Truck	$ 19.65	$ 19.65	$ 8.57	$ 28.22
Truck Driver, Semi-Trailer Truck	$ 12.50	$ 15.00	-	$ 15.00
Truck Driver, Water Truck	$ 12.00	$ 15.00	$ 4.11	$ 19.11
Waterproofer	$ 16.30	$ 16.30	$ 0.06	$ 16.36

http://www.wdol.gov/wdol/scafiles/davisbacon/tx.html

See below for Additional Wage Information.

Note: *Lead Paint & Asbestos Abatement and Roofer, Metal Classifications have been added to this Prevailing Wage Rate Determination pursuant to a City of Austin Prevailing Wage Survey (trades absent from DOL).

The Wage Compliance information detailed below was excerpted from DOL General Decision TX180323 or other sources.

1. ADDITIONAL TRADE INFORMATION

**Electricians - Including low voltage wiring for computers, fire/smoke alarms.
***Elevator Mechanics - also must be paid for 7 holidays - New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, the Friday after Thanksgiving Day, Christmas Day, and Veterans Day.
Welders - Receive rate prescribed for craft performing operation to which welding is incidental.

Unlisted classifications needed for work not included within the scope of the classifications

listed may be added upon the advance approval of City of Austin Contract Administration. CONTRACTOR shall submit to City of Austin Contract Administration for review the classification, a bona fide definition of work to be performed and a proposed wage with sample payrolls conforming to area practice **prior** to the start of the job for that type of work.

2. WAGES

The Total Wage may be met by any combination of cash wages and credible "bona fide" fringe benefits paid for by the employer. Overtime wages must be calculated using the Adjusted Wage Rate specified in the Wage Rate Determination or the actual basic rate of pay, whichever is higher. City of Austin Ordinance No. 20160324-015 requires that construction workers are paid a Minimum Wage of at least $15.00/hour. The cash portion of their compensation must meet or exceed this amount.

3. CREDITING FRINGE BENEFIT CONTRIBUTIONS TO MEET DBA/DBRA AND CITY OF AUSTIN REQUIREMENTS

The Davis-Bacon Act (and 29 CFR 5.23), list fringe benefits to be considered. Examples are:

> Life Insurance
> Health Insurance
> Pension
> Vacation
> Holidays
> Sick Leave

Note: The use of a truck is not a fringe benefit; a Thanksgiving turkey or Christmas bonus is not a fringe benefit. No credit may be taken for any benefit required by federal, state, or local law such as: workers compensation, unemployment compensation; or social security contributions.

Contributions to fringe benefit plans must be made regularly, e.g. daily, weekly, etc. They must be more frequent than quarterly. (See 29 CFR 5.5 (a)(1)(I)) A periodic bonus may not be counted as a fringe benefit.

4. ANNUALIZATION OF BENEFIT COSTS

If a firm provides an electrician with $200 per month medical insurance, to calculate allowable fringe benefit credit contributions per hour, the formula ([$200 x 12 months] divided by 2080 hours = $1.15 per hour) should be used.

5. PROPER DESIGNATION OF TRADE

A work classification on the wage decision for each worker must be made based on the actual type of work he/she performed and each worker must be paid no less than the wage rate on the wage decision for that classification **regardless** of his or her level of skill.

6. SPLIT CLASSIFICATION

If a firm has employees that perform work in more than one classification, it can pay the wage rates specified f o r each classification ONLY if it maintains accurate time records showing the amount of time spent in each classification. If accurate time records are not

maintained, these employees must be paid the highest wage rate of all the classifications of work performed by each worker. Accurate time records tracking how many hours a worker performed the work of one trade and then switched to another trade must be accounted for on a daily basis and reflected on Employer Certified Payroll accordingly.

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

6.1 Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: **PLUM0198-005 07/01/2014**. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014. Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

6.2 Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: **SULA2012-007 5/13/2014**. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier. Survey wage rates are not updated and remain in effect until a new survey is conducted.

6.3 Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: **UAVG-OH-0010 08/29/2014**. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

7. WAGE DETERMINATION APPEALS PROCESS

7.1 Has there been an initial decision in the matter? This can be:

- **.1** An existing published wage determination
- **.2** A survey underlying a wage determination
- **.3** A Wage and Hour Division letter setting forth a position on a wage determination matter
- **.4** A conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in .**2** and **.3** should be followed.

7.2 With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determination
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W. Washington, DC 20210

7.3 If the answer to the question in .**1** is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W. Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

7.3 If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W. Washington, DC 20210

7.4 All decisions by the Administrative Review Board are final.

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CONSTRUCTION TRAINING PROGRAM REQUIREMENTS

Section 00840

The **City of Austin Construction Training Program (the "Program")** is intended to train workers on City of Austin's construction projects in order to develop a pool of qualified, ready-to-work skilled and semi-skilled construction workers. This training commitment is not intended and shall not be used to discriminate against any applicant.

Training Requirement. Establishment of the Construction Training Requirement for each project will be based on project scope, dollar amount, and opportunities available to achieve the training requirements. The requirements will be established either prior to solicitation, or during contract negotiations, using the criteria in Charts A and B. Program requirements will be subject to availability of Trainees and Graduates.

Chart A - Evaluation Criteria
1. Material cost vs labor cost
2. Scope of work
3. Schedule of values (a comprehensive list of work for a particular project)
4. Project duration and schedule
5. Unique aspects of the project
6. Available training programs for the specific training plan
7. Workforce determined by the number of workers that will be on the project enough days to establish a training program.

Chart B – Construction Training Requirements	
Estimated Construction Cost	**Apprentice/ On-the-Job Training (OJT) /Construction Ready (CR) Trainee Requirements**
$500K to $2.5M	2 – Construction Ready Trainees*
Over $2.5M to $5M	4 - Construction Ready Trainees*
Over $5M to $10M	6 - Construction Ready Trainees*
Over $10M (Significant Budget)	OJT/Apprentice/Graduate/Trainee Minimum 15%

*These requirements may also be satisfied by workers enrolled in or graduated from DOL registered/approved training programs.

1. **DEFINITIONS**

1.1 *Capital Contracting Office (CCO)* – The City of Austin's Office responsible for administering the Construction Training Program

1.2 *City's Approved Minimum Wage Rate* – a minimum wage rate established by the City of Austin for workers performing construction activities on City of Austin contracts

1.3 *Construction-Ready Trainee* - a graduate or current trainee of a Pipeline training program, enrollee or graduate of a DOL-registered Apprenticeship Program, enrollee or graduate of a DOL-approved Training Program, and/or an enrollee or graduate of a DOL-certified Bilingual Training Program.

1.4 *Pipeline* - group of organizations that provide pre-employment, pre-apprentice, or apprentice readiness training related to construction

1.5 *Training Plan:* a plan identifying how a contractor intends to meet its training requirement, subject to OWNER's review and approval

1.6 *Construction Training Program Reporting Form* – a form provided by the OWNER which documents the contractor's training activities and trainee status

2. **TRAINING REQUIREMENT**

2.1 The Construction Ready Trainee requirement for this project is **two (2).**

3. **CONTRACTOR'S RESPONSIBILITIES**

3.1 No later than 10 business days after Council Award, the CONTRACTOR shall provide a Training Plan for OWNER's approval, specifying how the CONTRACTOR intends to satisfy the contract requirement. The CONTRACTOR will have fulfilled its responsibilities under Section 00840 of the contract by having complied with the CONTRACTOR's Training Plan approved by the OWNER.

3.2 In the event that a CONTRACTOR subcontracts a portion of the contract work, CONTRACTOR shall determine if the requirements of the program will be assumed by the subcontractor(s). The CONTRACTOR should ensure that this training provision is made applicable to such subcontract; however, the CONTRACTOR shall retain the responsibility for meeting the training requirements imposed by this provision.

3.3 Trainee must be paid at least the City's Approved Minimum Wage Rate.

3.4 OWNER will provide a list of available Pipeline organizations. The CONTRACTOR shall contact those Pipeline organizations as needed in order to recruit workers for the program.

3.5 The CONTRACTOR shall submit a Training Report to OWNER for each Trainee no later than 30 calendar days after the Notice-to-Proceed. This Training Report must be submitted monthly thereafter for the duration of the project. This shall indicate work classification and graduation details, as well as training status changes. If a trainee is terminated or resigns, the CONTRACTOR is required to make a reasonable effort to replace the trainee within 30 calendar days.

3.6 For each trainee performing work on the project, the CONTRACTOR must submit to CCO a completed Employee Certification Form for each Trainee.

3.7 CONTRACTOR's **Reasonable Efforts to Comply.** The CONTRACTOR will be responsible for demonstrating the steps taken to meet the trainee requirement. If CONTRACTOR has fewer trainees employed on the project than specified in the Training Plan, the CONTRACTOR must submit evidence of recruitment efforts, including:

3.7.1 contacts made to OWNER for a current list of approved training providers
3.7.2 log of applicants contacted
3.7.3 log of training organizations contacted
3.7.4 documented outreach efforts made to all available training organizations (per current OWNER list) to satisfy the requirement
3.7.5 documentation of CONTRACTOR's recruitment efforts performed until program requirements are met or project is complete as part of the Construction Training Program Reporting Form

4. **NON-COMPLIANCE**

4.1 Lack of demonstrated reasonable effort to comply with the Construction Training Program will be reflected in the Contractor's Performance Evaluation and may impact the receipt of future business with the City of Austin.

END

Notice to Bidders: *This form, Addendum, Section 00900, is included for your information only. If an actual Addendum is issued for this project, the format shown below will be used. Additionally, issued addenda will be bound at the beginning of the Project Manual following the Table of Contents at the time of contract execution.*

ADDENDUM NO. _____

Date _____, _____

City of Austin

Project Name _____

C.I.P. No. _____ IFB No.: _____

This Addendum forms a part of the Contract and corrects or modifies original Bid Documents, dated _____, ____ (*first advertisement date)*. **Acknowledge receipt of this addendum in space provided on bid form.** Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:

B. Drawing Revisions:

This addendum consists of ____ page(s)/sheet(s).

_____
Approved by OWNER

_____
Approved by ENGINEER/ARCHITECT (as applicable per license requirements)

END

SAMPLE

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including General Conditions, Section 00700, and Supplemental General Conditions, Section 00810, and Division 1 requirements.

1.2 DESCRIPTION OF WORK

St. Elmo Service Center Scope of Work includes, briefly and without force and effect upon the documents, demolition of curbs, paving, exterior wall and ADA parking. Construction includes the expansion of an existing concrete parking lot (West), new ADA parking, a new remote heavy-vehicle concrete parking lot (East) with the construction of a fence and lighting and a remote pole yard asphalt parking lot (East). New HVAC and lighting support the new secure service entry and parking lots.

The Work of this Contract includes sustainability requirements as shown in the Division 1 Section 01505 and all other applicable specification sections. It is the intent of the Owner to work with the Contractor to implement sustainable construction practices to the greatest extent possible.

1.3 SUBMITTALS

Provide shop drawings and other information as required by Section 01300 for coordination of the work.

1.4 CONTRACTOR'S USE OF CONSTRUCTION SITE

The construction site will be in use by public throughout the duration of contract. The CONTRACTOR shall refer to Section 01550, Public Safety and Convenience for coordination required to minimize disturbance and hazards to pedestrian as well as automobile traffic. CONTRACTOR shall not unreasonably encumber the construction site with materials or equipment. CONTRACTOR shall assume reasonable responsibility for protection of construction site.

PART 2 – PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END

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MEASUREMENT AND PAYMENT LUMP SUM CONTRACTS
Section 01025

For this Project, all measurement and payment sections, including standard technical specifications and special specifications, are modified by this Section.

All work items installed, provided, constructed, etc. with the exception of the unit price items listed in the 300L, shall not be paid for separately but shall be considered subsidiary to the lump sum bid price for the Project. The cost of all work materials, labor, overhead, insurance, equipment, etc. necessary to finish the work complete in place shall be included in the lump sum bid price for the project.

End

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PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Applicable portions of the Project Manual, including but not limited to relevant Drawings and Specifications.

1.2 SUMMARY

This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: A Bid Item for a scope of work described in the Section 00300 Bid Requirements and Contract Documents that, if accepted by Owner, may result in additions to or deductions from the Base Bid.

1.4 PROCEDURES

A. Coordination: The Contractor must modify or adjust any affected adjacent Work as necessary to completely integrate work of the Alternate into the Project.

B. The Contractor must include as part of each Alternate, any miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of the Alternate.

C. Notification: The awarded contract will include all accepted Alternates.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in such schedule contain requirements for materials necessary to achieve the Work described under each Alternate.

E. Bidders must respond to all Alternates listed on the 00300 Bid Form, even if acceptance or rejection of an alternate will not change the Bid amount. Bid amounts must be entered in the spaces for each Alternate in the Bid Form.

The Owner has established a priority order (Alternate No. 1 has the highest priority) for the acceptance of Bid Alternates based on the Project needs and budget. Alternates will be accepted in the order listed on the Bid Form, but such acceptance will not exceed the Project budget.

PART 2 - PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate No. 1: Proposed New Asphalt pavement (Austin Energy Pole Yard - East), including New Chain-Link Fence (at Pole Yard), New Concrete Driveway, and reinstallation of chain-link gate.

(The price for Alternate No. 1 is in addition to the Base Bid.)

END

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1. CONTRACTOR shall perform all layout work to transfer all controls for grades, lines, levels and measurements from a minimum of two reference points provided by OWNER. All survey work will be performed under the direct supervision of a Texas Registered Professional Land Surveyor (RPLS).

2. Within 5 work days of the Notice To Proceed date, or within 10 Working Days of initiating work based on the approved Schedule in a new area of the Project, the CONTRACTOR shall survey and stake the locations of all proposed improvements behind the curb and within the ROW (examples: manholes, storm inlets, fire hydrants, etc.), or any other improvements identified by the OWNER'S REPRESENTATIVE, for the purpose of identifying the nature and location of these improvements to the adjacent property owner(s). The OWNER'S REPRESENTATIVE will identify to the CONTRACTOR the improvements to be staked.

3. OWNER will not stake for construction and will not be on site for survey layout activities, except to perform quality control checks.

4. CONTRACTOR shall be required to set elevation hubs (blue tops) for subgrade and base course on centerline, at quarter points and curb lines or edge of pavement at intervals not exceeding 50 feet.

5. The construction plans will include horizontal and vertical control points. References to approved COA benchmarks used in establishing controls on the drawings will be provided by the Owner's E/A. In addition, on building projects and/or projects not built within an existing public ROW, a boundary survey will be supplied together with a legal description of the property and all easements where Work will take place.

6. CONTRACTOR shall submit construction staking layout sheets sealed by a Professional Engineer or Registered Professional Land Surveyor registered in the State of Texas. CONTRACTOR shall use a qualification-based selection process consistent with the Professional Services Procurement Act, Chapter 2254.004 of the Texas Government Code, when securing the services of a Professional Engineer or Registered Professional Land Surveyor. It is a violation of State Law to solicit bids for the services of a Professional Engineer of Registered Professional Land Surveyor.

    6.1 Any discrepancies found with the construction documents' dimensional layout will be corrected. CONTRACTOR shall assure that the Owner's Representative and E/A are notified so that the appropriate actions are taken to correct the Contract drawings.

    6.2 All Work shall be done to the lines, grades and elevations indicated on the drawings. Information concerning basic horizontal and vertical control points will be provided by the E/A, **GSC Architects through their civil engineering subconsultant Martinez Engineering (TBPE Firm Registration No. F-16723**. These points shall be used as the datum basis under this Contract.

    6.3 All work to transfer all controls for grades, lines, levels, layout and measurements shall be performed under the supervision of a Texas Registered Professional Land Surveyor, provided by the CONTRACTOR. Such work shall conform to the standards for construction staking in the most recent edition of the Texas Society of Professional Surveyors Manual of Practice for Land Surveying, Category 5, Sections 1-12 inclusive.

6.4 The offset centerline stakes will be set at no greater than fifty (50) foot intervals. References to lines and grades as established by the CONTRACTOR's surveyor shall be in reference to these stake lines. The CONTRACTOR is required to provide a sealed statement from his RPLS that the controls are correct and the site layout has been done by their professional staff.

6.5 The CONTRACTOR shall place grade stakes and submit construction staking layout sheets. The CONTRACTOR shall allow a minimum of ten (10) days after submission to the Owner's Representative for review of construction staking layout sheets. Construction staking layout sheets shall include, at a minimum, the information contained in the form included at the end of this section. No Work shall be performed without Owner's Representative review and return to CONTRACTOR of construction staking layout sheets. The Owner's Representative, E/A and the CONTRACTOR shall review the survey controls on the ground.

6.6 Prior to any excavation, the CONTRACTOR shall establish the elevation to top of ground at offset stakes at the distance deemed appropriate by the CONTRACTOR to preclude disturbance of offset stakes during construction. **The CONTRACTOR shall set all blue tops for subgrade and base courses on centerline at quarter points, at curb lines or edge of pavement, and other points that may be indicated on the Drawings, all at intervals not to exceed 50 feet.**

6.7 The CONTRACTOR shall furnish, without charge, experienced personnel and such calibrated survey equipment, tools, stakes, and other materials that the Owner's Representative may require in establishing or checking control points, or in checking survey, layout, and measurement work performed by the CONTRACTOR.

6.8 The CONTRACTOR shall keep the Owner's Representative informed in a reasonable time in advance of the times and places at which he wishes to do work, so that any checking deemed necessary by the OWNER may be done with minimum inconvenience to the E/A and minimum delay to the CONTRACTOR. Surveying will be coordinated between the Owner's Representative and CONTRACTOR in a manner convenient to both.

6.9 During layout, CONTRACTOR shall field verify the elevation and alignment of all tie-in points to existing infrastructure. This work shall be performed sufficiently in advance of construction so that any conflicts may be resolved without delay. Any work done without being properly located may be ordered removed and replaced at the CONTRACTOR's expense.

6.10 The CONTRACTOR shall carefully preserve all monuments, benchmarks, reference points, and stakes. In case of the destruction thereof, the CONTRACTOR shall bear the cost of replacement and shall be responsible for any mistake or loss of time that may be caused. Permanent monuments or benchmarks, which must be removed or disturbed, shall be protected until properly referenced for relocation. The CONTRACTOR shall furnish materials and assistance for the proper replacement of such monuments or benchmarks.

6.11 The CONTRACTOR shall satisfy himself before commencing work as to the meaning and correctness of all survey control stakes, marks, etc., and no claim will be entertained by the OWNER for or on account of any alleged inaccuracies, unless the CONTRACTOR notifies the OWNER in writing before commencing the affected Work.

7. As needed for necessary documentation of the work progress, the CONTRACTOR shall maintain and/or protect offset or survey staking for the duration of the project. Any re-staking required to meet this requirement shall be done at the CONTRACTOR'S expense.

8. This item is subsidiary to the work as a whole.

9. Upon completion of construction, or at intervals specified in the Contract CONTRACTOR shall provide a record survey of the work in progress or completed. This information will be submitted to the Owner's Representative and shall be supplied electronically and on a separate full-size plan sheet to be transmitted to the E/A for evaluation and merging into the Record Drawings.

End See attached "Construction Staking Layout Sheet"

CONSTRUCTION STAKING LAYOUT SHEET

Project Name: _____ **Date:** _____
C.I.P. ID#: _____ **Instrument No.:** _____
Person Recording: _____ **Weather Conditions:** _____
Crew Members: _____
General Purpose & Scope of Survey: _____

STATION	B.S.	H.I.	F.S.	LEVEL LOOP ELEVATION	ROD READING	HUB ELEVATION AT STATION	(TARGET) (eg., pipe invert) ELEVATION	C - CUT OR F - FILL	% GRADE	NOTES: INDICATE WHETHER CENTERLINE HUB OR _____ FT. OFFSET HUB

DEFINITIONS

General: Basic Contract definitions are included in the General Conditions, Section 00700 included herein.

Approved: The term approved, when used in conjunction with the Owner's Representative's action on the CONTRACTOR'S submittals, applications, and requests, is limited to the Owner's Representative's duties and responsibilities as stated in the Conditions of the Contract. A stamp reading "No Exceptions Taken" shall have the same intent as "Approved".

Furnish: The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.

Install: The term install describes operations at the Project site including the actual unloading, unpacking, assembly, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

Installer: An Installer is the CONTRACTOR or another entity engaged by the CONTRACTOR, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in operations they are engaged to perform.

Project Site: The space available to the CONTRACTOR for performing construction activities either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

Provide: The term provide means to furnish and install, complete and ready for the intended use.

Regulations: The term regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

Trades: Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.

INDUSTRY STANDARDS

Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

Publication Dates: Comply with the standards in effect as of the date of the Contract Documents.

Conflicting Requirements: Where compliance with two or more standards is specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer to the Owner's Representative for a decision before proceeding.

Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

Abbreviations and Names: Trade association names, titles of general standards, and names and titles of government agencies are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturer's Association
AAN	American Association of Nurserymen.
AASHTO	American Association of State Highway and Transportation Officials.
AATCC	American Association of Textile Chemists and Colorists
ACI	American Concrete Institute
ACIL	American Council of Independent Laboratories
ACPA	American Concrete Pipe Association
ADC	Air Diffusion Council
AFBMA	Anti-Friction Bearing Manufacturers Association
AGA	American Gas Association
AGC	Associated General Contractors of America
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	Asphalt Institute
AIA	American Institute of Architects
AIHA	American Industrial Hygiene Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction.
ALCA	Associated Landscape Contractors of America
ALI	Associated Laboratories, Inc.
ALSC	American Lumber Standards Committee
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute.

AOAC	Association of Official Analytical Chemists
AOSA	Association of Official Seed Analysts
APA	American Plywood Association
API	American Petroleum Institute.
AREA	American Railroad Engineers Association
ARI	Air Conditioning and Refrigeration Institute
ARMA	Asphalt Roofing Manufacturers Association
ASA	Acoustical Society of America
ASA	American Standards Association.
ASC	Adhesive and Sealant Council
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating & Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASSE	American Society of Sanitary Engineering
ASTM	American Society for Testing and Materials.
AWCMA	American Window Covering Manufacturers Association
AWG	American Wire Gage
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPB	American Wood Preservers Bureau
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Institute of America
BIFMA	Business and Institutional Furniture Manufacturers Association
CAGI	Compressed Air and Gas Institute
CAUS	Color Association of the United States
CBM	Certified Ballast Manufacturers

CCC	Carpet Cushion Council
CDA	Copper Development Association
CE	Corps of Engineers
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CISCA	Ceiling and Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CPSC	Consumer Product Safety Commission
CRI	Carpet and Rug Institute
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard of NBS (U.S. Dept. of Commerce)
CTI	Ceramic Tile Institute
DFPA	Douglas Fir Plywood Association
DHI	Door and Hardware Institute
DLPA	Decorative Laminate Products Association
DOC	U.S. Department of Commerce
DOT	Department of Transportation
ECSA	Exchange Carriers Standards Association
EIA	Electronic Industries Association
EIMA	Exterior Insulation Manufacturers Association
EJMA	Expansion Joint Manufacturers Association
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FGMA	Flat Glass Marketing Association
FHA	Federal Housing Administration
FM	Factory Mutual Research Organization
FS	Federal Specifications
FSC	Forest Stewardship Council
FTI	Facing Tile Institute

GA	Gypsum Association
GSA	General Services Administration
HEI	Heat Exchange Institute
HI	Hydronics Institute
H.I.	Hydraulic Institute
HMA	Hardwood Manufacturers Association
HPMA	Hardwood Plywood Manufacturers Association
IBD	Institute of Business Designers
ICEA	Insulated Cable Engineers Association, Inc.
IEEE	Institute of Electrical and Electronic Engineers, Inc.
IESNA	Illuminating Engineering Society of North American
IGCC	Insulating Glass Certification Council
ILI	Indiana Limestone Institute of America
IMSA	International Municipal Signal Association
IRI	Industrial Risk Insurers
ISA	Instrument Society of America
ITE	Institute of Transportation Engineers
LEED™	Leadership in Energy and Environmental Design
LIA	Lead Industries Association, Inc.
LPI	Lightning Protection Institute
MBMA	Metal Building Manufacturer's Association
MCAA	Mechanical Contractors Association of America
MFMA	Maple Flooring Manufacturers' Association
MIA	Marble Institute of America
ML/SFA	Metal Lath/Steel Framing Association
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry
MUTCD	Texas Department of Transportation Manual on Uniform Traffic Control Devices
NAAMM	National Association of Architectural Metal Manufacturers
NAIMA	North American Insulation Manufacturers Association
NAPA	National Asphalt Pavement Association

NBFU	National Board of Fire Underwriters
NBGQA	National Building Granite Quarries Association
NBS	National Bureau of Standards (U.S. Dept. of Commerce)
NCMA	National Concrete Masonry Association
NCRPM	National Council on Radiation Protection and Measurements
NCSPA	National Corrugated Steel Pipe Association
NEC	National Electrical Code (Published by NFPA)
NECA	National Electrical Contractors Association
NEII	National Elevator Industry, Inc.
NEMA	National Electrical Manufacturers Association
NETA	International Electrical Testing Association
N.F.P.A.	National Forest Products Association
NFPA	National Fire Protection Association
NHLA	National Hardwood Lumber Association
NIST	National Institute of Standards and Technology
NLGA	National Lumber Grades Authority
NOFMA	National Oak Flooring Manufacturers Association
NPA	National Particleboard Association
NPCA	National Paint and Coatings Association
NRCA	National Roofing Contractors Association
NWMA	National Woodwork Manufacturers Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PDI	Plumbing and Drainage Institute
PE	Professional Engineer
REA	Rural Electrification Administration
RFCI	Resilient Floor Covering Institute
RMA	Rubber Manufacturing Association
RPLS	Registered Professional Land Surveyor
SDI	Steel Deck Institute

S.D.I.	Steel Door Institute
SFPA	Southern Forest Products Association
SGCC	Safety Glazing Certification Council
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPIB	Southern Pine Inspection Bureau
SPRI	Single Ply Roofing Institute
SSPC	Steel Structures Painting Council
SSPMA	Sump and Sewage Pump Manufacturers Association
SWI	Steel Window Institute
SWPA	Submersible Wastewater Pump Association
TCA	Tile Council of America
TEX TEST	TxDOT Laboratory Test
TIMA	Thermal Insulation Manufacturers Association
TPI	Truss Plate Institute
TxDOT	Texas Department of Transportation
UL	Underwriters Laboratory, Inc.
USDA	U. S. Department of Agriculture
USGBC	U. S. Green Building Council
USPS	U. S. Postal Service
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Wallcovering Manufacturers Association
WIC	Woodwork Institute of California
WLPDIA	Western Lath, Plaster, Drywall Industries Association
WRI	Wire Reinforcement Institute
WSC	Water Systems Council
WSFI	Wood and Synthetic Flooring Institute
WWPA	Western Wood Products Association
W.W.P.A.	Woven Wire Products Association

END

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STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

The Storm Water Pollution Prevention Plan for this project is attached.

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Stormwater Pollution Prevention Plan

For Construction Activities At:

St. Elmo Service Center 8 Renovations Line Improvements
City of Austin Fleet Mobility Services
4411 Meinardus Drive, Service Center #8
Austin, Texas 78744

SWPPP Prepared For:

City of Austin, Fleet Mobility Services Department
1190 Hargrave Street
Austin, Texas 78702
512-974-1540
Gloria.Esparza@austintexas.gov

SWPPP Prepared By:

City of Austin Public Works Department
Andrew Clements, Architect, PWD APMD Project Manager
6800 Burleson Road, Building 312, Suite 200
Austin, Texas 78744
512-974-7152
Andrew.Clements@austintexas.gov

SWPPP Preparation Date:

03/18/2021

Estimated Project Dates:

Project Start Date: August 2021

Project Completion Date: June 2022

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SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information

Instructions:

- In this section, you can gather some basic site information that will be helpful to you later when you file for permit coverage.
- For more information, see *Developing Your Stormwater Pollution Prevention Plan: A SWPPP Guide for Construction Sites* (also known as the *SWPPP Guide*), Chapter 2
- Detailed information on determining your site's latitude and longitude can be found at www.epa.gov/npdes/stormwater/latlong

Project/Site Name: St. Elmo Service Center 8 Renovations

Project Street/Location: 4411 Meinardus Drive, Service Center #8

City: Austin State: Texas ZIP Code: 78744

County: Travis

City of Austin Permit Number (complete when assigned): TBD

City of Austin Case Manager (complete when assigned): TBD

TPDES project or permit tracking number*: TPDES

Latitude/Longitude (Use **one** of three possible formats, and specify method)

Latitude:	Longitude:
1. _ _ º _ _ ' _ _._ _" N (degrees, minutes, seconds)	1._ _º _ _ ' _ _._ _" W(degrees, minutes, seconds)
2. _ _ º _ _ . _ _' N (degrees, minutes, decimal)	2. _ _ º _ _ . _ _' W (degrees, minutes, decimal)
3. 30.209173º N (decimal)	3. -97.751853º W (decimal)

Method for determining latitude/longitude:

☐ USGS topographic map (specify scale:_____) ☐ EPA Web site ☐ GPS ☒ Other (please specify): http://itouchmap.com/latlong.html

Is the project located in Indian country? ☐ Yes ☒ No

If yes, name of Reservation, or if not part of a Reservation, indicate "not applicable." N/A

Is this project considered a federal facility? ☐ Yes ☒ No

TPDES project or permit tracking number*: TXR150000

**(This is the unique identifying number assigned to your project by your permitting authority after you have applied for coverage under the appropriate Texas Pollutant Discharge Elimination System (TPDES) construction general permit.)*

1.2 Contact Information/Responsible Parties

Instructions:

- List the operator(s), project managers, stormwater contact(s), and person or organization that prepared the SWPPP. Indicate respective responsibilities, where appropriate.
- Also, list subcontractors expected to work on-site. Notify subcontractors of stormwater requirements applicable to their work.
- See *SWPPP Guide*, Chapter 2.B.

Owner(s):
CITY OF AUSTIN
FLEET MOBILITY SERVICES
1190 Hargrave Street
Austin, Texas 78702

Operator(s)*: *Not applicable for City of Austin permit

TBD

Project Manager(s) or Site Supervisor(s):

TBD

SWPPP Contact(s):

Martinez Engineering
Al Hajka, P.E.
111 Congress, Suite 457
Austin, Texas 78701
713-530-7810

Certification: Professional Engineer registered with Texas Board of Professional Engineers

This SWPPP was Prepared by:

City of Austin Public Works Department
Andrew Clements, AIA, Project Manager
6800 Burleson Road, Building 312, Suite 200
Austin, Texas 78744
512-974-7152

Certification: Registered Architect registered with Texas Board of Architectural Examiners

Subcontractor(s)*: *Not applicable for City of Austin permit

TBD

Emergency 24-Hour Contact:

TBD

1.3 Soils, Slopes, Vegetation, and Current Drainage Patterns

Instructions:

- Describe the existing soil conditions at the construction site including soil types, slopes and slope lengths, and other topographic features that might affect erosion and sediment control. Use NRCS Soil Survey, USGS, or Bureau of Economic Geology Geologic Maps.
- Delineate and describe the existing topography and drainage patterns, including overland and concentrated flow.
- Delineate and describe the contributing drainage area for flow paths that drain at least 1 acre.
- Note the presence or absence of baseflow and USGS stream type (ephemeral, intermittent, or perennial).
- Describe predominant vegetation.
- Note any historic site contamination evident from existing site features and known past usage of the site.
- This information should also be included on your site maps.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

Soil type(s):

The soils found on this property are Austin-Urban land complex silty-clay soils (UsC), Frio silty-clay loam soils (Fs), and Urban land and Ferris clay and silty-clay soils (UvE).

Slopes:

The existing topography of the site gradually slopes from east to west. The site has a high point elevation of ±509 feet mean sea level (MSL) located along the eastern boundary and a low point elevation of ±490 feet MSL located on the southwest corner. On-site slopes gradually increase to the west and generally range from 2% to 25%.

Drainage Patterns:

The site currently has one major drainage area. The entire site (approximately 0.51 acres) drains to the west directly into Little Walnut Creek. There is no existing detention pond located on the site.

Vegetation:

The site is two distinct surveyed lots, west and east; with the west approximately 6-acres, and the east 38.53 acres. Both tracts of land are located on the south side of Sponberg Drive, between Meinardus Drive and Freidrich Lane in Austin, Texas. The property is the location of the City of Austin Fleet Mobility Services Building #8, a staff and service vehicle parking surrounding Building #8; and an existing fenced asphalt lay-down pole-yard utilized by Austin Energy. The property consists of native grasses, bushes, shrubs, and trees typically associated with the Northern Blackland Prairie, the site's EPA ecoregion.

The site's grasses vary from mowed Hairy Grabgrass, Perrenial rye, Bedsraw, Yaupon, and Ligustrum. The bushes, shrubs and tree overstory is dominated by Ashe Juniper, Hackberry, Green Ash, Crapemyrtle, Cedar Elm, Cottonwood, and Chinaberry.

Other:

1.4 Receiving Waters

Instructions:

- List the waterbody(s) that would receive stormwater from your site, including streams, rivers, lakes, coastal waters, and wetlands. Describe each as clearly as possible, such as *Boggy Creek, a tributary to the Colorado River*, and so on.
- Indicate the location of all waters, including wetlands, on the site map.
- Note any stream crossings, if applicable.
- List the storm sewer system or drainage system that stormwater from your site could discharge to and the waterbody(s) that it ultimately discharges to.
- If any of the waterbodies above are impaired and/or subject to Total Maximum Daily Loads (TMDLs), please list the pollutants causing the impairment and any specific requirements in the TMDL(s) that are applicable to construction sites. Your SWPPP should specifically include measures to prevent the discharge of these pollutants.
- For more information, see City of Austin Environmental Criteria Manual 1.4.
- Also, for more information and a list of TMDL contacts and links by state, visit www.epa.gov/npdes/stormwater/tmdl.

Description of receiving waters:

This site is located within the Williamson Creek Watershed, which is classified by the City of Austin as a suburban watershed. According to the FEMA Flood Insurance Rate Map (FIRM) No. 48453C0470K for Travis County, Texas, dated January 06, 2016, and the City of Austin's FloodPro website, no portion along the site is located in the 100-year and 500-year floodplain.

Description of storm sewer systems:

A single, 48-IN RCP below-grade storm sewer currently exists on the site, and no additional below-grade storm sewers are proposed. Surface runoff of storm water is handled by a catch/spill curb, which conveys water to a trickle channel and detention pond capable to detain the 500-year storm.

Description of impaired waters or waters subject to TMDLs:

None

1.5 Site Features and Sensitive Areas to be protected

Instructions:

- Describe unique site features including streams, stream buffers, heritage or protected trees, natural vegetation, steep slopes, or highly erodible soils that are to be preserved.
- Describe critical environmental features including bluffs, canyon rimrocks, caves, sinkholes, springs, and wetlands.
- Describe measures to protect these features.
- Include these features and areas on your site plans.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

Describe unique features that are to be preserved:

There are no unique features of note that are to be preserved.

1.6 Endangered Species Certification

Instructions:

- Before beginning construction, determine whether endangered or threatened species or their critical habitats are on or near your site.
- Adapt this section as needed for state or tribal endangered species requirements and, if applicable, document any measures deemed necessary to protect endangered or threatened species or their critical habitats.
- For more information on this topic, see *SWPPP Guide*, Chapter 3.B.
- Additional information on Endangered Species Act (ESA) provisions is at www.epa.gov/npdes/stormwater/esa

Are endangered or threatened species and critical habitats on or near the project area?

☐ Yes ☒ No

Describe how this determination was made:

Previous site plan applications

If yes, describe the species and/or critical habitat:

N/A

If yes, describe or refer to documentation that determines the likelihood of an impact on identified species and/or habitat and the steps taken to address that impact. (Note, if species are on or near your project site, EPA strongly recommends that the site operator work closely with the appropriate field office of the U.S. Fish and Wildlife Service or National Marine Fisheries Service. For concerns related to state or tribal listing of species, please contact a state or tribal official.)

N/A

1.7 Maps and Photographs

Instructions:

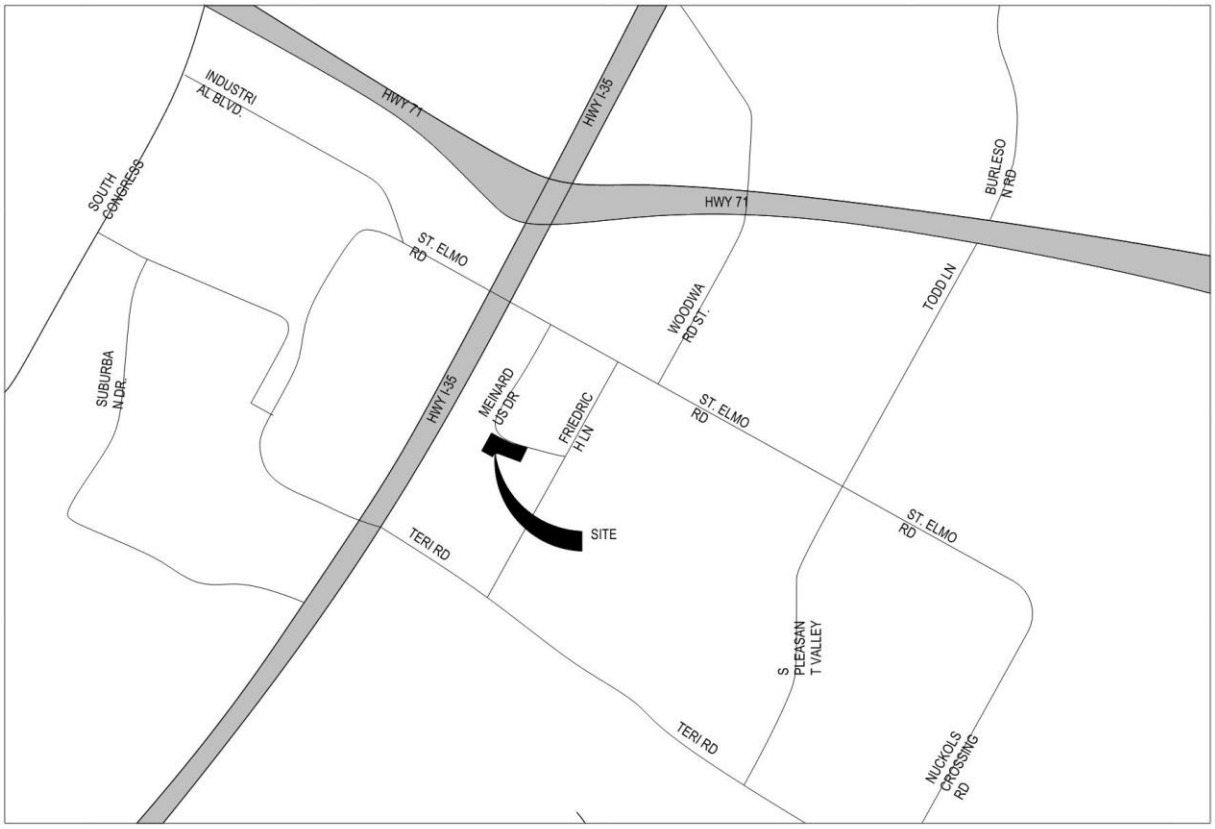
- Site plan sheets submitted to the City of Austin should include the graphics necessary to illustrate, review, and construct the systems outlined in the SWPPP. Specific submittal requirements are explained in the City of Austin Environmental Criteria Manual 1.4 as well as in later sections of this document.
- Attach additional maps and photographs. Include representative photograph of site that shows designer ON-SITE and photographs of predominant vegetation.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

Include the site maps and photographs with the SWPPP.

A site location map has been included.

The erosion and sedimentation control plans are included in the Construction Documents.

PROJECT LOCATION MAP



4411 MEINARDUS DRIVE
ST. ELMO SERVICE CENTER BUILDING #8
AUSTIN, TEXAS 78744

SECTION 2: CONSTRUCTION ACTIVITIES AND SITE MANAGEMENT PRACTICES

2.1 Nature and Sequence of Construction Activity

Instructions:

- Briefly describe the nature of the construction activity and approximate time frames (one or more paragraphs, depending on the nature and complexity of the project).
- For more information, see City of Austin Environmental Criteria Manual 1.4.

Describe the general scope of the work for the project, major phases of construction, etc:

This project will include the construction of a new parking lot consisting of 28 parking spaces, sidewalks, landscaping, lighting, and a detention pond. The parking spaces will be constructed out of permeable pavers that will provide water quality benefits.

Sequence of Construction:

1. Temporary erosion and sedimentation controls are to be installed as indicated on the approved site plan or subdivision construction plan and in accordance with the Stormwater Pollution Prevention Plan (SWPPP) that is required to be posted on the site. Install tree protection and initiate tree mitigation measures.

2. The Environmental Project Manager or Site Supervisor must contact the Watershed Protection Department, Environmental Inspection, at 512-974-2278, 72 hours prior to the scheduled date of the required on-site preconstruction meeting.

3. The Environmental Project Manager, and/or Site Supervisor, and/or Designated Responsible Party, and the General Contractor will follow the Storm Water Pollution Prevention Plan (SWPPP) posted on the site. Temporary erosion and sedimentation controls will be revised, if needed, to comply with City Inspectors' directives, and revised construction schedule relative to the water quality plan requirements and the erosion plan.

4. Rough grade the ponds at 100% proposed capacity. Either the permanent outlet structure or a temporary outlet must be constructed prior to the development of embankment or excavation that leads to ponding conditions. The outlet system must consist of a sump pit outlet and an emergency spillway meeting the requirements of the Drainage Criteria Manual and/or the Environmental Criteria Manual, as required. The outlet system shall be protected from erosion and shall be maintained throughout the course of construction until installation of the permanent water quality pond(s).

5. Temporary erosion and sedimentation controls will be inspected and maintained in accordance with this Storm Water Pollution Prevention Plan (SWPPP).

6. Begin site clearing/construction (or demolition activities).

7. Permeable pavers and gravel layers shall be kept clean of debris and mud throughout construction.

8. Complete construction and start revegetation of the site and installation of landscaping.

9. Upon completion of the site construction and revegetation of a project site, the design engineer shall submit an engineer's letter of concurrence to the Planning and Development Review Department indicating that construction, including revegetation, is complete and in substantial conformity with the approved plans. After receiving this letter, a final inspection will be scheduled by the appropriate City Inspector.

10. Upon completion of landscape installation of a project site, the Landscape Architect shall submit a letter of concurrence to the Planning and Development Review Department indicating that the required landscaping is complete and in substantial conformity with the approved plans. After receiving this letter, a final inspection will be scheduled by the appropriate City Inspector.

11. After a final inspection has been conducted by the City Inspector and with approval from the City Inspector, remove the temporary erosion and sedimentation controls and complete any necessary final revegetation resulting from removal of the controls. Conduct any maintenance and rehabilitation of the water quality ponds or controls.

What is the function of the construction activity?

☐ Residential ☐ Commercial ☐ Industrial ☐ Road Construction ☐ Linear Utility
☒ Other (please specify): City of Austin owned Service Center

Estimated Project Start Date: 08/2021
Estimated Project Completion Date: 05/2022

2.2 Construction Site Estimates

Instructions:

- Estimate the area to be disturbed by excavation, grading, or other construction activities, including dedicated off-site borrow and fill areas.
- Calculate the percentage of impervious surface area before and after construction
- Calculate the runoff coefficients before and after construction.
- Provide calculation of cut/fill volumes per phase, including a demonstration of how spoils will be handled during construction.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

The following are estimates of the construction site.

Total project area:	44.53 acres
Construction site area to be disturbed:	42.48 acres
Limits of construction:	42.48 acres
Percentage impervious area before construction:	67.0%
Runoff coefficient before construction:	100 Year C = 0.48
Percentage impervious area after construction:	82.0%
Runoff coefficient after construction:	100 Year C = 0.66
Cut/Fill Volumes per Phase:	

*Following the full development

Demonstration of how spoils will be handled during construction:

Any spoils will be held in the Spoils and Staging Area as shown on the Erosion and Sedimentation Control Plan and will be properly disposed of by the contractor per City of Austin and TCEQ guidelines.

2.3 Phasing and Construction Sequence Plan

Instructions:

- Provide maps and schedules of disturbances, phasing, and temporary and permanent stabilization.
- For site plan review purposes, construction sequence must show the duration of each activity, as opposed to specific start and end dates. Prior to the start of construction though, the SWPPP must be updated with actual dates of start/finish for each activity outlined in this sequence.
- Provide length of time to install construction phase E&S controls.
- Provide length of time for each identified phase of construction from initial groundbreaking to final grade and any intermediate steps that would require modification of E&S controls (temporary and permanent stormwater ponds, clearing and grubbing, rough grade, final grade, utilities, etc.).
- Identify areas within the limits of construction (LOC) that will require temporary stabilization and the times of installation, modification, and removal. Sequencing of grading, cut and fill activities will be required to show how disturbed and stockpiled sediment is accounted for each time it is transported from initial disturbance to permanent stabilization.
- Identify schedule for permanent stabilization.
- Identify schedule for converting temporary controls to permanent functions (e.g. basins).
- Identify schedule for removal of E&S controls.
- Identify maintenance schedule for Construction Phase BMPs.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

Sequence of Construction:

1. Temporary erosion and sedimentation controls are to be installed as indicated on the approved site plan or subdivision construction plan and in accordance with the Stormwater Pollution Prevention Plan (SWPPP) that is required to be posted on the site. Install tree protection and initiate tree mitigation measures.

2. The Environmental Project Manager or Site Supervisor must contact the Watershed Protection Department, Environmental Inspection, at 512-974-2278, 72 hours prior to the scheduled date of the required on-site preconstruction meeting.

3. The Environmental Project Manager, and/or Site Supervisor, and/or Designated Responsible Party, and the General Contractor will follow the Storm Water Pollution Prevention Plan (SWPPP) posted on the site. Temporary erosion and sedimentation controls will be revised, if needed, to comply with City Inspectors' directives, and revised construction schedule relative to the water quality plan requirements and the erosion plan.

4. Rough grade the ponds at 100% proposed capacity. Either the permanent outlet structure or a temporary outlet must be constructed prior to the development of embankment or excavation that leads to ponding conditions. The outlet system must consist of a sump pit outlet and an emergency spillway meeting the requirements of the Drainage Criteria Manual and/or the Environmental Criteria Manual, as required. The outlet system shall be protected from erosion and shall be maintained throughout the course of construction until installation of the permanent BMPs.

5. Temporary erosion and sedimentation controls will be inspected and maintained in accordance with this Storm Water Pollution Prevention Plan (SWPPP).

6. Begin site clearing/construction (or demolition activities).

7. Permeable pavers and gravel layers shall be kept clean of debris and mud throughout construction

8. Complete construction and start revegetation of the site and installation of landscaping.

9. Upon completion of the site construction and revegetation of a project site, the design engineer shall submit an engineer's letter of concurrence to the Planning and Development Review Department indicating that construction, including revegetation, is complete and in substantial conformity with the approved plans. After receiving this letter, a final inspection will be scheduled by the appropriate City Inspector.

10. Upon completion of landscape installation of a project site, the Landscape Architect shall submit a letter of concurrence to the Planning and Development Review Department indicating that the required landscaping is complete and in substantial conformity with the approved plans. After receiving this letter, a final inspection will be scheduled by the appropriate City Inspector.

11. After a final inspection has been conducted by the City Inspector and with approval from the City Inspector, remove the temporary erosion and sedimentation controls and complete any necessary final revegetation resulting from removal of the controls. Conduct any maintenance and rehabilitation of the water quality ponds or controls.

2.4 Potential Sources of Pollution

Instructions:

- Identify and list all potential sources of sediment, which may reasonably be expected to affect the quality of stormwater discharges from the construction site.
- Identify and list all potential sources of pollution, other than sediment, which may reasonably be expected to affect the quality of stormwater discharges from the construction site.
- Describe pollution controls procedures and devices.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

Potential sources of sediment to stormwater runoff:

See Table below

Potential pollutants and sources, other than sediment, to stormwater runoff:

See Table below

Pollution control procedures and devices:

Install and maintain erosion and sedimentation controls per plans.

Trade Name Material	Stormwater Pollutants	Location
TBD	Concrete Wash	Wash water from concrete trucks will be washed out at designated site
TBD	Concrete Curing Compound	Curing compound will be used as needed and concrete contractor will remove remaining compound from site.
TBD	Excavation Pump-out Water	Excavations may require water to be removed by way of pumping. Pump on vegetated area and direct to stormwater run-off controls.
TBD	Fertilizers	Revegetated areas will require the application of fertilizer. If used, application immediately preceding a rain event will be avoided as practicable, and will not be stored on site for extended periods.
TBD	Petroleum based products	Used by vehicles performing dirt work and construction activities.
TBD	Grease	Used by vehicles performing dirt work and construction activities.

TBD	Oils	Used by vehicles performing dirt work and construction activities.
TBD	Trash	Used by vehicles performing dirt work and construction activities.
TBD	Sanitary Waste	Portable units will be used on-site and emptied regularly.
TBD	Pipe joint lubricant	Used in the construction of utility lines.
TBD	Stains/paints	Interior/exterior finish out.
TBD	Solvents	Interior/exterior finish out.
	Sediment/Total suspended solids	Erosion from area where soil is disturbed due to construction has a high potential of sediment and suspended solids. Erosion and sedimentation control measures are included in this SWPPP.

SECTION 3: GRADING AND EROSION/SEDIMENT CONTROL BMPs

Instructions:

- Describe the BMPs that will be implemented to control pollutants in stormwater discharges. For each major activity identified, do the following
  - ✓ Clearly describe appropriate control measures.
  - ✓ Describe the general sequence during the construction process in which the measures will be implemented.
  - ✓ Describe the maintenance and inspection procedures that will be used for that specific BMP.
  - ✓ Include protocols, thresholds, and schedules for cleaning, repairing, or replacing damaged or failing BMPs.
  - ✓ Identify staff responsible for maintaining BMPs.
  - ✓ (If your SWPPP is shared by multiple operators, indicate the operator responsible for each BMP.)
- Plan sheets submitted to the City of Austin **MUST** show the following:
  - ✓ Direction of flow during grading operations.
  - ✓ Location, description, and calculations for off-site flow diversion structures.
  - ✓ Areas that will not be disturbed; natural features to be preserved.
  - ✓ Delineation of contributing drainage area to each proposed BMP (e.g., silt fence, sediment basin, etc.)
  - ✓ Location and type of E&S BMPs for each phase of disturbance.
  - ✓ Calculations for BMPs as required.
  - ✓ Location and description of temporary stabilization measures.
  - ✓ Location of on-site spoils, description of handling and disposal of borrow materials, and description of on-site permanent spoils disposal areas, including size, depth of fill and revegetation procedures.
- Categorize each BMP under one of the following 10 areas of BMP activity as described below:
  - ***3.1 Minimize disturbed area and protect natural features and soil***
  - ***3.2 Control Stormwater flowing onto and through the project***
  - ***3.3 Stabilize Soils***
  - ***3.4 Protect Slopes***
  - ***3.5 Protect Storm Drain Inlets***
  - ***3.6 Establish Perimeter Controls and Sediment Barriers***
  - ***3.7 Retain Sediment On-Site and Control Dewatering Practices***
  - ***3.8 Establish Stabilized Construction Exits***
  - ***3.9 Any Additional BMPs***
- Note the location of each BMP on your site map(s).
- For any structural BMPs, you should provide design specifications and details and refer to them.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

3.1 Minimize Disturbed Area and Protect Natural Features and Soil

Instructions:

- Describe the areas that will be disturbed with each phase of construction and the methods (e.g., signs, fences) that you will use to protect those areas that should not be disturbed. Describe natural features identified earlier and how each will be protected during construction activity. Also describe how topsoil will be preserved. Include these areas and associated BMPs on your site map(s) also.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

The areas of disturbance are shown on the Erosion and Sedimentation Plans.

Topsoil on-site will be preserved during grading construction by transferring cut areas to fill areas.

Maintenance

Temporary Controls and fences will be inspected and maintained as needed to insure that controls are functioning properly. Typically, maintenance items should be addressed following the identification of a problem during the site inspections and after any rain event. It is the responsibility of the site superintendent to conduct evaluations of controls that will require more frequent attention. Damaged controls will be repaired or replaced within seven (7) days of the inspection report.

Silt accumulation at each control will be removed and properly disposed when the depth of accumulation exceeds six (6) inches.

Permanent seeding and planting will be inspected for bare spots, washouts, and healthy growth.

General Contractor is responsible for the maintenance of erosion and sedimentation controls.

3.2 Control Stormwater Flowing onto and through the Project

Instructions:

- Describe structural practices (e.g., diversions, berms, ditches, storage basins) including design specifications and details used to divert flows from exposed soils, retain or detain flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

BMP Description: Silt Fence	
Installation Schedule:	Prior to site disturbance
Maintenance and Inspection:	Inspect at least once a week and after every rain event
Responsible Staff:	General Contractor

BMP Description: Rock Berm	
Installation Schedule:	Prior to site disturbance
Maintenance and Inspection:	Inspect at least once a week and after every rain event
Responsible Staff:	General Contractor

BMP Description: Mulch Sock	
Installation Schedule:	Prior to site disturbance
Maintenance and Inspection:	Inspect at least once a week and after every rain event
Responsible Staff:	General Contractor

The standard City of Austin Detail is included on the Grading, Drainage and Erosion Control Details Plan Sheet in the Construction Documents.

3.3 Stabilize Soils

Instructions:

- Describe controls (e.g., interim seeding with native vegetation, hydroseeding) to stabilize exposed soils where construction activities have temporarily or permanently ceased. Also describe measures to control dust generation. Avoid using impervious surfaces for stabilization whenever possible.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

BMP Description: Broadcast Seeding	
☒ ***Permanent***	☐ ***Temporary***
Installation Schedule:	No later than 14 days from the last construction activity in area
Maintenance and Inspection:	From September 15 to March 1, seeding shall be with a combination of two (2) pounds per 1,000 square feet of unhulled Bermuda and seven (7) pounds per 1,000 square feet of winter rye with a purity of 95% with 90% germination. From March 2 to September 14, seeding shall be with hulled Bermuda at a rate of two (2) pounds per 1,000 square feet with a purity of 95% with 85% germination. Fertilizer shall be a pelleted or granular slow release with an analysis of 15-15-15 to be applied once at planting and once during the period of establishment at a rate of one (1) pound per 1,000 square feet. Mulch type used shall be hay, straw, or mulch applied at a rate of 45 pounds per 1,000 square feet.
Responsible Staff:	General Contractor

BMP Description: Hydraulic Seeding	
☒ ***Permanent***	☐ ***Temporary***
Installation Schedule:	No later than 14 days from the last construction activity in area
Maintenance and Inspection:	From September 15 to March 1, seeding shall be with a combination of one (1) pound per 1,000 square feet of unhulled Bermuda and seven (7) pounds per 1,000 square feet of winter rye with a purity of 95% and 90% germination. From March 2 to September 14, seeding shall be with hulled Bermuda at a rate of one (1) pound per 1,000 square feet with a purity of 95% with 85% germination. Fertilizer shall be a water-soluble fertilizer with an analysis of 15-15-15 at a rate of 1.5 pounds per 1,000 square feet. Mulch type used shall be hay, straw or mulch applied at a rate of 45 pounds per 1,000 square feet, with soil tackifier at a rate of 1.4 pounds per 1,000 square feet.
Responsible Staff:	General Contractor

3.4 Protect Slopes

Instructions:

- Describe controls (e.g., erosion control blankets, tackifiers, rip rap, biotechnical slope stabilization) including design specifications and details that will be implemented to protect all slopes.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

There are no slopes exceeding three (3) foot horizontal and one (1) foot vertical which would require stabilization.

3.5 Protect Storm Drain Inlets

Instructions:

- Describe controls including design specifications and details that will be implemented to protect all inlets receiving stormwater from the project during the entire project.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

BMP Description: Inlet Protection	
Installation Schedule:	Install after inlets are constructed
Maintenance and Inspection:	Inspect once a week and after every rain event
Responsible Staff:	General Contractor

The standard City of Austin Detail is included on the Grading, Drainage and Erosion Control Details Plan Sheet in the Construction Documents.

3.6 Establish Perimeter Controls and Sediment Barriers

Instructions:

- Describe structural practices (e.g., silt fences or mulch berms) including design specifications and details to filter and trap sediment before it leaves the construction site.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

BMP Description: Silt Fence	
Installation Schedule:	Prior to site disturbance
Maintenance and Inspection:	Inspect at least once a week and after every rain event
Responsible Staff:	General Contractor

The standard City of Austin Detail is included on the Grading, Drainage and Erosion Control Details Plan Sheet in the Construction Documents.

3.7 Retain Sediment On-Site

Instructions:

- Describe sediment control practices (e.g., sediment trap or sediment basin), including design specifications and details (volume, dimensions, outlet structure) that will be implemented at the construction site to retain sediments on-site.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

BMP Description: Silt Fence	
Installation Schedule:	Prior to site disturbance.
Maintenance and Inspection:	Inspect at least once a week and after every rain event.
Responsible Staff:	General Contractor

BMP Description: Rock Berm	
Installation Schedule:	Prior to site disturbance
Maintenance and Inspection:	Inspect at least once a week and after every rain event
Responsible Staff:	General Contractor

BMP Description: Mulch Sock	
Installation Schedule:	Prior to site disturbance
Maintenance and Inspection:	Inspect at least once a week and after every rain event
Responsible Staff:	General Contractor

3.8 Establish Stabilized Construction Exits

Instructions:

- Describe location(s) of vehicle entrance(s) and exit(s), procedures to remove accumulated sediment off-site (e.g., vehicle tracking), and stabilization practices (e.g., stone pads or wash racks or both) to minimize off-site vehicle tracking of sediments and discharges to stormwater.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information, see City of Austin Environmental Criteria Manual 1.4.

BMP Description: Stabilized Construction Entrance	
Installation Schedule:	Prior to site disturbance.
Maintenance and Inspection:	Inspect at least once a week and after every rain event.
Responsible Staff:	General Contractor

The standard City of Austin Detail is included on the Grading, Drainage and Erosion Control Details Plan Sheet in the Construction Documents.

3.9 Additional BMPs

Instructions:

- Describe additional BMPs that do not fit into the above categories.
- Provide any necessary calculations. Computations shall be required for BMPs that rely on detention, sedimentation, filtration, diversion and velocity control.
- For more information or ideas on BMPs, see City of Austin Environmental Criteria Manual 1.4.

All BMP's have been listed.

SECTION 4: GOOD HOUSEKEEPING BMPs

Instructions:

- Describe the key good housekeeping and pollution prevention (P2) BMPs that will be implemented to control pollutants in stormwater.
- Categorize each good housekeeping and pollution prevention (P2) BMP under one of the following seven categories:
  - ***4.1 Material Handling and Waste Management***
  - ***4.2 Establish Proper Building Material Staging Areas***
  - ***4.3 Designate Washout Areas***
  - ***4.4 Establish Proper Equipment/Vehicle Fueling and Maintenance Practices***
  - ***4.5 Allowable Non-Stormwater Discharges and Control Equipment/Vehicle Washing***
  - ***4.6 Spill Prevention and Control Plan***
  - ***4.7 Any Additional BMPs***
- For more information, see *SWPPP Guide*, Chapter 5.
- Consult your state's design manual or resources in Appendix D of the *SWPPP Guide*.
- For more information or ideas on BMPs, see EPA's National Menu of BMPs http://www.epa.gov/npdes/stormwater/menuofbmps

4.1 Material Handling and Waste Management

Instructions:

- Describe measures (e.g., trash disposal, sanitary wastes, recycling, and proper material handling) to prevent the discharge of solid materials to receiving waters, except as authorized by a permit issued under section 404 of the CWA. (For more information, see *SWPPP Guide*, Chapter 5, P2 Principle 1.)
- Also, see EPA's *General Construction Site Waste Management BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/cons_wasteman

Material management practices will be utilized to reduce the risk of spills or other accidental exposure of the materials listed above to stormwater runoff, including the following:

1. An effort will be made to store only enough product required to do the job.
2. All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Products will be kept in their original containers with the original manufacturer's label.
4. Substances will not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product will be used up before disposing of the container.
6. Manufacturers' recommendations for proper use and disposal will be followed.
7. The site superintendent will inspect the site daily to ensure proper use and disposal of materials on-site.

The following practices will be used to reduce the risks associated with hazardous materials, if hazardous materials are needed for the work:

1. Products will be kept in original containers unless they are not resealable.
2. Original labels and material safety data will be retained.
3. If surplus product must be disposed of, manufacturers' or local and state recommended methods for proper disposal will be followed.

4.2 Establish Proper Building Material Staging Areas

Instructions:

— Describe construction materials expected to be stored on-site and procedures for storage of materials to minimize exposure of the materials to stormwater. (For more information, see *SWPPP Guide*, Chapter 5, P2 Principle 2.)

BMP Description: Spoils and Staging Area	
Installation Schedule:	Prior to site disturbance.
Maintenance and Inspection:	Inspect at least once a week and after every rain event.
Responsible Staff:	General Contractor

The Spoils and Staging Area is shown on the Erosion Control Plan Sheet in the civil Construction Documents.

4.3 Designate Washout Areas

Instructions:

- Describe location(s) and controls to eliminate the potential for discharges from washout areas for concrete mixers, paint, stucco, and so on. (For more information, see *SWPPP Guide*, Chapter 5, P2 Principle 3.)
- Also, see EPA's *Concrete Washout BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/concrete_wash

BMP Description: Washout Area	
Installation Schedule:	Prior to any concrete construction.
Maintenance and Inspection:	Inspect once a week.
Responsible Staff:	General Contractor

Note: Concrete washouts are located downstream of stabilized construction entrances. See Erosion and Sedimentation Control Plans for location details.

4.4 Establish Proper Equipment/Vehicle Fueling and Maintenance Practices

Instructions:

- Describe equipment/vehicle fueling and maintenance practices that will be implemented to control pollutants to stormwater (e.g., secondary containment, drip pans, and spill kits). (For more information, see *SWPPP Guide*, Chapter 5, P2 Principle 4.)
- Also, see EPA's *Vehicle Maintenance and Washing Areas BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/vehicile_maintain

Material management practices will be utilized to reduce the risk of spills or other accidental exposure of the materials listed above to stormwater runoff, including the following:

1. An effort will be made to store only enough product required to do the job.
2. All materials stored on-site will be stored in a neat, orderly manner in their appropriate containers and, if possible, under a roof or other enclosure.
3. Products will be kept in their original containers with the original manufacturer's label.
4. Substances will not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product will be used up before disposing of the container.
6. Manufacturers' recommendations for proper use and disposal will be followed.
7. The site superintendent will inspect the site daily to ensure proper use and disposal of materials on-site.

The following practices will be used to reduce the risks associated with hazardous materials, if hazardous materials are needed for the work:

1. Products will be kept in original containers unless they are not resealable.
2. Original labels and material safety data will be retained.
3. If surplus product must be disposed of, manufacturers' or local and state recommended methods for proper disposal will be followed.

4.5 Control Equipment/Vehicle Washing

Instructions:

- Describe equipment/vehicle washing practices that will be implemented to control pollutants to stormwater. (For more information, see *SWPPP Guide*, Chapter 5, P2 Principle 5.)
- Also, see EPA's *Vehicle Maintenance and Washing Areas BMP Fact Sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/vehicile_maintain

BMP Description: Stabilized Construction Entrance	
Installation Schedule:	Prior to site disturbance.
Maintenance and Inspection:	Inspect at least once a week and after every rain event.
Responsible Staff:	General Contractor

The standard City of Austin Detail is included on the Grading, Drainage and Erosion Control Details Plan Sheet in the Construction Documents.

4.6 Spill Prevention and Control Plan

Instructions:

- Describe the spill prevention and control plan to include ways to reduce the chance of spills, stop the source of spills, contain and clean up spills, dispose of materials contaminated by spills, and train personnel responsible for spill prevention and control. (For more information, see *SWPPP Guide*, Chapter 5, P2 Principle 6.)
- Also, see EPA's *Spill Prevention and Control Plan BMP Fact sheet* at www.epa.gov/npdes/stormwater/menuofbmps/construction/spill_control

Spill Prevention Practices

In addition to the good housekeeping and material management practices discussed in the previous sections of this plan, the following practices will be followed for spill prevention and cleanup:

- Manufacturers' recommended methods for spill cleanup will be clearly posted and site personnel will be made aware of the procedures and the location of the information and cleanup supplies.

- Materials and equipment necessary for spill cleanup will be kept in the material storage area on-site. Equipment and materials will include but not be limited to brooms, dustpans, mops, rags, gloves, goggles, kitty litter, sand, sawdust, and plastic and metal trash containers specifically for this purpose.

- All spills will be cleaned up immediately after discovery.

- The spill area will be kept well ventilated and personnel will wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

- The spill prevention plan will be adjusted to include measures to prevent this type of spill from reoccurring and how to clean up the spill if there is another one. A description of the spill, what caused it, and the cleanup measures will also be included.

- The site superintendent is responsible for the day-to-day site operations will be the spill prevention and cleanup coordinator. He will designate at least three other site personnel who will receive spill prevention and cleanup training. These individuals will each become responsible for a particular phase of prevention and cleanup. The names of responsible spill personnel will be posted in the material storage area and in the officer trailer on-site.

4.7 Any Additional BMPs

Instructions:

— Describe any additional BMPs that do not fit into the above categories. Indicate the problem they are intended to address.

All BMP's have been listed.

4.8 Allowable Non-Stormwater Discharge Management

Instructions:

- Identify all allowable sources of non-stormwater discharges that are not identified. The allowable non-stormwater discharges identified might include the following (see your permit for an exact list):
  - ✓ Waters used to wash vehicles where detergents are not used
  - ✓ Water used to control dust
  - ✓ Potable water including uncontaminated water line flushings
  - ✓ Routine external building wash down that does not use detergents
  - ✓ Pavement wash waters where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed) and where detergents are not used
  - ✓ Uncontaminated air conditioning or compressor condensate
  - ✓ Uncontaminated ground water or spring water
  - ✓ Foundation or footing drains where flows are not contaminated with process materials such as solvents
  - ✓ Uncontaminated excavation dewatering
  - ✓ Landscape irrigation
- Identify measures used to eliminate or reduce these discharges and the BMPs used to prevent them from becoming contaminated.
- For more information, see *SWPPP Guide*, Chapter 3.A.

List allowable non-stormwater discharges and the measures used to eliminate or reduce them and to prevent them from becoming contaminated:

1. Discharges from firefighting activities.

2. Fire hydrant flushing.

3. Water used to wash vehicles and pavement where detergents and soap are not used and where spills or leaks of toxic or hazardous materials have not occurred (unless spilled materials have been removed, and if local, state, or federal regulations are applicable, the materials are removed according to those regulations), and where the purpose is to remove mud, dirt, and dust.

4. Water used to control dust.

5. Potable water sources including waterline flushing.

6. Uncontaminated groundwater or spring water, including foundation or footing drains where flows are not contaminated with industrial materials such as solvents.

7. Air conditioning condensate originating from on-site vehicles or the construction trailer, if present.

SECTION 5: SELECTING POST-CONSTRUCTION BMPs

Instructions:

- Describe all post-construction stormwater management measures that will be installed during the construction process to control pollutants in stormwater discharges after construction operations have been completed. Examples of post-construction BMPs include the following:
  - ✓ Sedimentation/Filtration Systems
  - ✓ Wet Ponds
  - ✓ Retention/Irrigation Systems
  - ✓ Vegetative Filter Strips
  - ✓ Biofiltration
  - ✓ Rainwater Harvesting
  - ✓ Rain Garden
- Identify any applicable federal, state, local, or tribal requirements for design or installation.
- Describe how low-impact designs or smart growth considerations have been incorporated into the design.
- For any structural BMPs, you should have design specifications and details and refer to them.
- For more information on this topic, see the City of Austin Environmental Criteria Manual 1.6.

Each constructed pond will have a water quality and detention pond. Each water quality pond will be a retention – re-irrigation system. Per Ordinance No. 20130926-051, the water quality controls will be designed to comply with Section 25-8-213 Subsection D and 25-8-514 (A) of the City of Austin Land Development Code. The water quality volume to be treated is determined based on Table 1-12 of the City of Austin Environmental Criteria Manual (ECM). Two separate areas within the property will be designated as “Re-irrigation Areas” to serve Water Quality Ponds A and B. Re-irrigation area for Pond C is located off-site to the southeast of the property. These re-irrigation areas were sized based on permeability rates provided by Professional Service Industries, Inc. (PSI).

SECTION 6: INSPECTIONS

6.1 Inspections

Instructions:

- Identify the individual(s) responsible for conducting inspections and describe their qualifications (CPESC/CESSWI). Reference or attach the inspection form (see ECM Appendix P-8 for template) that will be used.
- Describe the frequency that inspections will occur at your site including any correlations to storm frequency and intensity.
- Note that inspection details for particular BMPs should be included in Sections 3 and 4.
- You should also document the repairs and maintenance that you undertake as a result of your inspections. These actions can be documented in the corrective action log described in Part 6.3 below.
- For more on this topic, see *SWPPP Guide*, Chapters 6 and 8.

1. **Inspection Personnel*:*** Identify the person(s) who will be responsible for conducting inspections and describe their qualifications:
   General Contractor – TBD

2. **Inspection Schedule and Procedures:**

   Describe the inspection schedules and procedures you have developed for your site (include frequency of inspections for each BMP or group of BMPs, indicate when you will inspect, e.g., before/during/and after rain events, spot inspections):

   Refer to individual BMP inspection schedules previously listed.

   Describe the general procedures for correcting problems when they are identified. Include responsible staff and time frames for making corrections:

   General Contractor is responsible for creating a solution and correcting any issues. Consult engineer of record for any major problems. Correct problems as soon as possible.

   Attach a copy of the inspection report you will use for your site.

   Attached is a copy of the inspection report.

6.2 Delegation of Authority

Instructions:

- Identify the individual(s) or specifically describe the position where the construction site operator has delegated authority for the purposes of signing inspection reports, certifications, or other information.
- Attach the delegation of authority form that will be used.
- For more on this topic, COA ECM section 1.4.

Duly Authorized Representative(s) or Position(s):

General Contractor – TBD

I,_____, am the general contractor and I am CPESC certified and I have the authority to sign inspection reports.

_____

Name Date

6.3 Corrective Action Log

Instructions:

- Create here, or as an attachment, a corrective action log. This log should describe repair, replacement, and maintenance of BMPs undertaken as a result of the inspections and maintenance procedures described above. Actions related to the findings of inspections should reference the specific inspection report.
- This log should describe actions taken, date completed, and note the person that completed the work.
- See Appendix P-9 of the City of Austin Environmental Criteria Manual for a Corrective Action Log.

Corrective Action Log:

Inspection Date	Date Work Completed	Description of Work	Who completed Work

SECTION 7: RECORDKEEPING AND TRAINING

7.1 Recordkeeping

Instructions:

- The following is a list of records you should keep at your project site available for inspectors to review:
- Dates of grading, construction activity, and stabilization (which is covered in Sections 3 and 4)
- A copy of the construction general permit (attach)
- The signed and certified NOI form or permit application form (attach)
- A copy of the letter from EPA or/the state notifying you of their receipt of your complete NOI/application (attach)
- Inspection reports (attach)
- Records relating to endangered species and historic preservation (attach)
- Check your permit for additional details
- For more on this subject, see *SWPPP Guide*, Chapter 6.C.

Records will be retained for a minimum period of at least 3 years after the permit is terminated.

Date(s) when major grading activities occur:

Date(s) when construction activities temporarily or permanently cease on a portion of the site:

Date(s) when an area is either temporarily or permanently stabilized:

7.2 Log of Changes to the SWPPP

Instructions:

- Create a log here, or as an attachment, of changes and updates to the SWPPP. You should include additions of new BMPs, replacement of failed BMPs, significant changes in the activities or their timing on the project, changes in personnel, changes in inspection and maintenance procedures, updates to site maps, and so on.
- See Appendix P-9 of the City of Austin Environmental Criteria Manual for a SWPPP Amendment Log.

Log of changes and updates to the SWPPP

Inspection Date	Date Update Completed	Description of Update	Who completed Update

7.3 Training

Instructions:

- Training your staff and subcontractors is an effective BMP. As with the other steps you take to prevent stormwater problems at your site, you should document the training that you conduct for your staff, for those with specific stormwater responsibilities (e.g. installing, inspecting, and maintaining BMPs), and for subcontractors.
- Include dates, number of attendees, subjects covered, and length of training.
- For more on this subject, see *SWPPP Guide*, Chapter 8.

Individual(s) Responsible for Training:

General Contractor – TBD

Describe Training Conducted:

- General stormwater and BMP awareness training for staff and subcontractors:
- Detailed training for staff and subcontractors with specific stormwater responsibilities:

SECTION 8: PERMANENT STABILIZATION

Instructions:

- Describe procedures for permanent stabilization. If you complete major construction activities on part of your site, you can document your permanent stabilization efforts for that portion of the site. Many permits will allow you to then discontinue inspection activities in these areas (be sure to check your permit for exact requirements). You can amend or add to this section as areas of your project are finally stabilized.
- Additional requirements for permanent stabilization submittals include:
  - ✓ Location and type of permanent stabilization (e.g., vegetation, slope stabilization, sodding, seed/soil retention blanket, Flexible Growth Medium, Bonded Fiber Matrix, or rock rip rap).
  - ✓ Establishment, irrigation, and maintenance plan for permanent vegetation. Revegetation plans for all disturbed areas on the site in accordance with the vegetative practices section of the City of Austin Environmental Criteria Manual. Information provided by the engineer should include any of the following which are applicable:
    - Topsoil requirements (see City of Austin Standard Specification 130, Class C)
    - Seed, sod, and mulch type and rate of application
    - If seed is used to revegetate, include the soil retention blanket, FGM or BFM to be used until establishment.
    - Irrigation schedule for permanent vegetative establishment (see City of Austin Special Specification for 609S)
    - Application technique
    - Maintenance requirements for each specific area
    - Whether vegetation is to be temporary or permanent
    - A clear definition of criteria to be utilized in determining when acceptable revegetation has taken place (minimum requirements are 95 percent coverage with no bare areas exceeding 16 square feet with a 1½ inch stand of grass)
  - ✓ Landscaping installation and natural area restoration requirements may be applicable to certain developments. To find out what regulations may apply, an inquiry should be made to the City of Austin Watershed Protection and Development Review Department.
  - ✓ Specific locations shall be noted where special slope stabilization techniques are to be utilized, and the extent of stabilization to be achieved shall be described.
  - ✓ Location and type of permanent Stormwater management facilities (e.g., detention ponds, water quality ponds, outlet protection/velocity dissipaters) shall be described.
  - ✓ A schematic representation of each control measure for each phase of construction, with adequate specifications for the measure, such as dimensions and length (or size) and references to the City of Austin Standard Specifications, so that the feature can be built and maintained as intended.
  - ✓ For detention/sedimentation control devices, a summary of calculations for runoff from the ten (10) year storm (see section 1.4.2 of the City of Austin Environmental Criteria Manual). Calculations shall include velocity for each of the drainage sub basins to a control in the pre-disturbance, under construction, and permanently stabilized conditions.
- Update your site plans to indicate areas that have achieved permanent stabilization.
- For more on this topic, see City of Austin Environmental Criteria Manual 1.4.

BMP Description: Broadcast Seeding	
☒ ***Permanent***	☐ ***Temporary***
Installation Schedule:	No later than 14 days from the last construction activity in area
Maintenance and Inspection:	From September 15 to March 1, seeding shall be with a combination of two (2) pounds per 1,000 square feet of unhulled Bermuda and seven (7) pounds per 1,000 square feet of winter rye with a purity of 95% with 90% germination. From March 2 to September 14, seeding shall be with hulled Bermuda at a rate of two (2) pounds per 1,000 square feet with a purity of 95% with 85% germination. Fertilizer shall be a pelleted or granular slow release with an analysis of 15-15-15 to be applied once at planting and once during the period of establishment at a rate of one (1) pound per 1,000 square feet. Mulch type used shall be hay, straw, or mulch applied at a rate of 45 pounds per 1,000 square feet.
Responsible Staff:	General Contractor

BMP Description: Hydraulic Seeding	
☒ ***Permanent***	☐ ***Temporary***
Installation Schedule:	No later than 14 days from the last construction activity in area
Maintenance and Inspection:	From September 15 to March 1, seeding shall be with a combination of one (1) pound per 1,000 square feet of unhulled Bermuda and seven (7) pounds per 1,000 square feet of winter rye with a purity of 95% and 90% germination. From March 2 to September 14, seeding shall be with hulled Bermuda at a rate of one (1) pound per 1,000 square feet with a purity of 95% with 85% germination. Fertilizer shall be a water-soluble fertilizer with an analysis of 15-15-15 at a rate of 1.5 pounds per 1,000 square feet. Mulch type used shall be hay, straw or mulch applied at a rate of 45 pounds per 1,000 square feet, with soil tackifier at a rate of 1.4 pounds per 1,000 square feet.
Responsible Staff:	General Contractor

See the Landscape Plans included in the Construction Documents for permanent irrigation, vegetation, and landscaping.

SECTION 9: CERTIFICATION AND NOTIFICATION

Instructions:

— The SWPPP should be signed and certified by the construction operator(s). Attach a copy of the NOI and permit authorization letter received from EPA or the state.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name_____ Title_____

Signature_____ Date_____

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Documents related to this section will include the construction drawings and general provisions of the Contract, including the General Conditions, Section 00700, Supplemental General Conditions, Section 00810, and other Division 1 requirements.

1.2 SUMMARY

A. This section describes the preconstruction conference and other Project related meetings which may be held on a routine schedule throughout the duration of the Project.

B. The CONTRACTOR, or his authorized representative(s), shall attend all Project related meetings as indicated herein. The CONTRACTOR's representatives, as a minimum, shall include his Project Manager and Superintendent. Other CONTRACTOR's representatives may attend Project related meetings; however, there shall be a maximum of four (4) CONTRACTOR's representatives at any one meeting unless the ENGINEER/ARCHITECT approves a larger number.

C. The CONTRACTOR shall provide all pertinent reports, copies of reports, etc., for each meeting as may be required by this or other sections of the Contract.

1.3 PRECONSTRUCTION CONFERENCE

A. Attendees - A preconstruction conference shall be held as soon after the award and execution of the Contract as possible and before any Work at the site is started. The conference will be held at a location selected by the Owner's Project Manager. The Owner's Project Manager shall prepare and distribute the meeting agenda, preside over the conference, and may distribute meeting minutes. The conference shall be attended by:

1. CONTRACTOR's Project Manager.
2. CONTRACTOR's Superintendent.
3. Any Subcontractors' and/or Suppliers' representatives whom the CONTRACTOR may desire to invite or whom the ENGINEER/ARCHITECT or OWNER may request to attend.
4. ENGINEER/ARCHITECT's representative.
5. OWNER's Project Manager.
6. OWNER's REPRESENTATIVE
7. OWNER's Sponsor Department Representative.
8. Representative from the City of Austin, Transportation Department if a traffic management plan is required.
9. Representative from the City of Austin, Watershed Protection and Development Review Department, Environmental Inspection Division, if site erosion / sedimentation controls are required.

10. Representative from the City of Austin, Transportation Department if utility coordination has occurred through the Austin Utility Location and Coordination Committee.
11. Representative from the City of Austin, Contract Management Department, Contract Administration Division, to discuss wage.
12. Representative from the City of Austin, Small and Minority Business Resources Department to discuss M/WBE compliance.

B. Meeting topics - The topics to be discussed may include, but will not be limited to, the following items:

1. Introduction of persons attending the meeting.
2. General project description, including length of contract and liquidated damages.
3. Key personnel associated with the construction (may include, but is not limited to the following):
   - CONTRACTOR's Project Manager
   - CONTRACTOR's Superintendent
   - OWNER's Project Manager
   - ENGINEER/ARCHITECT's representative
   - OWNER's Sponsor Department Representative.
   - Representatives of the various utilities.
4. Lines of communication and chains of command.
5. Wage and personnel records and reporting requirements.
6. Subcontractors and suppliers.
7. Submittal review and approval procedure. Submittals may include, but are not limited to the following:
   - Letter stating the name and qualifications of the CONTRACTOR's Superintendent
   - Letter(s) from the Subcontractor(s) listing their salaried specialists
   - If applicable, a letter designating the Registered Professional Land Surveyor
   - If applicable, a letter designating the Safety Representative (for general project safety) and the "Competent Person" for excavation safety
   - Excavation Safety Systems Plan
   - Schedule of Values
   - Schedule for submittals
   - Shop drawings
   - Construction schedule (The schedule shall indicate the phases of work in which subcontractors will be participating. Subcontractors shall be indicated by name.)
   - Payroll reports
   - Substitution of subcontractors
   - Non-use of asbestos materials affidavit
   - Appropriate safety training certificates for workers that will initially be on site

- Documentation for all workers initially on site who are governed by a prevailing wage classification as described in Section 00830.
- Construction Equipment Emissions Reduction Plan

8. Job and traffic safety.
9. Permits.
10. Utility coordination report.
11. Notification of property owners and other affected by the project
12. Job meetings.
13. Use of the site for construction, storage, staging, etc., and interrelationship with other contracts.
14. Equal opportunity requirements.
15. Laboratory testing of material requirements.
16. Inventory of materials stored on site provisions.
17. Progress estimate and payment procedure.
18. Posting of signs.
19. Project safety.
20. Prompt payment procedure.
21. Review of contract - addenda, supplementary general conditions, special provisions, special specifications, and other unique project items.
22. Other

1.4 JOB MEETINGS

A. General

Job meetings shall be held as deemed necessary by the ENGINEER/ARCHITECT or OWNER or as requested by the CONTRACTOR throughout the duration of the Project. The meetings shall be held at a location selected by or approved by the Owner's Representative. The CONTRACTOR shall preside over the meeting and issue meeting minutes.

B. Attendees

Job meetings will be attended by the following:

1. CONTRACTOR's Project Manager, when requested to attend.
2. CONTRACTOR's Construction Superintendent.
3. Any subcontractors' and/or suppliers' representatives whom the CONTRACTOR may desire to invite or whom the ENGINEER/ARCHITECT or OWNER requests to attend.
4. OWNER's REPRESENTATIVE
5. ENGINEER/ARCHITECT's representative(s), if needed or required.
6. OWNER's PROJECT MANAGER, if needed or required
7. OWNER's Sponsor Department representative(s), if needed or required.

C. Meeting topics

The topics will include, but not necessarily be limited to, the following subjects:

1. Review of previous meetings' notes and update of pertinent information and Project status.
2. Identification and discussion of new job related construction problems. Such discussion will be toward resolving identified problems.
3. Review work accomplished to date and establish proposed construction activities for the upcoming week(s).
4. Discuss the status of or need for change orders.
5. Check of required bonds and insurance certificates (including Workers' Compensation Insurance verification for CONTRACTOR's, Subcontractor's, and Sub-Subcontractor's employees as stated in Section 00700, General Conditions, 5.2 Workers' Compensation).
6. Status of pay requests.
7. Work in progress.
8. Review and update construction schedule.
9. Review of submittals schedule and status of submittals.
10. Status of SMBR Compliance Plan.
11. Status of Safety Training certificates for all new workers on project.
12. Other.

1.5 OTHER MEETINGS

Other meetings shall be held from time to time as may be requested by the CONTRACTOR, the ENGINEER/ARCHITECT, or the OWNER. The time and place of the meetings shall be as mutually agreed upon. The attendance at the meetings shall be as requested by the party requesting the meeting.

END

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

The Contractor prepares submittals. Drawings and general provisions of Contract, including Section 00700, "General Conditions"; Section 00810, "Supplemental General Conditions"; Division 1 requirements and City of Austin Technical Specifications and Special Provisions thereto, should be used as the related documents for this requirement.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Security plan.
2. Contractor's construction schedule.
3. Submittal schedule.
4. Shop drawings.
5. Product data.
6. Samples.
7. Quality assurance and quality control submittals, including calculations, mix designs and substantiating test results.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.
2. Applications for Payment.
3. Performance and Payment bonds.
4. Insurance certificates.
5. Monthly Subcontractors expense report.
6. Non-use of asbestos affidavits

C. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 00700, "General Conditions"; Section 00810, "Supplemental General Conditions"; specifies requirements for submittal of the Schedule of Values.

2. Division 1, Section 01200, "Project Meetings" specifies requirements for submittal and distribution of meeting and conference minutes.

3. Section 00700, "General Conditions"; Section 00810, "Supplemental General Conditions"; specifies requirements for submittal of Project Record Documents and warranties at project close-out.

4. Section 00700, "General Conditions" Article 6.2.4 specifies requirements for Substitutes and "Approved Equal" Items.

D. Technical Submittals: Technical information required to be submitted by the Standard Specifications, Special Provisions or Special Specifications.

PART 2 - PRODUCTS - not used

PART 3 - EXECUTION

3.1 SUBMITTAL PROCEDURES

Contractor shall be responsible for the following:

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

   2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals or resubmittals concurrently.

      a. The E/A reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

   3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.

      a. Allow fourteen (14) calendar days for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.

      b. If an intermediate submittal is necessary, process the same as the initial submittal.

      c. Allow fourteen (14) calendar days for processing each resubmittal.

      d. No extension of Contract Time will be authorized because of failure to transmit submittals to the E/A sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

   1. Provide a space approximately 4 inches by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

   2. Include the following information on the label for processing and recording action taken.

      a. Project name.
      b. Date.
      c. Name and address of the Contractor’s Engineer.
      d. Name and address of the Contractor.
      e. Name and address of the subcontractor.
      f. Name and address of the supplier.
      g. Name of the manufacturer.
      h. Number and title of appropriate Specification Section.
      i. Drawing number and detail references, as appropriate.

C. Number of Copies:

   1. Two (2) copies of the proposed Construction schedule and subsequent revision are required.

   2. Two (2) copies of the proposed Submittal schedule and subsequent revision are required.

   3. Nine (9) copies of Shop Drawings, Product, Product Samples, Quality Assurance and Quality Control submittals are required.

D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the E/A through the Owner’s

Representative using a transmittal form (An example Transmittal Form is provided at the end of this section). The E/A will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

2. Number transmittals in sequence for each Series of the Specifications thus: x-xxx. The number after the dash indicates the Section of the Specifications, and the number before the dash is the sequence number of the transmittal. For example, the first item submitted related to Specification Item No. 506, "Manholes" would be labeled **1-506**, the second item submitted would be labeled **2-506**, etc. If the submittal item relates to a Special Provision or Special Specification, use **SP506** or **SS5061**, for example, to indicate the applicable Specification Section. Identify resubmittals with a letter of the alphabet following the original sequence number, using "A" for the first resubmittal, "B" for the second resubmittal, etc. For example, the first resubmittal of the second item submitted for Specification SP506 would be labeled **2A-SP506**.

3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Construction Schedule: As described in Section 2.4.2 of Section 00700 "General Conditions", prepare a fully developed Contractor's construction schedule ("Baseline Schedule") using Microsoft Project© software unless otherwise approved by Owner's Representative. Submit Baseline Schedule prior to or at the preconstruction conference, and submit updated schedules as specified by the E/A, usually at each regularly scheduled Project Meeting and with each pay application.

1. Detail each significant construction activity and use a weekly timeframe for the schedule. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."

2. With each update, revise task completion percentage and mark completed tasks.

3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the critical path items and the sequences necessary for completion of related portions of the Work.

5. Indicate the phases of work in which subcontractors will be participating. Subcontractors shall be indicated by name.

6. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.

7. Indicate substantial completion in advance of the date established for Final Completion to allow time for the E/A's procedures necessary for certification of Substantial and Final Completion.

B. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Distribution: Following response to the Baseline Schedule submittal, distribute electronic copies to the E/A, subcontractors, suppliers, and other parties required to comply with scheduled dates. Keep a copy at the Project Site at all times.

E. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made and as requested by the E/A. Issue the updated schedule concurrently with the report of each meeting, or as requested by the E/A.

3.3 SUBMITTAL SCHEDULE

A. Concurrently with the development of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the initial Submittal Schedule along with the Construction Schedule, at, or prior to, the Pre-construction Conference.

1. Coordinate Submittal Schedule with the list of subcontractors, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule.

2. Prepare the schedule in chronological order. Provide the following information:

   a. Scheduled date for the first submittal.
   b. Related Section number or Specification number.
   c. Submittal category (Shop Drawings, Product Data, Calculations, Test Results, or Samples).
   d. Name of the subcontractor.
   e. Description of the part of the Work covered.
   f. Scheduled date for resubmittal.
   g. Scheduled date for completion of the E/A's review.

B. Contractor’s schedule of submittals will be reviewed to verify that the list of submittals provided is all inclusive and the schedule is reasonable and realistic for delivery of the project. Owner will provide a response to the Contractor based on the assessment of the schedule of submittals.

C. Distribution: Upon Owner’s agreement with the schedule of submittals, print and distribute copies to the Owner’s Representative, E/A, Owner, subcontractors, suppliers, and other parties required to comply with submittal dates indicated. Keep copies at the Project Site at all times.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

D. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting, or as requested by the E/A.

3.4 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, circle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions;
2. Identification of products and materials included by sheet and detail number;
3. Compliance with specified standards;
4. Notation of coordination requirements; and
5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 inches by 11 inches but no larger than 24 inches by 36 inches.
7. Do not use Shop Drawings without an appropriate stamp indicating action taken.

3.6 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, applicable certifications and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:

   a. Manufacturer's printed recommendations;
   b. Compliance with trade association standards;
   c. Compliance with recognized testing agency standards;
   d. Application of testing agency labels and seals;
   e. Notation of dimensions verified by field measurement; and
   f. Notation of coordination requirements.

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

   a. Do not proceed with installation until a copy of the final submission of Product Data is in the Installer's possession.

   b. Do not permit use of unmarked copies of Product Data in connection with construction.

3.7 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished when specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.

1. Mount or display Samples in the manner to facilitate review of qualities indicated. Include the following:

   a. Specification Section number and reference;
   b. Generic description of the Sample;
   c. Sample source;
   d. Product name or name of the manufacturer;
   e. Compliance with recognized standards; and
   f. Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

   a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.

   b. Refer to other Specification Sections for requirements of Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

   c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

3. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

   a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

   b. Sample sets may be used by Owner for final acceptance of the construction associated with each set.

B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

3.8 QUALITY ASSURANCE AND QUALITY CONTROL SUBMITTALS

A. Submit quality assurance and quality control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, materials test results, field testing and inspection reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a certification from the manufacturer or responsible Engineer certifying compliance with specified requirements.

   1. Signature: Certification shall be signed by an officer of the corporation or other individual authorized to sign documents on behalf of the company.

C. Calculations: When required in the technical specification, calculations shall be prepared and stamped by a Professional Engineer registered in the State of Texas.

D. Concrete, Controlled Low Strength Material, Asphalt Stabilized Base and Hot Mix Asphaltic Concrete Mix Designs and Substantiating Test Data: Requirements for submittal of mix designs and substantiating test data are specified in the applicable Technical Specification Section. Each separate batch plant supplying ASB, HMAC and/or concrete shall submit mix designs to the Owner’s Representative for review.

3.9 ENGINEER/ARCHITECT'S ACTION

A. Except for submittals, for the record, or for information where action and return is not required, the E/A will review each submittal, mark to indicate action taken, and return within the time frame specified in Paragraph 3.1.A.3.

   1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The E/A will stamp each submittal with a uniform, action stamp. The E/A will mark the stamp appropriately to indicate the action taken, as follows:

   1. “Reviewed”: the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.

   2. "Reviewed with Comments”: the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

   3. "Revise and Resubmit” or “Rejected": do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations and resubmit without delay. Repeat if necessary to obtain different action mark.

a. Do not use, or allow others to use, submittals marked "Revise and Resubmit" or "Rejected" at the Project Site or elsewhere where Work is in progress.

4. Other Action: Where a submittal is for information, or for record purposes, or for special processing, or for other activity, the E/A will return the submittal marked "Record Copy", "Action Not Required" or "No Action Taken."

C. Unsolicited Submittals: The E/A will return unsolicited submittals to the sender without action.

3.10 PREPARATION AND SUBMITTAL OF CONSTRUCTION RECORD DRAWINGS

The Owner's Representative and the Contractor's Superintendent will each maintain a set of bluelines noting any changes in ink during construction of the Project. The Owner's Representative and the Contractor's Superintendent will compare bluelines at least weekly (at a time mutually acceptable to both) to exchange information and compare notes to ensure all items installed and changes are documented. The following is a recommended minimum of items to be noted:

GENERAL

1. Notes should be sufficiently clear to allow a draftsperson to easily make the necessary changes without the need for field checks and interpretation.
2. One complete set of Construction Record bluelines will be submitted prior to the final pay request and forwarded to the Owner.

STREET RECONSTRUCTION AND OVERLAY PROJECTS

1. Location, type, and quantity of all work added or deleted from the Project including repair areas, milled areas, sidewalk, ramps, curb and gutter, etc.
2. Deviations in street, sidewalk, curb and gutter location and grades from Drawings.

The above list is not intended to be complete. Any information noted which could be used for future maintenance, location and construction projects is encouraged to be noted on the bluelines.

3.11 CONSTRUCTION DIARIES

The Contractor shall prepare a daily construction diary recording as a minimum the following information concerning events at the site and submit duplicate copies to the Owner's Representative at weekly intervals. The copies are to be signed by the project Superintendent as defined in Section 00700, Article 6.1.2.

1. Work performed;
2. Approximate count of Contractor's personnel, by classification, on the site;
3. List by classification, of all Subcontractors, personnel and any professionals on the site that day;
4. List of all equipment on the site by make and model;
5. High and low temperatures together with general weather conditions;
6. Start time and finish time of day's work;
7. Accidents and / or unusual events;
8. Meetings and significant decisions made;
9. Stoppages, delays, shortages and / or losses;
10. Meter readings and / or similar recordings;
11. Emergencies procedures that may have been needed;
12. Orders and requests of governing authorities;
13. Change Orders received and implemented;
14. Services connected and / or disconnected;
15. Installed equipment and / or system tests and / or startups and results;
16. Partial completions and / or occupancies; and
17. Date of substantial completion certified.

END

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CONSTRUCTION EQUIPMENT EMISSIONS REDUCTION PLAN
Section 01353

1. GENERAL

1.1. RELATED DOCUMENTS

A. This Section applies to Drawings and all provisions of Contract.

1.2. SUMMARY – CONSTRUCTION EQUIPMENT EMISSIONS PLAN

A. The OWNER, as part of the Council Resolution No. 20100211-019, has decided to take steps to reduce emissions associated with construction process including Nitrogen Oxides (NOx), particulate matter and greenhouse gas. Construction activity is a source of large quantities of particulate matter and ozone forming Nitrogen Oxides that adversely affect the health of our community and the natural environment.

B. The CONTRACTOR shall employ practices and take actions that reduce emissions from NOx, particulate matter (black soot) and greenhouse gases resulting from activities associated with new construction and demolition Projects.

C. The CONTRACTOR shall maximize the use of equipment and vehicles with advanced emission controls in support of the City's goals, utilizing equipment that meets defined EPA emissions standards.

1.3. DEFINITIONS

A. "Construction Equipment" means equipment powered by an internal combustion engine and used for performing or otherwise advancing the Work on the Project, other than motor vehicles intended for use on public highways and registered pursuant to Section 502.002 of the Texas Transportation Code.

B. The list of applicable Construction Equipment includes, but is not limited to excavators, backhoes, loaders, bulldozers, graders, rock saws, generators, and other similar equipment.

C. "EPA" means the United States Environmental Protection Agency.

D. "Low-Use Equipment" means any piece of construction equipment which is used for less than ten (10) hours per week on site for a single construction contract.

E. "Greenhouse Gases" are emissions that absorb and emit radiation within the atmosphere. Greenhouse Gases can be one or a combination of, these gases: carbon dioxide, methane, nitrous oxide and three groups of fluorinated gases (sulfur hexafluoride, hydro fluorocarbons, and perfluorocarbons)

1.4. REQUIREMENTS – Not Used

1.5. SUBMITTALS

A. CONSTRUCTION EQUIPMENT EMISSIONS REDUCTION PLAN:

1. The CONTRACTOR agrees to prepare a draft Emissions Reduction Plan (referred to as PLAN) prior to start of construction. This PLAN shall include an inventory report containing identifying data for each piece of equipment to be used on the worksite and shall include the following:

- Vehicle/Equipment: Make & Model Year
- Vehicle/Equipment: Engine Make & Model Year
- Vehicle/Equipment: Fuel Type
- Vehicle/Equipment: Expected gallons or hours used for project duration

a) The OWNER will provide Emissions Reduction Toolkit to help the CONTRACTOR in preparation of the PLAN and inventory.

2. The CONTRACTOR shall develop a list of strategies to be used in this Project in order to reduce emissions from NOx, particulate matter and greenhouse gas (CO_2 equivalent). Once prepared, the agreed upon strategies shall be incorporated into the PLAN. The PLAN will then be signed by the CONTRACTOR and made ready for implementation. Implementation progress will be reviewed once a month in regularly scheduled project progress meetings. The PLAN may be modified during construction if changes are made to the Project, but adjustments shall be approved by the OWNER prior to implementation.

3. This PLAN may be used by the Owner's Representative or Inspector to conduct site inspections and/or verify compliance with specification elements.

4. If additional equipment is brought on-site after construction begins, the Contractor shall provide this same inventory information to the Owner's Representative for the new equipment on or before the day it begins work on-site. All additional equipment shall conform to the PLAN.

5. Reports shall be provided for all equipment used on-site.

B. EQUIPMENT EMISSIONS CLOSEOUT DOCUMENTATION:

1. Submit the following prior to final payment:

a) Record of changes made to the original PLAN and reasons.

b) Provide a summary and documentation of strategies used and estimated reductions in fuel & emissions.

c) Provide documentation of amount and % of alternative fuel used.

2. PRODUCTS - Not used

3. EXECUTION

3.1. GENERAL

A. Implement the submitted PLAN. Provide personnel, documentation, equipment, signage, transportation, and other items as required to implement the PLAN during the entire duration of the Contract.

3.2. EQUIPMENT EMISSIONS PLAN IMPLEMENTATION

A. Plan Coordinator (Could be same as superintendent): Designate an on-site person responsible for instructing workers on the Owner's intent to reduce emissions, overseeing implementation and documenting results of the PLAN for the Project.

B. Plan Review: Review the PLAN in monthly progress meeting and include comments in the meeting notes.

C. Instruction: Provide on-site instructions to all subcontractors of emissions reduction methods to be used by all parties for the appropriate activities of the Project.

D. Discuss Owner's goals and requirements at the following meetings:

1. Pre-bid conference.
2. Pre-construction conference.
3. Progress meetings (monthly).

3.3 EQUIPMENT EMISSIONS REDUCTION TOOLKIT

A. Equipment Emissions Reduction Toolkit available at:

1. Website: (http://austintexas.gov/department/capital-improvement-program)
2. City of Austin Public Works Department, Project Management Division, One Texas Center, Suite 900
3. Construction Job Site Office (after contract award)

B. Equipment Emissions Reduction Toolkit consists of:

1. A list of Construction Equipment Emissions Reduction Strategies
2. EPA fuel savings calculator by idling reductions
3. Posting of Anti-idling signs
4. Memorandum of Agreement by Local Area Governments
5. Equipment Inventory Form

3.4 A LIST OF EQUIPMENT EMISSIONS REDUCTION STRATEGIES

The following are suggested emissions reduction strategies and references. As per the specification section 01353, 1.5 Submittals, the CONTRACTOR shall develop a list of strategies to be used in this Project at the start of construction.

C-1 Anti-Idling Strategies:

1. Implement and enforce anti-idling practices for all equipment and vehicles on and adjacent to the site and associated with the project. City will provide a construction site sign and stickers for vehicles and equipment. Add Hyperlink to COA Idling flyer location TBD

   Also refer to:

   https://www.nctcog.org/trans/quality/air/for-everyone/engine-off-north-texas

   Another potential resource for the COA website on emission specifications:
   https://www.tceq.texas.gov/airquality/mobilesource/vehicleidling.html

2. Limit all idling of project associated vehicles and equipment operations to five (5) minutes unless the idling is applicable to one or more of the following exceptions:
   a) Idling is being used for emergency response purposes;
   b) Idling is necessary for component of mechanical operation, maintenance, or diagnostic purposes; or
   c) Idling is for the health or safety of the equipment operator.

3. Provide education to all staff, vendors and subcontractors about emissions hazards and anti-idling practices and encourage use of EPA calculator for fuel savings.

4. To the extent possible, do not stop or idle haulage trucks directly under tree limbs and foliage overhanging the street along the haul route. Further avoid such damage from truck exhaust by means of exhaust diversion devices to redirect or diffuse exhaust from being directed in a concentrated manner to tree limbs and foliage.

5. Avoid vehicle loitering or queuing outside or inside the gates of the work area to minimize degradation of localized air quality.

   (http://austintexas.gov/airquality/)

C-2 Alternative Fuels:

6. Utilize **alternative fuels** including, Texas LED Compliant B20 (or higher) biodiesel, Compressed Natural Gas (CNG), propane and electric. (Refer to EPA Energy Policy Act for full list).
7. Avoid unnecessary fuel use by providing on-site fuelling for alternate fuels.

   (http://www.tceq.texas.gov/airquality/mobilesource/txled/cleandiesel.html)

   (http://www.eere.energy.gov/cleancities)

   (http://lonestarcfa.org)

C-3 Vehicle/Equipment Improvements:

8. It is recommended that CONTRACTOR takes advantage of the **Texas Emission Reduction Plan (TERP)** grant incentives to upgrade (replace or repower) vehicles with retrofitted emission reduction technologies. (http://www.tceq.texas.gov/airquality/terp/index.html) or (www.terpgrants.com)

9. Utilize **battery powered and/or solar powered equipment** where available. This strategy can be combined with anti-idling strategies by using this technology for sign boards. (evtransportal.org/dieselengineidlereduction.pdf)

10. Consider using voluntary and mandatory sections of the City of Chicago Clean Diesel Program related to https://www.chicago.gov/city/en/progs/env/clean-diesel.htmlfile:///C:/Users/user/Documents/Downloads/O2011-1418.pdf

11. Consider an air quality training section administered by a governmental entity to help comply with an updatedCOA Construction Equipment Emission Reduction Plan by using the California Air Resources Board (CARB) training section in the link below: https://ww2.arb.ca.gov/our-work/topics/construction-earthmoving-equipment

C-4 Maintenance Program:

1. Establish a preventative **maintenance program** addressing issues including but not limited to, fuel use, air emissions, tire pressure, smoke from exhaust and noise.
2. Make all efforts to **prevent oil/fuel spillage** on to site surfaces.

C-5 Resource Management:

3. Utilize equipment companies that are located closest to the construction site.

4. Store equipment on site during construction use or arrange for closest overnight storage including **temporary use of the Right of Way** if possible.

5. To the extent possible, CONTRACTOR shall maximize use of **local and regional materials** to reduce transportation emissions.

6. CONTRACTOR shall maximize **salvage and reuse** of appropriate on-site materials. (http://www.usgbc.org/ShowFile.aspx?DocumentID=1095)

7. To the greatest extent possible, stage equipment and vehicles away from, and minimize operation near, sensitive receptors including, but not limited to, operable windows, fresh air intakes, hospitals, schools, licensed day care facilities, residences and areas where people congregate.

END

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PART 1 - GENERAL

1.1 Related Documents:

Drawings and general provisions of Contract, including General Conditions, Section 00700,and Supplemental General Conditions, Section 00810, and Division 1 requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 Office at the Work Site

During the performance of this Contract, CONTRACTOR shall maintain a suitable office at or near the site of the Work which shall be the headquarters of his superintendent, in existing space provided for that purpose by OWNER. Any communication given to the superintendent or delivered to CONTRACTOR's office at the site of the Work in his absence shall be deemed to have been delivered to CONTRACTOR.

The Contractor may coodinate wih the Owner and facility manager to find a location inside the building that may be used as a temporary construction office.

3.2 Water for Construction

All water required for and in connection with the Work to be performed shall be furnished by and at the expense of the OWNER by existing delivery means at the site of the Work. CONTRACTOR to verify with OWNER acceptable access points, and acceptable usage times.

3.3 Electrical Power for Construction

All electrical power required for and in connection with the Work to be performed shall be furnished by and at the expense of the OWNER by existing delivery means at the site of the Work. CONTRACTOR to verify with OWNER acceptable access points, and acceptable usage times.

3.4 Telephone Service

CONTRACTOR shall make all necessary arrangements for telephone service in his offices at the site and shall provide all telephone instruments.

3.4 Sanitary Facilities

CONTRACTOR shall furnish temporary sanitary facilities at the site, as provided herein, for the needs of all construction workers and others performing Work or furnishing services on the Project.

Sanitary facilities shall be of reasonable capacity, properly maintained throughout the construction period, and obscured from public view to the greatest practical extent. If toilets of the chemically treated type are used, at least one toilet shall be furnished for each 20 employees. CONTRACTOR shall enforce the use of such sanitary facilities by all personnel at the site.

3.5 Protection of Public and Private Property

CONTRACTOR shall protect, shore, brace, support and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by the CONTRACTOR’s operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement/right-of-way. All replacements shall be made with new materials.

CONTRACTOR shall be responsible for all damage to streets, roads, curbs, sidewalks, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private

property, which may be caused by transporting equipment, materials, or men to or from the Work, whether by him or his Subcontractors. CONTRACTOR shall make satisfactory and acceptable arrangements with the owner of, or the agency having jurisdiction over, the damaged property concerning its repair or replacement or payment of costs incurred in connection with the damage.

All fire hydrants and water control valves shall be kept free from obstruction and available for use at all times.

3.6 Tree and Plant Protection

All trees and other vegetation which must be removed to perform the Work shall be removed and disposed of by the CONTRACTOR; however, no trees or cultured plants shall be unnecessarily removed unless their removal is indicated on the Drawings. All trees and plants not removed shall be protected against injury from construction operations.

No tree shall be removed outside of permanent easement(s), except where authorized by the E/A. Whenever practicable, CONTRACTOR shall tunnel beneath trees in yards and parking lots when on or near the line of trenching operations. Hand excavations shall be employed as necessary to prevent injury to trees. Care shall be taken with exposed roots, unearthed during construction, so that roots do not dehydrate causing tree damage.

Trees considered by the E/A to have any significant effect on construction operations are indicated on the Drawings and those which are to be preserved are so indicated.

CONTRACTOR shall take extra measures to protect trees designated to be preserved, using methods shown on the Drawings and as specified in Standard Specification Item No. 610S "Preservation of Trees and other Vegetation".

3.7 Security

CONTRACTOR shall be responsible for protection of the site, and all Work, materials, equipment, and existing facilities hereon, against vandals and other unauthorized persons.

No claim shall be made against OWNER by reason of any act of an employee or trespasser, and CONTRACTOR shall make good all damage to the OWNER's property resulting from CONTRACTOR's failure to provide security measures as specified.

Security measures shall be at least equal to those usually provided by OWNER to protect existing facilities during normal operations, and shall also include such additional security fencing, barricades, lighting, and other measures as required to protect the site. When required, the CONTRACTOR shall provide a security plan to the OWNER for review as to appropriateness of the security measures proposed.

3.8 Parking

CONTRACTOR and subcontractors shall be permitted to use the existing on-site parking facilities. Contractor shall coordinate with Owner and facility manager to determine the most appropriate location for work related parking.

3.9 Dust Control

Dust Control during construction of this Project shall conform to Standard Specifications Item No. 220S, "Sprinkling for Dust Control". No direct payment will be made for dust control. Dust Control shall be considered subsidiary work relating to various Bid items of the Contract.

3.10 Temporary Drainage Provisions

CONTRACTOR shall be responsible for providing for the drainage of stormwater and such water as may be applied or discharged on the site in performance of the Work. CONTRACTOR shall obtain E/A approval for temporary drainage facilities which will handle, carry through, or divert around his Work all drainage flow, including storm flow and flows created by construction activity, to prevent silting of waterways or flooding damage to the property and adjacent property.

3.11 Erosion Control

CONTRACTOR shall prevent erosion of soil on the site and adjacent property resulting from his construction activities. Effective measures shall be initiated prior to the commencement of clearing, grading, excavation, or other operations which will disturb the natural protection.

CONTRACTOR shall use controls found in "Environmental Criteria Manual" or developed from successful techniques elsewhere as approved by E/A.

3.12 Pollution Control

CONTRACTOR shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris and the substances resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse. No sediment, debris or other substance will be permitted to enter sanitary sewers and reasonable measures shall be taken by CONTRACTOR to prevent such materials from entering any drain or watercourse.

CONTRACTOR shall observe the rules and regulations of the State of Texas and agencies of the U.S. Government prohibiting the pollution of any lake, stream, river, or wetland by the dumping of any refuse, rubbish, dredge material, or debris therein.

CONTRACTOR is specifically cautioned that disposal of materials into any water of the State must conform to the requirements of the Texas Commission on Environmental Quality (TCEQ), and any applicable permit from the U.S. Army Corps of Engineers.

3.13 Fences

All existing fences affected by the Work shall be maintained by the CONTRACTOR until completion of the Work. Fences which interfere with construction operations shall not be relocated or dismantled until written permission is obtained from the owner of the fence, and the period the fence may be left relocated or dismantled has been agreed upon. Where fences must be maintained across any construction easement, adequate gates shall be installed. Gates shall be kept closed and locked at all times when not in use.

Upon completion of the Work across any tract of land, CONTRACTOR shall restore all fences to preconstruction, or to a better, condition and to their preconstruction location.

3.14 Emergency Facilities

Free access shall be maintained at all times to fire lanes and emergency and utility control facilities such as fire hydrants, fire alarm boxes, police call boxes, and utility valves, manholes, junction boxes, etc. In the event that it is necessary to make one of these facilities temporarily inaccessible, CONTRACTOR shall obtain approval of such action and schedule of Work from the OWNER. CONTRACTOR shall also provide at least 24 hours prior notice to the Fire Department, Police Department, and City Department governing the affected utility. The same Department(s) shall be promptly notified by the CONTRACTOR when such facilities are placed back in unobstructed service.

3.15 Maintenance of Traffic

CONTRACTOR shall conduct his Work to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks whether public or private, the CONTRACTOR shall provide and maintain suitable safe bridges, detours or other temporary measures to accommodate public and private travel, and shall provide reasonable notice to owners of private drives before interfering with them. Such maintenance of traffic will not be required when CONTRACTOR has obtained written permission from the owner and the tenant of the private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point. A copy of the initial written permission shall be provided to the Owner’s Representative.

Safety and conveyance of traffic shall be regarded as prime importance. Unless otherwise directed, all portions of streets associated with this Project shall be kept open and provided a dust free, smooth and comfortable ride to traffic. It shall be the responsibility of the

CONTRACTOR to ensure that two-way traffic may safely bypass the construction site and that access is provided to abutting private property. In making open cut street crossings, the CONTRACTOR shall not block more than one-half of the street at one time without approval of the OWNER. Whenever possible, CONTRACTOR shall widen the shoulder on the opposite side to facilitate traffic control. Temporary surfacing shall be provided as necessary on shoulders.

Prior to beginning Work, CONTRACTOR shall designate, in writing, a competent person who will be responsible and available on the Project site, or in the immediate area, to ensure compliance with the traffic control plan. CONTRACTOR shall provide documentation to demonstrate the sufficient training in Traffic Control for his competent person. Owner will designate a qualified person to observe implementation and who will have authority to assure compliance with the traffic control plan.

The CONTRACTOR shall perform the necessary cleanup and finishing immediately after all or a portion of the Work is completed. When the Work includes paving operations, the entire site shall be kept clean to facilitate placement of required traffic control devices. Temporary and permanent striping lay-out shall be approved by the Transportation Department prior to placement, when included in the Work.

1. Detours

Where indicated on the traffic control plan CONTRACTOR shall erect and maintain detours around construction activities. Should CONTRACTOR desire to propose a detour, not already included in the traffic control plan, it shall be his responsibility to prepare a revised traffic control plan showing the detour, and obtain approval of the revised traffic control plan from the Transportation Department, prior to implementation of the detour. The Transportation Department has final authority as to the acceptability of any proposed revisions to the traffic control plan. The CONTRACTOR shall bear all costs for revising the traffic control plan and for maintaining the proposed detour.

2. Barricades and lights

CONTRACTOR shall place and maintain in good condition, standard barricades at each end of the Project and at other locations where traffic is rerouted or blocked from using regular traffic lanes. Barricades and warning signs shall be in accordance with the Texas Manual on Uniform Traffic Control Devices (MUTCD) and City of Austin Standard Specification Item No. 803S, "Barricades, Signs and Traffic Handling". Signs, barricades, and warning devices informing the public of construction features will be placed and maintained by the CONTRACTOR, who shall be solely responsible for their maintenance. The decision to use a particular device at a particular location as indicated in the traffic control plan or as determined by the CONTRACTOR, shall be the sole responsibility of the CONTRACTOR.

All open trenches and other excavations shall have suitable barricades, signs, and lights to provide adequate protection to the public. Obstructions, such as material piles and equipment shall be provided with similar warning signs and lights.

All barricades and obstructions shall be illuminated with warning lights from sunset to sunrise. Material storage and conduct of the Work on, or along side, public streets and highways shall cause a minimum obstruction and inconvenience of the traveling public.

3.16 Required Job Site Postings and Notices

CONTRACTOR shall post the following postings and notices in English and Spanish at one or more conspicuous locations on the job site. In the case of Projects with multiple sites, the notices and postings must be displayed at each site. In the case of Projects that do not have a job shack or other temporary facility on the site, CONTRACTOR shall post all notices on a temporary bulletin board. Other special conditions are noted below.

Required for all Projects	
Poster	Available at:
Wage Rates as required	Section 00830BC and/or Section 008300HH

under Section 00830.	
City of Austin Wage Contact posters	Provided at Pre-Construction meeting (English and Spanish)
City of Austin Equal Employment Opportunity posters	http://austintexas.gov/department/wage-compliance (English and Spanish)
Texas Commission on Environmental Quality "Construction Site Notice" form, if applicable, as required or the required TPDES information	http://www.tceq.state.tx.us/assets/public/permitting/waterquality/attachments/stormwater/txr152d2.pdf (Option 1 – as required under Section 00810, 6.7.4.2 N/A (Option 2 – as required under Section 00810, 2.6.7.4.3)
OSHA poster "Job Safety and Health: It's the Law"	http://www.osha.gov/Publications/osha3165.pdf (English) http://www.osha.gov/Publications/osha3167.pdf (Spanish)
City of Austin Rest Break Ordinance Signs	http://austintexas.gov/department/wage-compliance (English and Spanish) As required to be posted in English and Spanish under Ordinance No. 20100729-047
Texas Payday Law Poster	http://www.twc.state.tx.us/ui/lablaw/ll10.pdf (English) http://www.twc.state.tx.us/ui/lablaw/ll10s.pdf (Spanish)
Texas Workers Compensation notice that the employer does or does not carry Workers Compensation insurance	Does not carry Workers Compensation Insurance: http://www.tdi.state.tx.us/forms/dwc/notice5.pdf (English) http://www.tdi.state.tx.us/forms/dwc/notice5s.pdf (Spanish) Does carry Workers Compensation Insurance: http://www.tdi.state.tx.us/forms/dwc/notice6.pdf (English) http://www.tdi.state.tx.us/forms/dwc/notice6s.pdf (Spanish)
TWC Employer's Notification of the Ombudsman Program to Employees	http://www.oiec.state.tx.us/documents/Employer_Notice_of_O.pdf (both versions)
DOL – The Uniformed Services Employment and Reemployment Rights Act (USERRA)	http://www.dol.gov/vets/programs/userra/USERRA_Private.pdf
EEOC Equal Employment Act and the Americans with Disabilities Act (ADA)	http://www.dol.gov/ofccp/regs/compliance/posters/pdf/eeopost.pdf (English) http://www.dol.gov/ofccp/regs/compliance/posters/pdf/eeosp.pdf (Spanish)
Fair Labor Standards Act (FLSA) Minimum Wage Poster	http://www.dol.gov/whd/regs/compliance/posters/flsa.htm (English) http://www.dol.gov/whd/regs/compliance/posters/flsaspan.htm (Spanish)
If applicable: Employee Rights for Workers with Disabilities/Special Minimum Wage Poster – Employment Standards	http://www.dol.gov/whd/regs/compliance/posters/disabc.pdf http://www.dol.gov/whd/regs/compliance/posters/disabspanc3p.pdf
"Your Rights Under the Family and Medical Leave Act (FLMA)"	http://www.dol.gov/whd/regs/compliance/posters/fmlaen.pdf (English) http://www.dol.gov/whd/regs/compliance/posters/fmlasp.pdf (Spanish)
Title VI Rights Poster	http://austintexas.gov/department/wage-compliance

END

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PART 1 – GENERAL

1.1 RELATED DOCUMENTS

1. Division 01 Section 01500 "Temporary Facilities"

1.2 SUMMARY

A. The Owner has established that the Project shall minimize the creation of construction and demolition waste on the Project site and shall recycle and/or salvage non-hazardous construction, demolition, and land clearing debris to divert waste from Landfills.

1. Contractor shall minimize factors that contribute to waste such as over packaging, improper storage, ordering error, poor planning, breakage, mishandling, and contamination.

2. Contractor shall reuse, salvage, or recycle as many of the non-hazardous waste materials as economically feasible.

3. As an incentive to encourage resourcefulness, all profits resulting from salvaging and recycling shall go to the Contractor.

4. In cases where there is little to no cost difference between recycling/salvaging and land-filling of items not required to be recycled or salvaged, the Contractor is directed to recycle/salvage.

5. Contractor shall minimize waste disposal in landfills.

B. Hazardous materials are an exception to this Section. Comply with applicable requirements of Local, State and Federal regulations.

C. This Section includes administrative and procedural requirements for the following:

1. Salvaging non-hazardous demolition and construction waste

2. Recycling non-hazardous demolition and construction waste

3. Disposing of non-hazardous demolition and construction waste.

1.3 REFERENCES

A. The standards listed below form a part of this Section to the extent referenced. Standards are referred to in the text by basic reference only.

1. LEED-NCReference Guide MR credit 2 (Reference only - Certification is not required)

2. Sustainable Building Sourcebook – Austin Energy Green Building:

www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/Sourcebook/constructionWasteManagement.htm

3. Resource Exchange Network for Eliminating Waste (RENEW), TCEQ (MC-112), Biannual catalog lists materials available and wanted; serves Texas and surrounding states; lists are posted on the Internet:
http://www.tceq.state.tx.us/assistance/P2Recycle/renew/renew.html

4. Recycle Texas Online, A service of the Texas Commission on Environmental Quality. Contains information on about 1000 businesses and local governments handling materials from Texas. Organizations' information is self-reported and listings are free of charge. http://www.tceq.state.tx.us/assistance/P2Recycle/rtol/rtol.htm

5. The "Construction Materials Management Guidelines", a publication of AIA/Austin for the Governor's Energy Office provides construction waste recycling economics worksheets, recycling market information and other related information that may be useful in estimating the construction waste quantities and recycling costs for this project. Available from AIA/Austin (512) 452-4332.

6. "WasteSpec", Triangle J Council of Governments, Research Triangle Park, NC 27709, (919) 549-9390.

1.4 DEFINITIONS

A. Chemical Waste: Includes petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.

B. Clean: Untreated and unpainted, not contaminated with oils, solvents, caulk, or the like.

C. Co-mingled: Keeping mixed recyclable materials in one container on site. The container is then taken to a material recovery facility where materials are separated for recycling.

D. Deconstruction: Process of carefully dismantling a building in order to salvage components for reuse and recycling. Also known as "construction in reverse".

E. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

F. Demolition: Process of removing structures as quickly as possible by using heavy machinery and generating large amounts of waste.

G. Disposal: Acceptance of solid wastes at legally permitted and operating facility for the purposes of land-filling.

H. Diversion: Avoidance of demolition and construction waste sent to landfill or incineration. Diversion does not include using materials for landfill, alternate daily cover on landfills, or materials used as fuel in waste-to-energy processes.

I. Hazardous Waste: Byproducts of society that can pose a substantial or potential hazard to human health or the environment when improperly managed, and possessing at least 1 of 4 of the following characteristics, or appearing on a special Environmental Protection Agency (EPA) list.

1. Ignitability.

2. Corrosivity.

3. Reactivity.

4. Toxicity.

J. Non-Hazardous Waste: Solid wastes, such as building materials, packaging, rubbish, debris, and rubble resulting from construction, remodeling, repair, and demolition operations, possessing none of the 4 characteristics of hazardous substances, i.e., ignitability, corrosivity, reactivity, or toxicity.

K. Landfill: Authorized land waste disposal site that is located to minimize waste pollution from runoff and leaching. Waste is spread in thin layers, compacted and covered with a fresh layer of soil each day to minimize pest, aesthetic, disease and air and water pollution problems.

L. Municipal Solid Waste Landfill: A permitted facility that accepts solid, non-hazardous waste such as household, commercial, and industrial waste, including construction and demolition waste.

M. Non-hazardous: Exhibiting none of the characteristics of hazardous substance, i.e. ignitability, corrosiveness, toxicity or reactivity.

N. Non- toxic: Neither immediately poisonous nor poisonous after a long period of exposure.

O. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

P. Recycle: To remove a waste material from the Project site to another site for remanufacture into a new product for reuse by others.

Q. Recycling: The process of sorting, cleansing, treating, and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

R. Return: To give back reusable items or unused products to vendors for credit.

S. Reuse: A strategy to return materials to active use in the same or a related capacity.

T. Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.

U. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become a waste.

V. Toxic: Poisonous to living beings either immediately or after a long period of exposure.

W. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

X. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

All materials removed from the Project site to be land-filled, recycled, or salvaged for reuse. Pallets, containers, packaging and packing materials in which construction products are delivered to the Project site are considered waste materials. New, leftover materials that are returned to the material suppliers are <u>not</u> considered waste.

Y. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material being land-filled.

1.5 WASTE MANAGEMENT GOALS

A. The Owner has established that at least **<u>50%</u>** of the "waste" materials produced as a result of the Work, shall be employed, salvaged, reused, or recycled in order to minimize the impact of construction and demolition waste on landfills, and to minimize the expenditure of energy and cost in fabricating new materials. Of the waste that is generated, as many of the waste materials as economically feasible shall be reused, salvaged, or recycled. Waste disposal in landfills or incinerators shall be minimized, thereby reducing disposal costs. As a minimum, **<u>50%</u>** of material that would otherwise go to the landfill shall be diverted.

B. Contractor shall employ and encourage practices that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Revenues, savings, rebates, tax credits and other incentives received for recycling waste materials shall accrue to the Contractor.

D. Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, State and local laws and regulations, pertaining to legal disposal of all construction waste materials.

E. Recycle material including diverting materials for secondary uses whenever economically feasible.

F. Dispose of materials with no practical use or economic benefit at landfill.

G. Acceptable methods of diversion include:
Donation to nonprofit organizations
Removal from jobsite by staff or subcontractors for use (not disposal)
Return to supplier
Sale to organizations or individuals
Recycling

H. The Contractor shall develop a Construction Demolition Waste Management Plan that results in end-of-Project rates for recycle and/or salvage at least **50%** of non-hazardous construction and demolition debris. Develop and implement the plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or co-mingled. Calculations can be done by weight or volume, but must be consistent throughout.

1.6 SUBMITTALS

A. ***Draft Waste Management Plan***: Within 14 calendar days after date of the Notice to Proceed, or prior to any waste removal, whichever occurs first, submit a draft Waste Management Plan outlining how demolished items and waste material will be removed from the Project Site.

An example template is included as "Appendix A" to this section.

1. The Waste Management Plan shall include the following:

a. Identify each type of demolished and waste material produced as a result of the Work on the Project Site.

b. Identify each type of demolished and waste material intended to be recycled or reused.

c. Identify estimated quantities for each type of demolished and waste material that can be recycled or reused.

d. Identify material separation requirements.

e. Identify location of temporary on-Site storage for recycled and reused materials.

f. Identify final destination for each recycled and reused material.

g. Identify means of transportation for each recycled and reused material to their final destination.

h. Identify the name/phone number of the Coordinator of the Waste Management Plan. The Coordinator is Contractor-designated on-site party responsible for workers and overseeing and documenting results of Waste Management Plan.

i. Indicate permit or license and the location of the municipal solid waste landfills and other disposal area(s) to be used.

j. List of materials that cannot be recycled or reused.

B. ***Final Construction Waste Management Plan:*** Once the Owner has determined which of the recycling options addressed in the draft Construction Waste Management Plan are

acceptable, revise and resubmit, within 14 calendar days, a final Construction Waste Management Plan. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

C. ***Waste Management Reports:*** Prepare and maintain through Project duration a record of waste management. An Example template of a waste management record form is attached as "Appendix B" of this Section. With each application for progress payment, Contractor shall submit a summary of solid waste generated by the construction and demolition operations. Submit an electronic version of the updated form (showing new and cumulative information), indicating solid waste generated by the construction and means of disposal or diversion. Failure to submit updated reports with each Application for Progress Payment may delay payment. Include as a minimum the following information on the form: manifests, weight tickets, receipts and invoices, specifically identifying the Project and waste material for:

1. Municipal solid waste landfills.

2. Recycling centers.

3. Non-Profit organizations.

4. Landfill or Incinerator Disposal: Updates to the form and other updates required as part of the Waste Management Report shall include:

a. Land-fill Materials Description. Include date removed from jobsite.

b. Land-fill Hauler and Location of disposal or incineration.

c. Quantity of Land-filled (or incinerated) Waste

d. Submit electronic copy of manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

e. The amount (in tons or cubic yards) of material land-filled from the Project, the identity of the landfill, the total amount of tipping fees paid at the landfill, and the total disposal cost.

f. For each material recycled, reused, or salvaged from the Project, include the amount (in tons or cubic yards, pounds, feet, square yards, gallons, etc.), the date removed from the Project site, the receiving party, the transportation cost, the amount of any money paid or received for the recycled or salvaged material, and the net total cost or savings of salvaging or recycling each material.

5. Recycled and Salvaged Materials: Updates to the form shall include the following information:

a. Diverted / Recycled Materials Description, including those retrieved by installer for use on other projects, those taken by the Contractor's staff or subcontractors for use on their projects, and those donated to charitable organizations. Include date item was removed from jobsite.

b. Diversion / Recycling Hauler and Location, indicating name of person or company removing the material for future use and the location to which the item was removed.

c. Quantity of Diverted / Recycled Waste

d. Submit electronic copy of manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

e. The City of Austin Project manager may request further information regarding how the diverted material was used or is intended to be used.

D. ***CWM Closeout Documentation:*** Submit the following upon the completion of The Work and prior to final payment:

a. The completed Project Waste Management Record Form with Contract closeout documents, "signed" by the Contractor's representative and including calculations on end-of-project recycling rates, salvage rates, and landfill rates demonstrating that 100% of all non-hazardous construction wastes were recycled, salvaged or disposed of properly.

b. Copy of all receipts, manifests, weight tickets, and other documentation of materials recycled, salvaged, land-filled or incinerated, that have not already been documented.

c. Electronic copy of a final summary.

2 PART 2 - PRODUCTS

Not used

3 PART 3 – EXECUTION

3.1 GENERAL

A. Implement the waste management plan as approved by the City of Austin Project Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

B. Satisfy the requirements outlined in Subsection 1.5, Waste Management Goals.

3.2 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Plan Coordinator: Designate an on-site party (or parties) responsible for instructing workers, overseeing implementation and documenting results of the Waste Management Plan for the Project.

B. Plan Distribution: Provide copies of the Waste Management Plan to the Contractor's superintendent, each Subcontractor, the Owner, and the E/A.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project. Contractor is responsible for requiring participation of subcontractors.

D. Meetings: Conduct construction waste management meetings. Include subcontractors affected by the Waste Management Plan. At a minimum, discuss and develop a mutual understanding for achieving all of the Owner's waste management goals at the following meetings:

1. Pre-bid conference.

2. Pre-construction conference.

3. Progress meetings.

E. Careful Ordering.

F. Materials Handling Procedures: Protect materials to be recycled from contamination. Handle, store and transport in a manner that meets the requirements set by the designated facilities for acceptance. All materials shall be covered during transportation to prevent contamination and littering.

G. Separation Facilities: The Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas shall be kept neat and clean and clearly marked in order to avoid contamination of materials.

H. Handling:

1. Clean materials which are contaminated prior to placing in collection containers. Deliver materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to recycling process.

2. Arrange for collection by, or delivery to, the appropriate recycling or reuse facility.

I. Hazardous Wastes: shall be separated, stored, and disposed of according to local prevailing regulations, and in accordance with the appropriate section of this specification.

3.3 RECYCLING REQUIREMENTS

A. Materials: Refer to individual specification sections for detailed Waste Management requirements. In general, the following types of construction waste materials generated during the course of this project that are not salvaged shall be recycled:

1. Asphalt concrete pavement.

2. Concrete.

3. Concrete block.

4. Metals, including the following.

a. Banding straps.
b. Reinforcing steel.
c. Iron.
d. Brass and bronze.
e. Lead.
f. Extruded aluminum.
g. Aluminum sheet.
h. Stainless steel sheet.
i. Steel studs.
j. Copper pipe.
k. Steel pipe.
l. Galvanized steel pipe.
m. Metal ductwork.

5. Clean dimensional lumber.

6. Broken wood crates and pallets.

7. Glass and glass containers.

8. Plastics.

9. Plaster.

10. Gypsum board.

11. Acoustic ceiling tile.

12. Carpet and pad.

13. Paint and paint containers.

14. Metal toilet partitions.

15. Food service equipment.

16. HVAC heating and cooling coils.

17. HVAC equipment.

18. Plumbing fixtures.

19. Electrical conduit.

20. Electrical wiring.
21. Light fixtures.
22. Cardboard, paper, and packaging.
23. Beverage containers.

B. Methods: The following recycling methods may be used.
   1. On-site separation: Each material to be recycled shall be separated at the Project site and delivered to the recycling markets or directly from the Project site.
      a. If on-site separation method is used, designate a specific area or areas to facilitate separation of materials for potential reuse, salvage, recycling, and return.
      b. Maintain recycling and waste bin areas neat and clean and clearly marked, both in Spanish and in English, in order to avoid commingling of materials.
      c. Protect bins during non-working hours from off site contamination.
   2. Off-site separation: Materials to be recycled are delivered unsorted from the Project site to a materials recovery facility or transfer station where recyclable materials are separated from other waste.
      a. If this method is selected, Contractor shall verify that the entity responsible for the off-site separation has a market for all of the materials that are required to be recycled that it receives from the Project site.
      b. The same Submittals procedures shall apply.
      c. Protect bins during non-working hours from off site contamination.
   3. A combination of each of the above methods.

C. Area Recyclers: A reference for waste recycling markets and resources for the Austin, Texas area is included at the end of this Section.

3.4 REUSE

A. Contractor is encouraged to reuse as many demolished and waste materials as possible.

B. Reuse of demolished and waste materials includes the following:
   a. Salvaging existing materials scheduled for resale.
   b. Off-Site storage of demolished materials for future reuse by Contractor on other projects.
   c. Returning reusable materials, such as packaging and pallets, to vendor.
   d. Returning unused new materials to vendor.
   e. Assemble designated reuse items in a single location safe from damage, for review and approval by the Owner's Representative.

C. Submit a list of reused materials as part of the Waste Management Record

D. Contractor shall investigate the possibility of off-Site reuse of demolished and removed materials in the Austin, Texas metropolitan area.

3.5 SALVAGE

A. Salvage materials as identified on the Architectural and Engineering Demolition Plans.

B. Salvage Guidelines:

1. The contractor shall salvage as many items as deemed economically possible, considering that each item salvaged saves on land filling fees and may be of use to others.
2. Assemble potentially salvageable items in one area for review by the City of Austin Project Manager. No items may be donated or sold to the public without prior approval by the City of Austin Project Manager.
3. The Contractor, with assistance requested from the City of Austin Waste Reduction Assistance contact and Engineer, shall consider several possible markets for salvaged items. Examples of potential markets are:
    a. Habitat for Humanity Restore.
    b. Project site display for public purchase/donation
    c. Demolition Contractor's sales yard/area
4. Salvage items shall be stored in a manner that prevents damage.
5. All proceeds from the sale of salvaged items shall go to the contractor.
6. The contractor shall submit a list of items salvaged as part of the Waste Management Records.

3.6 SCHEDULE OF MATERIAL DISPOSAL & RECYCLING SERVICES

A. The following list is provided for informational purposes only. Additional opportunities may be available. All information contained in this list is from the Austin Energy Green Building Program. Shortcut to: http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/Sourcebook/constructionWasteManagement.htm

Contractor shall re-verify any crucial information prior to making arrangements that involve any of the firms listed.

Appendix A. Sample Construction Waste Management Plan

Construction Waste Management Plan

Project:
Contractor:
Date:
Contact:
Phone:
Prepared by:

Diversion Goal: Salvage and recycle at least **50%** *(by weight or volume) of land-clearing and construction waste*

Complete all sections below that are required by or pertinent to this project as outlined in the Construction Documents.

I. Coordination and Training

a. Name of Contractor's representative responsible for CWM implementation & coordination:

b. How will Contractor's staff and subcontractors be instructed and updated regarding demolition and construction phase **salvaging** activities?

c. How will Contractor's staff and subcontractors be instructed and updated regarding proper **recycling and separation** procedures, and how will contamination of separated waste materials will be prevented?

d. Describe and/or show on an attached site map where the temporary waste material storage area(s) will be located.

e. Recycling and trash containers and areas shall be clearly marked in English and Spanish in order to avoid contamination. Architect's review and approval of the storage area(s) and signage will be required as part of the approval of this Construction Waste Management Plan.

II. Waste Minimization

a. What waste minimization techniques will be employed during the construction phase? (See "Waste Minimization" subsection in specifications Section 01505, Construction Waste Management)_____

b. Which employees and / or subcontractors will be involved with each technique?

III. Construction Waste Analysis (including site / land-clearing materials, as applicable)

a. ***Diverted Materials***: For each of the materials anticipated to be reused or recycled (and thereby diverted from the landfill) to meet the minimum **50%** diversion goal, provide information to complete the table below. (Note: Whenever possible, please make efforts to use or donate usable construction waste materials rather than recycling.)

Material or Item	Storage Method (roll-off, bin, area, on pallet, etc.)	Quantity estimate (no., linear ft., square ft., etc.)	Proposed Recipient

Add rows (or paper pages) as required

b. ***Landfill***: For construction phase trash and materials / items that will not be diverted, complete the following table:

Quantity estimate (weight or volume)	Number and size of roll offs anticipated	Proposed landfill site

Appendix B. Summary of Solid Waste Disposal and Diversion

Project name _____ Project Number _____
Contractor Name _____ License Number_____
Contractor Address_____

Solid Waste Material	**Date Material Disposed/ diverted**	**Amount Disposed/ Diverted** (Ton or cubic yd.)	**Municipal Solid Waste Facility** (Name, address, Phone)	**Recycling/Reuse Facility** Name Address Phone	**Comment** (If disposed state why not diverted)
Land Clearing Debris					
Asphalt					
Concrete					
Metal					
Wood					
Debris					
Glass					
Clay Brick					
Paper/Cardboard					
Plastic					
Gypsum					
Paint					
Carpet					
Other					
Other					

Signature _____ Date _____

END SECTION 01505

ARTICLE 1 - GENERAL

1.1 RELATED DOCUMENTS

The following documents are a part of this section:

All documents in Bidding Requirements, Contract Forms and Conditions of the Contract.

Other sections of Division 1 - General Requirements apply to this section.

1.2 DESCRIPTION AND INTENT OF THE WORK

No asbestos containing material (ACM) shall be brought onto the Project site, and/or incorporated into the Project construction without the written consent of the OWNER. Any asbestos containing material found at any time including after contract completion, to have been brought onto the site or incorporated into the Project construction by the CONTRACTOR, or any Subcontractors, Sub-Subcontractors or Suppliers, shall be removed and disposed of in accordance with the then current governmental regulatory standards.

All costs associated with the inspection, sampling, testing, removal and disposal of ACM as described above shall be paid by the CONTRACTOR.

1.3 DEFINITIONS

ASBESTOS: The asbestiform varieties of serpentine (chrysotile), riebeckite (crocidolite) cummingtonite-grunerite (amosite), anthophyllite, actinolite and tremolite.

ASBESTOS CONTAINING MATERIAL (ACM): Any material containing more than one percent (1%) by weight of asbestos of any type or mixture of types.

ASBESTOS CONTAINING BUILDING MATERIAL (ACBM): Any material used in the construction of, or incorporated into the construction of, any building that contains more than one percent (1%) by weight of asbestos of any type or mixture of types.

MSDS: A material safety data sheet (MSDS) is a form containing data regarding the properties of component substances that comprise a manufactured product. They are a basic hazard communication tool that gives details on chemical and physical dangers, safety procedures, and emergency responses for chemicals.

1.4 QUALITY ASSURANCE

PROHIBITION OF ASBESTOS CONTAINING MATERIALS

The E/A has been instructed to not permit any asbestos containing materials to be specified, requested or approved for use in conjunction with this Project.

The E/A has signed the following:

A. 01900A Statement of Non-Inclusion of Asbestos Containing Material (E/A, Prior to Design): stating that the Engineer/Architect shall not specify, request or approve any ACM in this Project without prior written approval of OWNER.

B. 01900B Statement of Non-Inclusion of Asbestos Containing Material (E/A, After Design): stating that the Engineer/Architect has not specified, requested or approved any ACM in this Project without the prior written approval of the OWNER, and that any ACM allowed in this Project is identified in the Statements.

These Statements are included in the Construction Documents.

ASBESTOS CONTAINING MATERIALS PROHIBITED FROM SITE

No asbestos containing materials will be permitted as part of the Project construction. The following list is intended to be used as a general guide to show which types of materials are suspected to contain asbestos:

- Cement Pipes
- Cement Wallboard
- Cement Siding
- Asphalt Floor Tile
- Vinyl Floor Tile
- Vinyl Sheet Flooring/vinyl wall coverings
- Flooring Backing
- Construction Mastics (floor tile, carpet, ceiling tile, etc.)
- Acoustical Plaster
- Decorative Plaster / stucco
- Textured Paintings/Coatings
- Ceiling Tiles and Lay-in Panels
- Spray-Applied Insulation
- Blown-in Insulation
- Fireproofing Materials
- Taping Compounds (thermal)
- Packing Materials (for wall/floor penetrations)
- High Temperature Gaskets
- Laboratory Gloves
- Fire Blankets
- Fire Curtains
- Elevator Equipment Panels
- Elevator Brake Shoes
- HVAC Duct Insulation
- Boiler Insulation
- Breeching Insulation
- Ductwork Flexible Fabric Connections
- Cooling Towers
- Pipe Insulation (corrugated air-cell, block, etc.)
- Heating and Electrical Ducts
- Electrical Panel Partitions
- Electric Cloth
- Electric Wiring Insulation
- Chalkboards
- Roofing Shingles / tiles / membranes
- Roofing Felt
- Roof Coatings
- Base Flashing
- Thermal Paper Products
- Fire Doors
- Caulking/Putties
- Adhesives / mastics
- Wallboard
- Joint Compounds
- Spackling Compounds
- Laboratory hoods/tabletops
- CMU block fill materials

If any of these suspect materials are specified for use on the Project, and if they do not have specific labelling identifying them as asbestos free, then the CONTRACTOR shall notify the OWNER immediately. Laboratory analysis of the material by an OWNER-approved laboratory shall be performed at CONTRACTOR's expense in order to warrant that the material does not contain asbestos. A copy of the package labelling or results of laboratory testing must be provided to the OWNER prior to inclusion of the specified material during construction. Contractor's construction submittals must include MSDSs for all new materials used in construction of buildings, facilties and infrastructure.

1.5 SUBMITTALS

NON-USE OF ASBESTOS AFFIDAVITS

At the time that the CONTRACTOR signs the Agreement, they shall sign a Non-Use of Asbestos Affidavit (Contractor Prior to Construction), Contract Document 00680. This Affidavit certifies that the CONTRACTOR agrees that they will not allow any asbestos containing materials to be incorporated into the construction of the Project or allow any asbestos containing building materials on the site for which the OWNER has not given prior written approval.

Prior to final payment, the CONTRACTOR will provide to the OWNER a Non-Use of Asbestos Affidavit (Contractor After Construction), Contract Document 00681. This Affidavit certifies that the CONTRACTOR did not allow asbestos containing materials to be incorporated into the construction or allowed any asbestos containing building materials on the site for which the OWNER of the Project did not give prior written approval.

ASBESTOS CONTAINING MATERIALS: When any asbestos containing materials are used on the Project, provide the following information:

A detailed description of the material containing the asbestos.

The type and percent of asbestos contained in the material.

The quantity of the materials used, including the square footage, or in the case of pipe insulation, the size and linear footage.

A drawing showing the exact location of any asbestos containing materials.

Final payment shall be withheld until the above described Affidavits, submittals and/or information are received and approved.

END

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CITY OF AUSTIN

STATEMENT OF NON-INCLUSION OF ASBESTOS CONTAINING MATERIAL

STATE OF TEXAS
COUNTY OF TRAVIS

ENGINEER/ARCHITECT PRIOR TO DESIGN

"My name is Bonita Tice Gray, AIA LEED AP BD+C, hereinafter known as Authorized Representative.

"I am over the age of 18 years and I have never been convicted of a crime. I am the employee of GSC Architects hereinafter known as ENGINEER/ARCHITECT.

"I am fully competent to make this statement. I have personal knowledge of the facts set forth below and they are all true and correct.

"WHEREAS ENGINEER/ARCHITECT has been selected to provide designs, to prepare the bid and construction documents, and to assist the City of Austin, Texas, hereinafter known as OWNER, during the construction of St. Elmo Service Center 8 Renovations, located at Fleet Mobility Services Building #8, 4411 Meinardus Drive, Austin, Texas, hereinafter known as Project, and

"WHEREAS asbestos in a dust form is a recognized health hazard, and
"WHEREAS the OWNER desires not to have any asbestos containing materials used or incorporated into the construction of the Project;
"THEREFORE the ENGINEER/ARCHITECT affirms that to the best of its knowledge and belief:

1. The ENGINEER/ARCHITECT, any person, firm or organization representing or represented by the ENGINEER/ARCHITECT, shall not knowingly specify, request, or approve for use in conjunction with the Project, any asbestos containing materials or any other materials defined as containing asbestos by any laws, rules or regulations promulgated by the United States Government, the State of Texas or any governmental organization or agency operating under the authority of either of those entities.
2. Realizing that there might be materials required in which a satisfactory non-asbestos containing material cannot be obtained, the ENGINEER/ARCHITECT will do the following before specifying any asbestos containing material:
   A. Inform the OWNER's Project Manager for this Project, in writing, of any intent to specify asbestos containing materials.
   B. Receive written approval from the City of Austin Project Manager for the specifying of any asbestos containing materials.
   C. At the completion of the design phase, and before the OWNER receives any bids for this Project, provide to the Project Manager, in writing, the proposed location of any asbestos containing materials, the type of asbestos they contain, and the percent of asbestos by types.
3. The ENGINEER/ARCHITECT states its understanding that if any asbestos containing materials not approved by the OWNER for inclusion into the Project, are determined, as a result of any inspection and sample analysis performed by an individual(s) and/or firm(s) certified and/or licensed to perform such inspection by the United States Government and/or the State of Texas, to have been knowingly specified, requested and/or approved by the ENGINEER/ARCHITECT for inclusion in the Project, the OWNER shall look to the ENGINEER/ARCHITECT for reimbursement of any and all costs incurred in the removal and/or other abatement of said asbestos containing materials.
4. ENGINEER/ARCHITECT further understands that OWNER shall also look to the ENGINEER/ARCHITECT for any and all damages to OWNER which result from the inability of the OWNER to use any portion or all of the Project due to the incorporation of asbestos containing materials that have been knowingly specified, requested and/or approved by the ENGINEER/ARCHITECT.
5. ENGINEER/ARCHITECT further understands that OWNER will pursue reimbursement of any said cost and compensation for any said damages from the ENGINEER/ARCHITECT by any and every means within OWNER's right and power.

Signature of Authorized Representative: [signature]

STATE OF TEXAS
COUNTY OF TRAVIS

ON March 19, 2021, personally appeared Bonita Tice Gray Assoc. Principal and been duly sworn by me, subscribed to the foregoing statement and has stated that the facts stated therein are true and correct.

SUSAN B. MURRAY
My Notary ID # 126165273
Expires June 16, 2024

Notary Public, State of Texas [signature]

Printed Name of Notary Susan B Murray

My Commission Expires: June 16, 2024

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CITY OF AUSTIN

STATEMENT OF NON-INCLUSION OF ASBESTOS CONTAINING MATERIAL

STATE OF TEXAS
COUNTY OF TRAVIS

ENGINEER/ARCHITECT AFTER DESIGN

"My name is Bonita Tice Gray, AIA LEED AP BD+C, hereinafter known as Authorized Representative.

"I am over the age of 18 years and I have never been convicted of a crime. I am the employee of GSC Architects hereinafter known as ENGINEER/ARCHITECT.

"I am fully competent to make this statement. I have personal knowledge of the facts set forth below and they are all true and correct.

"WHEREAS ENGINEER/ARCHITECT has been selected to provide designs, to prepare the bid and construction documents, and to assist the City of Austin, Texas, hereinafter known as OWNER, during the construction of St. Elmo Service Center 8 Renovations, located at Fleet Mobility Services Building #8, 4411 Meinardus Drive Austin, Texas, hereinafter known as Project, and

"WHEREAS asbestos in a dust form is a recognized health hazard, and
"WHEREAS the OWNER desires not to have any asbestos containing materials used or incorporated into the construction of the Project;
"THEREFORE the ENGINEER/ARCHITECT affirms that to the best of its knowledge and belief:

1. The ENGINEER/ARCHITECT, any person, firm or organization representing or represented by the ENGINEER/ARCHITECT, shall not knowingly specify, request, or approve for use in conjunction with the Project, any asbestos containing materials or any other materials defined as containing asbestos by any laws, rules or regulations promulgated by the United States Government, the State of Texas or any governmental organization or agency operating under the authority of either of those entities.
2. The only exceptions to the above statement are the following materials that are required because a satisfactory non-asbestos containing material cannot be obtained. The inclusion of these materials has been approved by the OWNER's Project Manager for this Project.

   N/A

3. The ENGINEER/ARCHITECT states its understanding that if any asbestos containing materials not approved by the OWNER for inclusion into the Project, are determined, as a result of any inspection and sample analysis performed by an individual(s) and/or firm(s) certified and/or licensed to perform such inspection by the United States Government and/or the State of Texas, to have been knowingly specified, requested and/or approved by the ENGINEER/ARCHITECT for inclusion in the Project, the OWNER shall look to the ENGINEER/ARCHITECT for reimbursement of any and all costs incurred in the removal and/or other abatement of said asbestos containing materials.
4. ENGINEER/ARCHITECT further understands that OWNER shall also look to the ENGINEER/ARCHITECT for any and all damages to OWNER which result from the inability of the OWNER to use any portion or all of the Project due to the incorporation of asbestos containing materials that have been knowingly specified, requested and/or approved by the ENGINEER/ARCHITECT.
5. ENGINEER/ARCHITECT further understands that OWNER will pursue reimbursement of any said cost and compensation for any said damages from the ENGINEER/ARCHITECT by any and every means within OWNER's right and power.

Signature of Authorized Representative: _____

STATE OF TEXAS
COUNTY OF TRAVIS

ON March 19, 2021 personally appeared Bonita Tice Gray Assoc. Principal and been duly sworn by me, subscribed to the foregoing statement and has stated that the facts stated therein are true and correct.

SUSAN B. MURRAY
My Notary ID # 126165273
Expires June 16, 2024

Notary Public, State of Texas _____

Printed Name of Notary Susan B Murray

My Commission Expires: June 16, 2024

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ITEM NO. 403S - CONCRETE FOR STRUCTURES 9-26-12

403S.1 - Description

This item shall govern quality, storage, handling, proportioning and mixing of materials for hydraulic cement concrete construction of buildings, bridges, culverts, slabs, prestressed concrete and incidental appurtenances.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

403S.2 - Submittals

The submittal requirements of this specification item may include:

A. Mix design option(s) of the class of concrete required on the project,

B. The supplier of the concrete mix design(s) and type of mixing equipment, and

C. Type of admixtures to be used with the concrete mixes.

403S.3 - Materials

Concrete shall be composed of hydraulic cement or hydraulic cement and supplementary cementing materials, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

A. Cementitious Materials

Hydraulic cement shall conform to ASTM C 150, Type I (General Purpose), Type II (General Purpose with Moderate Sulfate Resistance) and Type III (High Early Strength). Type I shall be used when none is specified or indicated on the drawings. Type I and Type III cements shall not be used when a Type II cement is specified or indicated on the drawings. Type III cement may be used in lieu of a Type I cement, when the anticipated air temperature for the succeeding 12 hours will not exceed 60°F (15.6°C). A Type III cement shall only be used in precast concrete or when otherwise specified or allowed. All cement shall be of the same type and from the same source for a monolithic placement.

Unless otherwise specified the cementitious material content shall be limited to no more than 700 lbs. per cubic yard (417 kg per cubic meter). When supplementary cementing materials are used, cement is defined as "cement plus supplementary cementing material." Supplementary cementing materials include fly ash (DMS 4610), ultra-fine fly ash (DMS-4610), ground granulated blast furnace slag grade 100 or 120 (DMS-4620), silica fume (DMS-4630) and metakaolin (DMS-4635).

Supplementary cementing materials shall not be used when white hydraulic cement is specified.

Class C flyash shall not be used in sulfate-resistant concrete.

Hydraulic cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

When sulfate-resistant concrete is required for a project, mix design options 1, 2, 3 or 4 presented in Section 403S.8, "Mix Design Options" shall be used to develop appropriate mix design utilizing Type I/II, II, V, IP or IS cement.

B. Mixing Water

Water for use in concrete and for curing shall be potable water free of oils, acids, organic matter or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl or sulfates as SO4.

Water from the City of Austin will not require testing. Contractor may request approval of water from other sources. Contractor shall arrange for samples to be taken from the source and tested at the Contractor's expense. When water from other sources is proposed, test reports shall be provided that indicates compliance with Table 1 before use.

Table 1: Chemical Limits for Mix Water

Contaminant	Test Method	Maximum Concentration (ppm)
Chloride (CL) Prestressed concrete Bridge decks & superstructure All other concrete	ASTM D-512	 500 500 1,000
Sulfate (SO_4)	ASTM D-516	1,000
Alkalies (NA_2O + 0.658 K_2O)	ASTM D-4191 & D-4192	600
Total Solids	AASHTO T-26	50,000

Water that has an adverse effect on the air-entraining agent or any other chemical admixture or on strength or time of set of the concrete shall not be used. Water used in white Portland cement concrete shall be free from iron and other impurities, which may cause staining, or discoloration.

C. Coarse Aggregate

Coarse aggregate shall consist of durable particles of crushed or uncrushed gravel, crushed blast furnace slag, crushed stone or combinations thereof; free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material either free or as an adherent coating. When white hydraulic cement is specified, the coarse aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout.

The coarse aggregate from each source shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TXDOT Test Method TEX-413-A. The coarse aggregate from each source shall have a wear of not more than 40 percent when tested in accordance with TXDOT Test Method TEX-410-A.

Unless otherwise indicated on the drawings, the coarse aggregate from each source shall be subjected to 5 cycles of the soundness test conforming to TXDOT Test Method TEX-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

Coarse aggregate shall be washed. The Loss by Decantation (TXDOT Test Method TEX-406-A), plus allowable weight of clay lumps, shall not exceed 1 percent or the value indicated on the drawings or in the project manual, whichever is less. If material finer than the # 200 (75 micrometer) sieve is definitely established to be dust of fracture of aggregates made primarily from crushing of stone, essentially free from clay or shale as established by Part III of TXDOT Test Method TEX-406-A, the percent may be increased to 1.5. When crushed limestone coarse aggregate is used in concrete pavements, the decant may exceed 1% but not more than 3% if the material finer than the #200 (75 micrometer) sieve is determined to be at least 67% calcium carbonate in accordance with TxDoT Test Method Tex-406-A, Part III.

The coarse aggregate factor may not be more than 0.82; however, when voids in the coarse aggregate exceed 48 percent of the total rodded volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor may not be less than 0.68 except for a Class I machine extruded mix that shall not have a coarse aggregate factor lower than 0.61.

When exposed aggregate surfaces are required, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable for exposed aggregate finishes.

When tested by approved methods, the coarse aggregate including combinations of aggregates when used, shall conform to the grading requirements shown in Table 2.

Table 2: Coarse Aggregate Gradation Chart (Percent Passing)

Grade	Nom. Size	2½″ (62.5mm)	2″ (50mm)	1½″ (37.5mm)	1″ (25mm)	¾″ (19mm)	½″ (12.5mm)	3/8″ (9.5mm)	No. 4 (4.75mm)	No. 8 (2.36mm)
1	2″ (50 mm)	100	80—100	50—85		20—40			0—5	
2 (467)*	1½″(37.5 mm)		100	95—100		35—70		10—30	0—5	
3	1″ (50 mm)		100	95—100		60—90	25—60		0—5	
4 (57)*	1″ (50 mm)			100	95—100		25—60		0—10	0—5
5 (67)*	¾″ (19 mm)				100	90—100		20—55	0—10	0—5

6 (7)*	½″ (12.5 mm)					100	90—100	40—70	0—15	0—5
7	3/8″ (9.5 mm)						100	70—95	0—25	
8	3/8″ (9.5 mm)						100	95—100	20—65	0—10

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.
2. The use of recycled crushed hydraulic cement concrete as a coarse aggregate shall be limited to Concrete Classes A, B and D (see Table 5).

D. Fine Aggregate

Fine aggregate shall be washed and consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. When white hydraulic cement is specified, the fine aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps in accordance with TEX-413-A. When subjected to color test for organic impurities per TXDOT Test Method TEX-408-A, it shall not show a color darker than standard.

Unless indicated otherwise on the drawings the acid insoluble residue of fine aggregate used in slab concrete subject to direct traffic shall not be less than 60 percent by weight (mass) when tested conforming to TXDOT Test Method TEX-612-J.

Unless indicated otherwise on the Drawings, fine aggregate shall be blended, when necessary, to meet the acid insoluble residue requirement.

When blending the following equation shall be used:

Acid Insoluble (%) = {(A1)(P1)+(A2)(P2)}/100

Where:

A1 = acid insoluble (%) of aggregate 1,

A2 = acid insoluble (%) of aggregate 2,

P1 = % by weight of A1 of the fine aggregate blend, and

P2 = % by weight of A2 of the fine aggregate blend.

When tested in accordance with TxDoT Test Method Tex-401-A, the fine aggregate, including mineral filler and combinations of aggregates, when used, shall conform to the grading requirements shown in Table 3.

Table 3: Fine Aggregate Gradation Chart[1] (Grade 1 - Percent Passing)							
3/8 (9.5 mm)	No. 4 (4.75 mm)	No. 8 (2.36 mm)	No. 16 (1.18mm)	No. 30 (600 µm)	No. 50 (300 µm)	No. 100 (150 µm)	No. 200 (75 µm)
100	95—100	80—100	50—85	25—65	10—351	0—10	0—32

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.
2. The use of recycled crushed hydraulic cement concrete as a fine aggregate shall be limited to Concrete Classes A, B and D (see Table 5).
3. 6 to 35 when sand equivalent value is greater than 85.
4. 0 to 6 for manufactured sand.

Sand equivalent per TXDOT Test Method TEX-203-F shall not be less than 80 nor less than otherwise indicated on the drawings, whichever is greater.

The fineness modulus will be determined by adding the percentages by weight retained on sieve Nos. 4, 8, 16, 30, 50 and 100 (4.75 mm, 2.36 mm, 1.18mm, 600 µm, 300 µm, and 150 µm) and dividing the sum of the six sieves by 100. For all classes of concrete except K (see Table 5), the fineness modulus shall be between 2.30 and 3.10. For Class K concrete, the fineness modulus shall be between 2.40 and 2.90, unless indicated otherwise on the Drawings.

E. Mineral Filler

Mineral filler shall consist of stone dust, clean crushed sand or other approved inert material. When tested in accordance with TxDoT Test Method Tex-401-A, it shall conform to the following gradation:

Passing the No. 30 (600 µm) Sieve	100 percent
Passing the No. 200 (75 µm) Sieve	65 to 100 percent

F. Mortar and Grout

Unless otherwise specified, indicated on the drawings or approved by the Engineer or designated representative mortar and grout shall consist of 1 part cement, 2 parts finely graded sand and enough water to make the mixture plastic. When required to prevent color difference, white cement shall be added to produce color required. When required by the Engineer or designated representative, approved latex adhesive may be added to the mortar. Mortar shall be provided with a consistency such

that the mortar can be easily handled and spread by trowel. Grout shall be provided of a consistency that will flow into and completely fill all voids.

G. Admixtures

All chemical admixtures including water reducing, placticizers and air entrainment shall conform to TxDoT DMS-4640, "Chemical Admixtures for Concrete". Calcium chloride-based admixtures shall not be approved. Admixtures shall be included in the prequalified concrete admixtures list maintained by TxDot's Construction Division. High-range water-reducing admixtures (TxDoT Type F or G) and accelerating admixtures (TxDoT Type C or E) shall not be used in bridge deck concrete.

H. Air Entrainment

Unless indicated otherwise on the drawings, all concrete classes with the exception of Class B shall be air entrained in accordance with Table 8. If the air content is more than 1½ percentage points below or 3 percentage points above the required air, the load of concrete will be rejected. If the air content is more than 1½ but less than 3 percentage points above the required air, the concrete may be accepted based on strength test results.

403S.4 - Storage of Materials

A. Cement, Supplementary Cementing Materials and Mineral Filler

All cement, supplementary cementing materials and mineral filler shall be stored in separate and well ventilated, weatherproof buildings or approved bins, which will protect the material from dampness or absorption of moisture. Storage facilities shall be easily accessible and each shipment of packaged cement shall be kept separated to provide for identification and inspection. The Engineer or designated representative may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

B. Aggregates

The method of handling and storing concrete aggregates shall prevent contamination with foreign materials. If the aggregates are stored on the ground, the sites for the stockpiles shall be clear of all vegetation and shall be level. Aggregates shall be stockpiled in sizes to facilitate blending. If the aggregate is not stockpiled on a hard, non-contaminant base, the bottom 6-inch (150 mm) layer of the stockpile shall not be used without recleaning the aggregate.

When conditions require the use of 2 or more grades of coarse aggregates, separate stockpiles shall be maintained to prevent intermixing. Where space is limited, stockpiles shall be separated by walls or other appropriate barriers.

Aggregate shall be stockpiled and protected from the weather a minimum of 24 hours prior to use to minimize free moisture content. When stockpiles are too large to protect from the weather, accurate and continuous means acceptable to the Engineer or designated representative shall be provided to monitor aggregate temperature and moisture. Aggregates shall be stockpiled and handled such that segregation and contamination are minimized.

The stockpiles shall be sprinkled to control moisture and temperature as necessary. A reasonably uniform moisture content shall be maintained in aggregate stockpiles.

C. Admixtures

Admixtures shall be stored in accordance with manufacturer's recommendations and shall be protected against freezing.

D. Hot Weather Concrete Mixes

Ice may be used during hot weather concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures") to lower the concrete temperature; however, the Contractor shall

furnish a mix design acceptable to the Engineer or designated representative for class of concrete specified. The addition of ice shall not exceed 50% of the total mix water weight.

403S.5 - Measurement of Materials

Water shall be accurately metered. Fine and coarse aggregates, mineral filler, bulk cement and fly ash shall be weighed separately. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates and admixtures. Volumetric and weight measuring devices shall be acceptable to the Engineer or designated representative. Measurement of materials in non-volumetric and volumetric mixers shall conform to Section 421.4.D of TxDot Specification Item 421, "Hydraulic Cement Concrete".

Batch weighing of sacked cement is not required; however, bags, individually and entire shipments, may not vary by more than 3 percent from the specified weight of 94 pounds (42.6 kilograms) per bag. The average bag weight of a shipment shall be determined by weighing 50 bags taken at random.

403S.6 - Mix Design

The Contractor shall furnish a mix design acceptable to the Engineer or designated representative for the class of concrete required in accordance with Table 5. The mix shall be designed by a qualified commercial laboratory and signed/sealed by a registered Professional Engineer, licensed in the state of Texas to conform with requirements contained herein, to ACI 211.1 or TXDOT Bulletin C-11 (and supplements thereto). The maximum water-to-cementitious material ratio identified in Table 5 for specific classes of concrete shall not be exceeded.

A higher-strength class of concrete with equal or lower water-to-cementituous-material ratio may be substituted for the specified class of concrete.

The mix design shall be over-designed in accordance with Table 5 in order to account for production variability and to ensure minimum compressive strength requirements are met.

Allowable mix design options are presented in Section 403S.8.

The Contractor shall perform, at the Contractor's expense, the work required to substantiate the design, including testing of strength specimens. Complete concrete design data shall be submitted to the Engineer or designated representative for approval. The mix design will be valid for a period of one (1) year provided that there are no changes to the component materials.

When there are changes in aggregates or in type, brand or source of cement, supplementary cementing material or chemical admixtures, the mix shall be evaluated as a new mix design. A change in vendor does not necessarily constitute a change in materials or source. When only the brand or source of cement is changed and there is a prior record of satisfactory performance of the cement with the ingredients, the submittal of new trial batches may be waived by the Engineer or designated representative.

At the end of one (1) year, a previously approved mix may be resubmitted for approval if it can be shown that no substantial change in the component materials has occurred and that test results confirming the adequacy of the mix designs have been acquired during the previous year. The resubmittal analysis must be reviewed, signed and sealed by a registered Professional Engineer, licensed in the state of Texas. This resubmittal shall include a reanalysis of specific gravity, absorption, fineness modulus, sand equivalent, soundness, wear and unit weights of the aggregates. Provided that the fineness modulus did not deviate by more than 0.20 or that the re-proportioned total mixing water, aggregate and cement (or cement plus fly ash) are within 1, 2, and 3 percent, respectively, of pre-approved quantities, a one-year extension on the approval of the mix may be granted by the Engineer or designated representative. Updated cement, fly ash, and admixture certifications shall accompany the resubmittal.

Approved admixtures that are included in the prequalified concrete admixtures list maintained by TxDot's Construction Division may be used with all classes of concrete at the option of the Contractor provided that

specific requirements of the governing concrete structure specification are met. Water reducing and retarding agents shall be required for hot weather, large mass, and continuous slab placements. Air entraining agents may be used in all mixes but must be used in the classes indicated on Table 5. Unless approved by the Engineer or designated representative, mix designs shall not exceed air contents for extreme exposure conditions as recommended by ACI 211.1 for the various aggregate grades.

403S.7 - Consistency and Quality of Concrete

Concrete shall be workable, cohesive, possess satisfactory finishing qualities and of stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements specified in Table 4 without the development of segregation or honeycombing. No concrete will be permitted with a slump in excess of the maximums shown unless water-reducing admixtures have been previously approved. Concrete that exceeds the maximum acceptable placement slump at time of delivery will be rejected. Slump values shall be conducted in accordance with TXDOT Test Method TEX-415-A.

Consistency and quality of concrete should allow efficient placement and completion of finishing operations before initial set. Re-tempering (i.e. addition of water and reworking concrete after initial set) shall not be allowed. When field conditions are such that additional moisture is needed for final concrete surface finishing operation, the required water shall be applied to surface by fog spray only and shall be held to a minimum. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder.

Table 4: Slump Requirements

	Slump[1], inches (mm)	
Type of Construction	**Maximum**	**Minimum**
Cased Drilled Shafts	4 (100)	3 (75)
Reinforced Foundation Caissons and Footings	3 (75)	1 (25)
Reinforced Footings and Substructure Walls	3 (75)	1 (25)
Uncased Drilled Shafts	6 (150)	5 (125)
Thin-walled Sections; 9 inches (225 mm) or less	6½ (165)	4 (100)
Prestressed Concrete Members1	6½ (165)	4 (100)
Precast Drainage Structures	6 (150)	4 (100)
Wall Sections over 9 inches (225 mm)	5 (125)	3 (75)
Reinforced Building Slabs, Beams, Columns and Walls	4 (100)	1 (25)

Bridge Decks	4 (100)	2 (50)
Pavements, Fixed-form	6½ (165)	4 (100)
Pavements, Slip-form	3 (75)	1½ (37.5)
Sidewalks, Driveways and Slabs on Ground	4 (100)	2 (50)
Curb & Gutter, Hand-vibrated	3 (75)	1 (25)
Curb & Gutter, Hand-tamped or spaded	4 (100)	2 (50)
Curb & Gutter, Slip-form/extrusion machine	2 (50)	½ (12.5)
Heavy Mass Construction	2 (50)	1 (25)
High Strength Concrete	4 (100)	3 (75)
Riprap and Other Miscellaneous Concrete	6 (150)	1 (25)
Under Water or Seal Concrete	8½ (213)	6 (150)

1. Slump values when a high range water reducer (HRWR) is not used.
2. When a high range water reducer (HRWR) is used, maximum acceptable placement slump will be 9 in (225 mm).

During progress of the work, the Engineer or designated representative shall cast test cylinders as a check on compressive strength of concrete actually placed. The Engineer or designated representative may also perform slump tests, entrained air tests and temperature checks to ensure compliance with specifications.

Proportioning of all material components shall be checked prior to discharging. Excluding mortar material for pre-coating of the mixer drum [see section 403S.8.B] and adjustment for moisture content of admixtures and aggregates, material components shall fall within the range of + 1% for water, + 2% for aggregates, + 3% for cement, +2% for fly ash and within manufacturer recommended dosage rates for admixtures except that air entrainment shall be within + 1½ percentage points of the mix design requirements.

Unless otherwise specified or indicated on the drawings, concrete mix temperature shall not exceed 90°F (32°C) except in mixes with high range water reducers where a maximum mix temperature of 100°F (38°C) will be allowed. Cooling an otherwise acceptable mix by addition of water or ice during agitation will not be allowed.

Test cylinders will be required for small placements such as manholes, inlets, culverts, wing walls, etc. The Engineer or designated representative may vary the number of tests to a minimum of 1 for each 25 cubic yards (1 for each 19 cubic meters) placed over a several day period.

Test cylinders shall be required for each monolithic placement of bridge decks or superstructures, top slabs of direct traffic culverts, cased drilled shafts, structural beams and as otherwise directed by Engineer or designated representative for design strength confirmation or early form removal. Test cylinders made for early form removal or for consideration of use of structure will be at Contractor's expense, except when required by Engineer or designated representative.

A strength test shall be defined as the average breaking strength of 2 cylinders. A minimum of four test cylinders shall be prepared; two each to be tested at 7 and 28 days. Specimens will be tested conforming to TXDOT Test Method TEX-418-A. If required strength or consistency of class of concrete being produced cannot be secured with minimum cementitious material specified or without exceeding maximum water/cementitious material ratio, Contractor will be required to furnish different aggregates, use a water reducing agent, an air entraining agent or increase the cement content in order to provide concrete meeting these specifications.

Slump tests will be performed in accordance with TxDoT Test Method Tex-415-A. Entrained air tests will be performed in accordance with TxDoT Test Method Tex-416-A.

Test specimens shall be cured using the same methods and under the same conditions as the concrete represented. Design strength cylinders shall be cured conforming to TXDOT Bulletin C-11 (and supplements thereto).

When control of concrete quality is by 28-day compressive tests, job control testing will be by 7-day compressive strength tests. The minimum strength requirement for seven (7) day test will be 70 percent of the specified minimum 28-day compressive strength. If the required 7-day strength is not secured with the quantity of cement specified in Table 4, changes in the mix design shall be made and resubmitted for approval. For an occasional failure of the seven-day compressive test, the concrete may be tested at 28 days for final evaluation.

Table 5: Classes of Concrete

Class	Cement Sks Per CY	Minimum Strength, psi (MPa)		Maximum W/C Ratio[1]	Coarse Aggr. Grade[2,3,4]	Air Entrain.
		28 Days	7 Days			
A	5.0 (280 kg/m^3)	3000 (20.6)	2100 (14.5)	0.6	1,2,3,4,8	Yes
B	4.0 (225 kg/m^3)	2000 (13.8)	1400 (9.7)	0.6	2,3,4,5,6,7	No
C[5]	6.0 (335 kg/m^3)	3600(24.8)	2520 (17.4)	0.45	1,2,3,4,5,6	Yes
D	4.5 (252 kg/m^3)	2500 (17.2)	1750 (12.1)	0.6	2,3,4,5,6,7	No
H[5]	6.0 (335 kg/m^3)	As indicated	As Indicated	0.45	3,4,5,6	Yes
I	5.5 (308 kg/m^3)	3500 (24.1)	2450 (16.9)	0.45	2,3,4,5	Yes
J	2.0 (112 kg/m^3)	800 (5.5)	560 (3.9)	N/A	2,3,4,5	No

S[5]	6.0 (335 kg/m^3)	4000 (27.6)	2800 (19.3)	0.45	2,3,4,5	Yes

Notes:

1. Maximum water-cement or water-cementitious ratio by weight
2. Unless otherwise allowed, Grade 1 coarse aggregate shall only be used in massive foundations with 4-in (100-mm) minimum clear spacing between reinforcing steel bars.
3. Grade 1 coarse aggregate grading shall not be used in drilled shafts.
4. Unless otherwise allowed, Grade 8 coarse aggregate shall be used in extruded curbs.
5. Structural concrete classes.
6. When Type II cement is used in Class C, S or A concrete, the 7-day compressive strength requirement will be 2310 psi (15.9 MPa) for Class C, 2570 psi (17.7 MPa) for Class S and 1925 psi (13.3 MPa) for Class A minimum.

Table 6: Over Design Required to Meet Compressive Strength Requirements[1]

Number Of Tests[2,3]	Standard Deviation, psi (MPa)				
	300 (2.06)	400 (2.75)	500 (3.44)	600 (4.13)	700 (4.82)
15	470 (3.24)	620 (4.27)	850 (5.85)	1,120 (7.71)	1,390 (9.57)
20	430 (2.96)	580 (3.99)	760 (5.23)	1,010 (6.95)	1,260 (8.67)
30 or more	400 (2.75)	530 (3.65)	670 (4.61)	900 (6.20)	1,130 (7.78)

Notes:

1. When designing the mix, add the tabulated amounts to the minimum design strength in Table 5. Maximum water-cement or water-cementitious ratio by weight
2. Number of tests of a concrete mixture used to estimate the standard deviation of a concrete production facility. Test of another mix within 1,000 psi (6.88 MPa) of the specified strength may be used.
3. If less than 15 prior tests are available, the overdesign should be 1,000 psi (6.88 MPa) for specified strength less than 3,000 psi (20.65 MPa), 1,200 psi (8.26 MPa) for specified strengths from 3,000 to 5,000 psi (20.65 to 34.42 MPa) and 1,400 psi (9.64 MPa) for specified strengths greater than 5,000 psi (34.42 MPa).

Table 7: Expected Usage of Concrete Classes

Class	General Usage
A	Inlets, manholes, curb, gutter, curb & gutter, concrete retards, sidewalks, driveways, backup walls and anchors
B	Riprap, small roadside signs and anchors
C[5]	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, and cast-in-place concrete traffic barrier
D	Riprap
H[5]	Prestressed concrete beams, boxes, piling and precast concrete traffic barrier
J	Utility trench repair
S[5]	Bridge slabs and top slabs of direct traffic culverts

Table 8: Air Entrainment[1]

Nominal Maximum Aggregate Size In (mm)	% Air Entrainment	
	Moderate Exposure	Severe Exposure
3/8 (9.5)- Grades 7 & 8	6	7½
½ (12.5)- Grades 6	5½	7
¾ (19)- Grades 5	5	6
1 (25)- Grades 4	4½	6
1½ (37.5)- Grades 2 & 3	4½	5½
2 (50)- Grades 2	4	5

1. For specified concrete strengths above 5,000 psi (34.42 MPa) a reduction of 1 percentage point is allowed.

403S.8 - Mix Design Options

For the structural concretes identified in Table 5 (Classes C, H and S) and any other class of concrete designed using more than 520 lbs. of cementitious material per cubic yard (310 kgs per cubic meter), one of the mix design options presented below shall be used.

For the non-structural concretes identified in Table 5 (Classes A, B, D and I) and any other class of concrete designed using less than 520 lbs. of cementitious material per cubic yard (310 kgs per cubic meter), one of the mix design options presented below will be used, except that Class C fly ash may be used instead of Class F fly ash for Options 1, 3 and 4 unless a sulfate-resistant concrete is required.

A. Option 1: Twenty (20) to thirty-five (35) percent of the cement may be replaced with Class F fly ash.

B. Option 2: Thirty-five (35) to fifty (50) percent of the cement may be replaced with ground granulated blast-furnace slag.

C. Option 3: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class F fly ash, ground granulated blast-furnace slag or silica fume. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.

D. Option 4: Type IP or Type IS will be used and up to ten (10) percent of the cement may be replaced with Class F fly ash, ground granulated blast-furnace slag or silica fume.

E. Option 5: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class C fly ash and at least six (6) percent of silica fume, ultra fine fly ash or metakaolin. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.

F. Option 6: A lithium nitrate admixture will be added at a minimum dosage of 0.55 gal. of thirty (30) percent lithium nitrate solution per pound of alkalis present in the hydraulic cement.

G. Option 7: When hydraulic cement only is used in the design, the total alkali contribution from the cement in the concrete does not exceed 4.0 lbs. per cubic yard, when calculated as follows:

   alkali (lbs. per CY) = .01 (lbs cement/CY) (% Na2O equivalent in cement)

   where (% Na2O equivalent in cement) is assumed to be the maximum cement alkali content reported on the cement mill certificate.

H. Option 8: When there are deviations from Options 1 through 7, the following shall be performed:

   1. Conduct tests on both coarse and fine aggregate separately in accordance with ASTM C-1260, using 440 g of the proposed cementitious in the same proportions of hydraulic cement to supplementary cementing material to be used in the mix.

   2. Prior to use of the mix, a certified test report signed and sealed by a Professional Engineer, licensed in the state of Texas shall be submitted that demonstrates that ASTM C 1260 test results for each aggregate do not exceed 0.10 percent expansion.

403S.9 - Mixing and Mixing Equipment

All equipment, tools and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work without excessive delays for repairs and replacement. Mixing shall be done in a mixer of approved type and size that will produce uniform distribution of material throughout the mass and shall be capable of producing concrete meeting requirements of ASTM C 94, Ready-mixed Concrete and these specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities. Entire contents of the drum shall be discharged before any materials are placed therein for a succeeding batch. Improperly mixed concrete shall not be placed in

a structure. For all mixers an adequate water supply and an accurate method of measuring the water shall be provided.

The mixer may be batched by either volumetric or weight sensing equipment and shall be equipped with a suitable timing device that will lock the discharging mechanism and signal when specified time of mixing has elapsed.

A. Proportioning and Mixing Equipment

For all miscellaneous concrete placements, a mobile, continuous, volumetric mixer or a volumetric or weight batch mixer of the rotating paddle type may be used.

When approved by Engineer or designated representative in writing or when specified for use in other items, these mixers may be used for other types of concrete construction, including structural concrete, if the number of mixers furnished will supply the amount of concrete required for the particular operation in question.

These mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging.

For continuous volumetric mixers, the materials delivered during a revolution of the driving mechanism or in a selected interval, will be considered a batch and the proportion of each ingredient will be calculated in the same manner as for a batch type plant.

Mixing time shall conform to recommendations of manufacturer of mixer unless otherwise directed by Engineer or designated representative.

B. Ready-mixed Concrete

Use of ready-mixed concrete will be permitted provided the batching plant and mixer trucks meet quality requirements specified herein. When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the mixer drum. Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

1. A ticket system will be used that includes a copy for the Inspector. Ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.
2. Sufficient trucks will be available to support continuous placements. The Contractor will satisfy the Engineer or designated representative that adequate standby trucks are available to support monolithic concrete placement requirements.
3. A portion of mixing water required by the mix design to produce the specified slump may be withheld and added at the job site, but only with permission of the Engineer or designated representative and under the Inspector's observation. When water is added under these conditions, the concrete batch will be thoroughly mixed before any slump or strength samples are taken. Additional cement shall not be added at the job site to otherwise unacceptable mixes.
4. A metal plate(s) shall be attached in a prominent place on each truck mixer plainly showing the various uses for which it was designed. The data shall include the drum's speed of rotation for mixing and for agitating and the capacity for complete mixing and/or agitating only. A copy of the manufacturer's design, showing dimensions of blades, shall be available for inspection at the plant at all times. Accumulations of hardened concrete shall be removed to the satisfaction of the Engineer or designated representative.
5. The loading of the transit mixers shall not exceed capacity as shown on the manufacturer's plate attached to the mixer or 63 percent of the drum volume, whichever is the lesser volume. The

loading of transit mixers to the extent of causing spill-out en route to delivery will not be acceptable. Consistent spillage will be cause for disqualification of a supplier.

6. Excess concrete remaining in the drum after delivery and wash water after delivery shall not be dumped on the project site unless approval of the dump location is first secured from the Engineer or designated representative.

C. Volumetric Batching

Use of volumetric batched concrete will be permitted provided the batching and continuous mixing operations conform to ASTM C 685, "Concrete Made By Volumetric Batching and Continuous Mixing". This type concrete shall be made from materials continuously batched by volume, mixed in a continuous mixer and delivered to the site in a freshly mixed and unhardened state. Tests and criteria for batching accuracy and mixing efficiency shall be as specified in ASTM C 685.

1. A ticket system will be used that includes a copy for the Inspector. The ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

2. Each batching or mixing unit, or both, shall carry in a prominent place a metal plate or plates on which are plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed and the weight-calibrated constant of the machine in terms of a revolution counter or other output indicator. The mixer shall produce a thoroughly mixed and uniform concrete.

3. The batcher-mixer unit shall contain in separate compartments all the necessary ingredients needed for the manufacture of concrete. The unit shall be equipped with calibrated proportioning devices to vary the mix proportions and it shall produce concrete as required by the Work and ASTM C 685.

D. Truck-mixed Concrete

The concrete shall be mixed in a truck mixer from 70 to 100 revolutions at the mixing speed designated by the manufacturer that will produce a uniform concrete mix. The concrete shall be delivered to the project in a thoroughly mixed and uniform mass and shall be discharged with a satisfactory degree of uniformity. Additional mixing at the job site, at the mixing speed designated by the manufacturer, may be allowed by the Engineer or designated representative as long as the concrete is discharged before the drum has revolved a total of 300 revolutions after the introduction of the mixing water to the cement and the aggregates.

Re-tempering or adding concrete chemical admixtures is only permitted at the job site when concrete is delivered in a truck mixer. Water shall not be added after introduction of mixing water at the batch plant except on arrival at the job site with approval of the Engineer or designated representative, in order to adjust the slump of the concrete. When this water is added, the mix design water-cementitious-material ratio shall not be exceeded. The drum or blades shall be turned at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete. Water or chemical admixtures shall not be added to the batch after any concrete has been discharged.

When the concrete contains silica fume, mixing times and batching operations shall be adjusted as necessary to ensure that the material is completely and uniformly dispersed in the mix. The dispersion of the silica fume within the mix shall be verified in trial batches.

E. Hand-mixed Concrete

Hand mixing of concrete may be permitted for small placements or in case of an emergency and then only on authorization of the Engineer or designated representative. Hand-mixed batches shall not exceed a 4 cubic foot (0.113 cubic meters) batch in volume. Material volume ratios shall not be leaner than 1 part cement, 2 parts large aggregate, 1 part fine aggregate and enough water to produce a consistent mix with a slump not to exceed 4 inches (100 mm). Admixtures shall not be used unless specifically approved by the Engineer or designated representative.

403S.10 - Excavation, Placing of Concrete, Finishing, Curing and Backfill

Excavation, placing of concrete, finishing, curing and backfill shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill", Standard Specification Item No. 410S, "Concrete Structures" and Standard Specification Item No. 411S, "Surface Finishes for Concrete".

403S.11 - Measurement

Where measurement of concrete for a structure is not provided by another governing pay item, measurement shall be made under this specification in accordance with the following.

The quantities of concrete of the various classifications which constitute the completed and accepted structure or structures in place will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.308 cubic yards), each, square yard (square meter: 1 square yard equals 0.836 square meters) or linear foot as indicated in the Contract Documents. Measurement will be as follows:

A. General

1. Measurement based on dimensions shall be for the completed structure as measured in place. However, field-measured dimensions shall not exceed those indicated on the drawings or as may have been directed by the Engineer or designated representative in writing.
2. No deductions shall be made for chamfers less than 2 inches (50 mm) in depth, embedded portions of structural steel, reinforcing steel, nuts, bolts, conduits less than 5 inches (125 mm) in diameter, pre/post tensioning tendons, keys, water stops, weep holes and expansion joints 2 inches (50 mm) or less in width.
3. No measurement shall be made for concrete keys between adjoining beams or prestressed concrete planks.
4. No measurement shall be made for fill concrete between the ends or adjoining prestressed concrete planks/box beams at bent caps or between the ends of prestressed concrete planks/box beams and abutment end walls.
5. No measurement shall be made for inlet and junction box invert concrete.
6. No measurement shall be made for any additional concrete required above the normal slab thickness for camber or crown.

B. Plan Quantity. For those items measured for plan quantity payment, adequate calculations have been made. If no adjustment is required by Article 403S.11, additional measurements or calculations will not be required or made.

C. Measured in Place. For those items not measured for Plan Quantity payment, measurement will be made in place, subject to the requirements of Article 403S.10.A.1 above.

403S.12 - Payment

The work performed and materials furnished as prescribed by this item and measured in accordance with the applicable provisions of "Measurement" above will be paid for as follows.

The quantity to be paid for will be that quantity indicated in the contract documents and/or shown on the drawings, regardless of errors in calculations, except as may be modified by the following.

Plan Quantities will be adjusted:

A. When a complete structure element has been erroneously included or omitted from the drawings, the quantity shown on the drawings for that element will be added to or deducted from the plan quantity and included for payment. A complete structure element will be the smallest portion of a total structure

for which a quantity is included on the drawings. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

B. When the plan quantity for a complete structure element is in error by 5 percent or more, a recalculation will be made and the corrected quantity included for payment. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

C. When quantities are revised by a change in design, the "plan quantity" will be increased or decreased by the amount involved in the design change. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The party to the contract requesting the adjustment shall present to the other, a copy of the description and location, together with calculations of the quantity for the structure element involved. When this quantity is certified correct by the Engineer or designated representative, it will become the revised plan quantity.

Payment for increased or decreased costs due to a change in design on those items measured as "Cubic Yard", "Each", "Square Foot", "Square Yard" or "Linear Foot" will be determined by Change Order. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The unit prices bid for the various classes of concrete shown shall include full compensation for furnishing, hauling, and mixing all concrete material; placing, finishing and curing all concrete; all grouting, pointing and finishing; furnishing and placing drains; furnishing and placing metal flashing strips; furnishing and placing expansion joint material required by this item; and for all forms and false work, labor, tools, equipment and incidentals necessary to complete the work.

Pay Item No. 403S-CY:	(Structure or Structural Component)	Per Cubic Yard.
Pay Item No. 403S-EA:	(Structure or Structural Component)	Per Each.
Pay Item No. 403S-SY:	(Structure or Structural Component)	Per Square Yard.
Pay Item No. 403S-LF:	(Structure or Structural Component)	Per Lineal Foot.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 403S, "Concrete For Structures"	
City of Austin Standard Specification Items	
Designation	Description

Item No. 401S	Structural Excavation and Backfill
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finishes for Concrete

Texas Department of Transportation: Departmental Material Specifications

Designation	Description
DMS-4640	Chemical Admixtures for Concrete

American Association of State Highway & Transportation Officials, AASHTO Standard Method of Test for

Designation	Description
Method T 26	Quality of Water to be Used in Concrete

American Concrete Institute, ACI

Designation	Description
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

American Society for Testing and Materials, ASTM

Designation	Description
ASTM C 94	Specification For Ready-Mixed Concrete
ASTM C 150	Specification For Portland Cement
ASTM C 685	Concrete Made By Volumetric Batching and Continuous Mixing

ASTM C-1260	Standard Test Method for Potential Alkali Reactivity of Aggregates
ASTM D-512	Test Methods for Chloride Ion in Water
ASTM D-516	Test Methods for Sulfate Ion in Water
ASTM D-4191	Test Method for Sodium in Water by Atomic Absorption
ASTM D-4192	Test Method for Potassium Water by Atomic Absorption

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
TEX-203-F	Sand Equivalent Test
TEX-401-A	Sieve Analysis of Fine and Coarse Aggregate
TEX-406-A	Mineral Finer than 75 µm (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
TEX-408-A	Organic Impurities in Fine Aggregate for Concrete
TEX-410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
TEX-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
TEX-413-A	Determination of Deleterious Materials in Mineral Aggregate
TEX-415-A	Slump of Portland Cement Concrete
TEX-416-A	Air Content of Freshly-Mixed Concrete by the Pressure Method
TEX-418-A	Compressive Strength of Cylindrical Concrete Specimens
TEX-612-J	Acid Insoluble Residue

Texas Department of Transportation: Publications	
Designation	Description
Bulletin C-11	Construction Bulletin

Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4610	Fly Ash
DMS-4620	Ground Granulated Blast-Furnace Slag
DMS-4630	Silica Fume
DMS-4635	Metakaolin

RELATED CROSS REFERENCE MATERIALS	
Standard Specification Item 403S, "Concrete For Structures"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Hydraulic Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete

Item 520	Weighing and Measuring Equipment
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants
DMS-6100	Epoxy and Adhesives
DMS 8900	Fly Ash

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ITEM NO. 405S - CONCRETE ADMIXTURES 11-13-07

405S.1 - Description

This item shall govern material requirements of admixtures for Portland cement concrete.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

405S.2 - Submittals

The submittal requirements of this specification item include:

A. Type and manufacturer of any proposed admixture.

B. Certification that proposed admixture meet the requirements of this specification, ASTM C260 and ASTM C494.

C. For a specific mix design, a statement of compatibility of products shall be submitted when admixtures from multiple manufacturers are proposed.

405S.3 - Materials

All admixture submittals must be approved by the Engineer or designated representative. No admixture shall be chloride-based or have chloride(s) added in the manufacturing process. Admixtures must be pretested by the Texas Department of Transportation (TXDOT) Materials and Tests Engineer and be included in the State's current approved admixture list. All admixtures must retain an approved status through the duration of a mix design's one-year approval period.

(1) **Air Entraining Admixture:**

An "Air Entraining Admixture" is defined as a material which, when added to a concrete mixture in the proper quantity, will entrain uniformly dispersed microscopic air bubbles in the concrete mix. The admixture shall meet the requirements of ASTM Designation: C 260 modified as follows:

(a) The cement used in any series of test shall be either the cement proposed for the specific work or a "reference" Type I cement from one mill.

(b) The air entraining admixture used in the reference concrete shall be Neutralized Vinsol Resin.

(2) **Water-reducing Admixture:**

A "Water-reducing Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and required strength. This admixture shall conform to ASTM C 494, Type A.

(3) **Accelerating Admixture:**

An "Accelerating Admixture" is defined as an admixture that accelerates the setting time and the early strength development of concrete. This admixture shall conform to ASTM C 494, Type C. The accelerating admixture will contain no chlorides.

(4) **Water-reducing, Retarding Admixture:**

A "Water-reducing, Retarding Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of

a given consistency and retard the initial set of the concrete. This admixture shall conform to ASTM C 494, Type D.

(5) **High-range Water Reducing Admixtures:**

A "High-range Water Reducing Admixture", referred to as a superplasticizer, is defined as a synthetic polymer material which, when added to a low slump concrete mixture increases the slump without adversely affecting segregation, impermeability or durability of the mix. This admixture shall conform to ASTM C 494, Type F or G.

(6) **Fly Ash:**

Fly ash used in Portland cement concrete as a substitute for Portland cement or as a mineral filler shall comply with TXDOT Materials Specification D-9-8900 and be listed on TXDOT's current list of approved fly ash sources. Fly ash obtained from a source using a process fueled by hazardous waste (30 Texas Administrative Code, Section 335.1) shall be prohibited. This applies to any other specification concerning the use of fly ash. Contractor shall maintain a record of source for each batch. Supplier shall certify that no hazardous waste is used in the fuel mix or raw materials.

405S.4 - Certification and Product Information

The Contractor shall submit the name of the admixture proposed and manufacturer's certification that the selected admixtures meet the requirements of this item and of ASTM C 260 and C 494 as applicable. Admixtures for a mix design shall be of the same brand. If more than one admixture is proposed in the concrete mix, a statement of compatibility of components shall accompany certification. Manufacturer's product literature shall specify when in the batching/mixing operation the admixture must be added.

The Engineer or designated representative may request additional information such as infrared spectrophotometry scan, solids content, pH value, etc., for further consideration. Any unreported changes in formulation discovered by any of the tests prescribed herein may be cause to permanently bar the manufacturer from furnishing admixtures for Owner's work.

405S.5 - Construction Use of Admixtures

All admixtures used shall be liquid except high-range water reducers which may be a powder. Liquid admixtures shall be agitated as needed to prevent separation or sedimentation of solids; however, air agitation of Neutralized Vinsol Resin will not be allowed.

No admixture shall be dispensed on dry aggregates. Admixtures shall be dispensed at the batching site separately, but at the same time as the mixing water. Only high range water reducers may be introduced into the mix at the job site.

When other admixtures are used with fly ash, the amount of the other admixture to be used shall be based on the amount of Portland cement only and not the amount of Portland cement and fly ash.

When high-range water reducers are to be added at the job site, transit mixers shall be used. Admixture manufacturer literature shall indicate recommended mixing methods and time for the specific equipment and mix design used. The transit mix equipment shall not be loaded in excess of 63 percent of its rated capacity to ensure proper mixing of the admixture at the site. If during discharging of concrete a change in slump in excess of 30% is noted, the remaining concrete shall be rejected unless prior approval was given by the Engineer or designated representative to retemper a load with a second charge of admixture. Retempering with water shall not be allowed.

Accelerating admixtures will not be permitted in combination with Type II cement.

All mixes with air entrainment shall have a minimum relative durability factor of 80 in accordance with ASTM C 260. Dosage of air entrainment admixtures may be adjusted by the Contractor to stay within the specified tolerances for air entrainment of Standard Specification Item No. 403S, "Concrete for Structures".

405S.6 - Measurement and Payment

The requirements of this specifications shall not be measured and paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 405S, "Concrete Admixtures"	
City of Austin Standard Specifications	
Designation	Description
Item No. 403S	Concrete for Structures
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C495	Chemical Admixtures for Concrete
Texas Department of Transportation: Department Material Specification	
Designation	Description
DMS-8900	Fly Ash

RELATED CROSS REFERENCE MATERIALS
Specification Item No. 405S, "Concrete Admixtures"
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 437	Concrete Admixtures
Item 520	Weighing and Measuring Equipment
Item 522	Portland Cement Concrete Plants
Item 524	Hydraulic Cement

ITEM NO. 406S - REINFORCING STEEL 9-26-12

406S.1 - Description

This item shall govern furnishing and placement of reinforcing steel, deformed and smooth, of the size and quantity indicated on the drawings and in accordance with these specifications.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

406S.2 - Submittals

The submittal requirements of this specification item may include:

A. Evidence that the steel reinforcement producer is included on the TxDoT list of approved producing mills

B. Listing of the size, grade, type and quantity of reinforcing steel proposed for the project.

C. If welding of reinforcing steel is proposed, evidence that carbon equivalent (C.E.) of the proposed steel is at least 0.55% with a report of chemical analysis showing the percentages of elements necessary to establish C.E.

D. If epoxy coated steel is proposed, evidence that the steel reinforcement producer is included on the TxDoT list of approved epoxy coating applicators

E. If epoxy coated steel is proposed, written certification that the epoxy-coated reinforcing steel meets the requirements of this Item with a copy of the manufacturer's control tests.

F. When mechanical splices are proposed, the types of couplers proposed for use.

406S.3 - Materials

A. Approved Mills

Prior to furnishing reinforcing steel, the producing mills must be included on the list of approved producing mills that is maintained by the Construction Division of the State of Texas Department of Transportation

B. Deformed Bars and Wire Reinforcement

Unless indicated otherwise on the drawings, Bar reinforcement shall be Grade 60 and deformed. Reinforcing steel must conform to one of the following:

ASTM A615/615M, Grades 40 or 60 (300 or 420)

ASTM A996/996M, Type A, Grades 40 or 60 (300 or 420)

ASTM A996/996M, Type R, Grade 60 (420), permitted in concrete pavement only (furnished as straight bars only without bends. Bend tests are not required)

ASTM A706/706M

In cases where the provisions of this item are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this item shall govern.

The nominal size, area and weight (mass) of reinforcing steel bars covered by these specifications are as follows:

Bar Size Number 1/8 ins (mm)	Nominal Diameter, inches (mm)	Nominal Area, Sq. ins. (mm^2)	Weight/Linear Foot Lbs. (kg)
2 (6)	0.250 (6.6)	0.05 (32)	0.167 (.075)
3 (10)	0.375 (9.5)	0.11 (71)	0.376 (.171)
4 (13)	0.500 (12.5)	0.20 (127)	0.668 (.303)
5 (16)	0.625 (15.5)	0.31 (198)	1.043 (.473)
6 (19)	0.750 (19.0)	0.44 (285)	1.502 (.681)
7 (22)	0.875 (22.0)	0.60 (388)	2.044 (.927)
8 (25)	1.000 (25.5)	0.79 (507)	2.670 (2.211)
9 (29)	1.128 (28.5)	1.00 (641)	3.400 (1.542)
10 (32)	1.270 (32.0)	1.27 (792)	4.303 (1.952)
11 (36)	1.410 (36.0)	1.56 (958)	5.313 (2.410)
14 (43)	1.693 (43.0)	2.25 (1552)	7.65 (3.470)
18 (57)	2.257 (57.5)	4.00 (2565)	13.60 (6.169)

Smooth, round bars shall be designated by size number through a No. 4. Smooth bars above No. 4 shall be designated by diameter in inches.

C. Smooth Bar and Spiral Reinforcement

Smooth bars and dowels for concrete pavement must have a minimum yield strength of 60 ksi (414 MPa) and meet ASTM A615/615M. Smooth bars that are greater in diameter than a No. 3 (10 mm) designation shall conform to ASTM A615 or meet the physical requirements of ASTM A36.

Spiral reinforcement shall be either smooth or deformed bars or wire of the minimum size or gauge indicated on the drawings. Bars for spiral reinforcement shall comply with ASTM A615 Grade 40(300), ASTM A996, Type A, Grade 40 (300); or ASTM A675, Grade 80(550), meeting dimensional

requirements of ASTM A615. Smooth wire shall comply with ASTM A82, and deformed wire shall comply with ASTM A496.

D. Weldable Reinforcing Steel

Reinforcing steel to be welded must comply with ASTM A706 or have a carbon equivalent (C.E.) of at most 0.55%. A report of chemical analysis showing the percentages of elements necessary to establish C.E. is required for reinforcing steel that dose not meet ASTM A706 to be structurally welded. No tack welding will be allowed. All welding shall conform to the requirements of AWS D1.1/D1.1M.

Carbon Equivalent (C.E.) shall be calculated as follows:

C.E. = %C + 1.67*(% Mn) + .025*(% Cu) + .05*(% Ni) + .01*(%Cr) - .02*(%Mo) - .1*(%V)

Where C is carbon,

Mn is manganese

Cu is copper

Ni is nickel

Cr is chromium

Mo is molybdenum, and

V is vanadium.

The requirements above do not apply to the following miscellaneous welding applications:

Splicing reinforcing steel to extend bars in the bottom of a drilled shaft;

Attaching chairs to the reinforcing steel cage of a drilled shaft;

Armor joints and their supports;

Screed rail and form hanger supports where permitted on steel units;

Reinforcing steel to R-bars for lateral stability between prestressed beams, spirals, or bands of reinforcing bars in drilled shaft cages;

Permanent bridge deck forms;

Steel added in railing when slip-form construction is used; and

Other similar miscellaneous members that have no load carrying capacity in the completed structure.

E. Welded Wire Fabric

Wire shall conform to the requirements of the Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A 82 or A 496. Wire fabric, when used as reinforcement, shall conform to ASTM A 185 or A 497.

When wire is ordered by size numbers, the following relation between size number, diameter in inches and area shall apply unless otherwise indicated on the drawings:

Size, W Number 1/100 in^2 (mm^2)	Nominal Diameter inch (mm)	Nominal Area, sq. inches (mm^2)
31 (200)	0.628 (16.0)	0.310 (200)
30 (194)	0.618 (15.7)	0.300 (194)
28 (181)	0.597 (15.2)	0.280 (181)
26 (168)	0.575 (14.6)	0.260 (168)
24 (155)	0.553 (14.0)	0.240 (155)
22 (142)	0.529 (13.4)	0.220 (142)
20 (129)	0.505 (12.8)	0.200 (129)
18 (116)	0.479 (12.2)	0.180 (116)
16 (103)	0.451 (11.5)	0.160 (103)
14 (90)	0.422 (10.7)	0.140 (90)
12 (77)	0.391 (9.9)	0.120 (77)
10 (65)	0.357 (9.1)	0.100 (65)
8 (52)	0.319 (8.1)	0.080 (52)
7 (45)	0.299 (7.6)	0.070 (45)
6 (39)	0.276 (7.0)	0.060 (39)
5.5 (35)	0.265 (6.7)	0.055 (35)
5 (32)	0.252 (6.4)	0.050 (32)
4.5 (29)	0.239 (6.1)	0.045 (29)
4 (26)	0.226 (5.7)	0.040 (26)

3.5 (23)	0.211 (5.4)	0.035 (23)
3 (19)	0.195 (5.0)	0.030 (19)
2.5 (16)	0.178 (4.5)	0.025 (16)
2 (13)	0.160 (4.1)	0.020 (13)
1.5 (9)	0.138 (3.5)	0.015 (9.7)
1.2 (8)	0.124 (3.1)	0.012 (7.7)
1 (6)	0.113 (2.9)	0.010 (6.5)
0.5 (3)	0.080 (2.0)	0.005 (3.2)

Where deformed wire is required, the size number shall be preceded by D and for smooth wire the prefix W shall be shown.

Welded wire fabric shall be designated as follows: 6 x 12 - W16 x W8, which indicates a 6 in. (150 mm) longitudinal wire spacing and 12-in (300 mm) transverse wire spacing with smooth No. 16 (103) wire longitudinally and smooth no. 8 (52) wire transversely.

F. Epoxy Coating

Epoxy coating shall be required as indicated on the drawings. Prior to furnishing epoxy-coated reinforcing steel, the epoxy applicator must be included on the list of approved applicators that is maintained by the Construction Division of the State of Texas Department of Transportation.

The reinforcing steel shall be epoxy coated in accordance with the following.

Epoxy Coating Requirements for Reinforcing Steel

Material	Specification
Bar	ASTM A775 or A934
Wire or Fabric	ASTM A884 Class A or B
Mechanical Coupler	As indicated on the drawings
Hardware	As indicated on the drawings

The epoxy coating material and coating repair material shall comply with TxDoT's DMS-8130, "Epoxy Powder Coating for Reinforcing Steel". The applicator shall not patch more than ¼ inch total length in any foot (20 mm total length in any meter) at the applicator's plant.

The epoxy-coated reinforcing steel shall be sampled and tested in accordance with TxDoT Test Method Tex-739-I, "Sampling and Testing Epoxy Coated Reinforcing Steel".

The identification of all reinforcing steel shall be maintained throughout the epoxy coating and fabrication and until delivery to the project site.

Written certification that the epoxy-coated reinforcing steel meets the requirements of this Item shall be provided along with a copy of the manufacturer's control tests.

G. Mechanical Couplers

When mechanical splices in reinforcing steel bars are indicated on the drawings, the following types of couplers may be used:

Sleeve-filler

Sleeve-threaded

Sleeve-swaged, or

Sleeve-wedge.

H. Chairs and Supports

Chairs and Supports shall be steel, precast mortar or concrete blocks cast in molds meeting the approval of the Engineer or designated representative of sufficient strength to position the reinforcement as indicated on the drawings when supporting the dead load of the reinforcement, the weight of the workers placing concrete and the weight of the concrete bearing on the steel. Chairs shall be plastic coated when indicated on the drawings.

Chair Types and Applicable Uses	
Structural or Architectural Elements (columns, beams, walls, slabs) exposed to weather, not subjected to sand blasting, water blasting or grinding.	Galvanized steel or steel chairs with plastic coated feet.
Structural or Architectural Elements exposed to weather and subject to sand blasting, water blasting or grinding.	Stainless steel chairs.
Structural or Architectural Elements not exposed to weather or corrosive conditions.	Uncoated steel chairs

Slabs and grade beams cast on grade.	Steel chairs with a base with 9 inch^2 (58 cm^2) minimum area or sufficient area to prevent the chair from sinking into fill or subgrade. Precast mortar or concrete blocks meeting the requirements of this item may be used.

406S.4 - Bending

The reinforcement shall be bent cold, true to the shapes indicated on the drawings. Bending shall preferably be done in the shop. Irregularities in bending shall be cause for rejection. Improperly fabricated, damaged or broken bars shall be replaced at no additional expense to the City. Damaged or broken bars embedded in a previous concrete placement shall be repaired using a method approved by the Engineer or designated representative.

Unless otherwise indicated on the drawings, the inside diameter of bar bends, in terms of the nominal bar diameter (d), shall be as follows:

Bends of 90 degrees and greater in stirrups, ties and other secondary bars that enclose another bar in the bend.

Bar Number in 1/8 inches (mm)	**Diameter**
3, 4, 5 (10, 13, 16)	4d
6, 7, 8	6d

All bends in main bars and in secondary bars not covered above.

Bar Number in 1/8 inches (mm)	**Diameter**
3 thru 8 (10 thru 25)	6d
9, 10, 11 (29, 32, 36)	8d
14, 18 (43, 57)	10d

406S.5 - Tolerances

Fabricating tolerances for bars shall not be greater than shown on Standard (Detail) 406S-1.

406S.6 - Storing

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, paint, grease, oil or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross sectional area and tensile properties of a hand wire brushed specimen meets the physical requirements for the size and grade of steel indicated on the drawings.

406S.7 - Splices

Splicing of bars, except when indicated on the drawings or specified herein, will not be permitted without written approval of the Engineer or designated representative. No substitution of bars will be allowed without the approval of the Engineer or designated representative. Any splicing of substituted bars shall conform to the requirements in the Table below.

Splices not indicated on the drawings will be permitted in slabs not more than 15 inches (380 mm) in thickness, columns, walls and parapets.

Splices will not be permitted in bars 30 feet (9.1 meters) or less in plan length unless otherwise approved. For bars exceeding 30 feet (9.1 meters) in plan length, the distance center to center of splices shall not be less than 30 feet (9.1 meters) minus 1 splice length, with no more than 1 individual bar length less than 10 feet (3 meters). Splices not indicated on the drawings, but permitted hereby, shall conform to the Table below. The specified concrete cover shall be maintained at such splices and the bars placed in contact and securely tied together.

Minimum Lap Requirements		
Bar Number in 1/8 inches (mm)	**Uncoated Lap Length**	**Coated Lap Length**
3 (10)	1 foot 4 inches (0.4 meters)	2 foot 0 inches (0.610 meters)
4 (13)	1 foot 9 inches (0.533 meters)	2 foot 8 inches (0.813 meters)
5 (16)	2 foot 2 inches (0.660 meters)	3 feet 3 inches (0.991meters)
6 (19)	2 foot 7 inches (0.787 meters)	3 feet 11 inches (1.194 meters)
7 (22)	3 feet 5 inches (1.041 meters)	5 feet 2 inches (1.575 meters)
No. 8 (25)	4 feet 6 inches (1.372 meters)	6 feet 9 inches (2.057 meters)
No. 9 (29)	5 feet 8 inches (1.727 meters)	8 feet 6 inches (2.591 meters)

No. 10 (32)	7 feet 3 inches (2.210 meters)	10 feet 11 inches (3.327 meters)
No. 11 (36)	8 feet 11 inches (2.718 meters)	13 feet 5 inches (4.089 meters)

Spiral steel shall be lapped a minimum of 1 turn. Bar No. 14 and No. 18 may not be lapped.

Welded wire fabric shall be spliced using a lap length that includes an overlap of at least 2 cross wires plus 2 inches (50 mm) on each sheet or roll.

Splices using bars that develop equivalent strength and are lapped in accordance with the table above are permitted.

Welding of reinforcing bars may be used only where indicated on the drawings or as permitted herein. All welding operations, processes, equipment, materials, quality of work and inspection shall conform to the requirements indicated on the drawings. All splices shall be of such dimension and character as to develop the full strength of the bar being spliced.

End preparation for butt-welding reinforcing bars shall be done in the field, except Bar No. 6 and larger shall be done in the shop. Delivered bars shall be of sufficient length to permit this practice.

For box culvert extensions with less than 1 foot (0.3 meters) of fill, the existing longitudinal bars shall have a lap with the new bars as shown in the table above. For box culvert extensions with more than 1 foot (0.3 meters) of fill, a minimum lap of 12 inches (300 mm) will be required.

Unless otherwise indicated on the drawings, dowel bars transferring tensile stresses shall have a minimum embedment equal to the minimum lap requirements shown in the table above. Shear transfer dowels shall have a minimum embedment of 12 inches (300 mm).

406S.8 - Placement

Reinforcement shall be placed as near as possible in the position indicated on the drawings. Unless otherwise indicated on the drawings, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than ¼ inch (6 mm). Cover of concrete to the nearest surface of steel shall be as follows:

	Minimum Cover, Inches (mm)
(a) Concrete cast against and permanently exposed to earth	3 (76 mm)
(b) Concrete exposed to earth or weather:	
Bar No. 6 (19) through No. 18 bars (57)	2 (51 mm)
Bar No. 5 (16), W31 (W200) or D31 (D200) wire and smaller	1½ (38 mm)

(c) Concrete not exposed to weather or in contact with ground:	
Slabs, walls, joists:	
Bar No. 14 (43) and 18 (57)	1½ (38mm)
Bar No. 11 (36) and smaller	1 (25 mm)
Beams, columns:	
Primary reinforcement, ties, stirrups, spirals	1 ½ (38 mm)
Shells, folded plate members:	
Bar No. 6 (19) and larger	1 (25 mm)
Bar No. 5 (16), W31 (W200) or D31 (D200) wire, and smaller	1 (25 mm)

Vertical stirrups shall always pass around the main tension members and be attached securely thereto.

The reinforcing steel shall be located accurately in the forms and held firmly in place before and during concrete placement by means of bar supports that are adequate in strength and number to prevent displacement and to keep the steel at the required distance from the form surface. Bars shall be supported by means of approved galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, plastic spacers or approved precast mortar or concrete blocks when supports are in contact with removable or stay-in-place forms. Bright basic bar supports shall be used to support reinforcing steel placed in slab overlays on concrete panels or on existing concrete slabs. Bar supports in contact with soil or subgrade shall be approved.

For bar supports with plastic tips, the plastic protection must be at least 3/32 in. (2.4 mm) thick and extend upward on the wire to a point at least ½ in. (12.5 mm) above the formwork.

For approval of plastic spacers on a project, representative samples of the plastic shall show no visible indications of deterioration after immersion in a 5 percent solution of sodium hydroxide for 120 hours.

All accessories such as tie wires, bar chairs, supports, or clips used with epoxy-coated reinforcement shall be of steel, fully coated with epoxy or plastic. When approved by the Engineer or designated representative, plastic supports may also be used with epoxy-coated reinforcement.

All reinforcing steel shall be tied at all intersections, except that where spacing is less than 1 foot (300 mm) in each direction, alternate intersections only need be tied. For reinforcing steel cages for other structural members, the steel shall be tied at enough intersections to provide a rigid cage of steel. Mats of wire fabric shall overlap each other 1 full space as a minimum to maintain a uniform strength and shall be tied at the ends and edges.

Where prefabricated deformed wire mats are specified or if the Contractor requests, welded wire fabric may be substituted for a comparable area of steel reinforcing bar plan, subject to the approval of the Engineer or designated representative.

Mortar or concrete blocks shall be cast to uniform dimensions with adequate bearing area. A suitable tie wire shall be provided in each block, to be used for anchoring to the steel. Except in unusual cases and when specifically authorized by the Engineer, the size of the surface to be placed adjacent to the forms shall not exceed 2½ inches (63.5 mm) square or the equivalent thereof in cases where circular or rectangular areas are provided. Blocks shall be cast accurately to the thickness required and the surface to be placed adjacent to the forms shall be a true plane, free of surface imperfections. The blocks shall be cured by covering them with wet burlap or mats for a period of 72 hours. Mortar for blocks should contain approximately 1 part hydraulic cement to three parts sand. Concrete for blocks should contain 850 pounds of hydraulic cement per cubic yard (500 kilograms per cubic meter) of concrete

Individual bar supports shall be placed in rows at 4-ft (1.22 meters) maximum spacing in each direction. Continuous type bar supports shall be placed at 4-ft (1.22 meters) maximum spacing. Continuous bar supports shall be used with permanent metal deck forms.

The exposure of the ends of longitudinals, stirrups and spacers used to position the reinforcement in concrete pipe and in precast box culverts or storm drains is not a cause for rejection.

Reinforcing steel for bridge slabs, top slabs of direct traffic culverts, and top slabs of prestressed box beams at all intersections, except tie only alternate intersections where spacing is less than 1 ft. (300 mm) in each direction.

For steel reinforcing cages for other structural members, reinforcement shall be supported and tied in such a manner that a sufficiently rigid cage of steel is provided. Fasten mats of wire fabric securely at the ends and edges. If the cage is not adequately supported to resist settlement or floating upward of the steel, overturning of truss bars or movement in any direction during concrete placement, permission to continue concrete placement will be withheld until corrective measures are taken. Sufficient measurements shall be made during concrete placement to insure compliance with the above.

No concrete shall be deposited until the Engineer or designated representative has reviewed the placement of the reinforcing steel and all mortar, mud, dirt, etc, shall be cleaned from the reinforcement, forms, workers' boots and tools. Do not place concrete until authorized by the Engineer or designated representative

406S.9 - Handling, Placement and Repair of Epoxy-coated Reinforcement Steel

A. Handling

Systems for handling coated-reinforcement with padded contact areas shall be provided. Handling bands shall be padded to prevent damage to the coating. Bundles of coated reinforcement shall be lifted with a strongback, spreader bar, multiple supports or a platform bridge. The bundled reinforcement shall be carefully transported and stored on protective cribbing. The coated reinforcement should not be dropped or drug during handling.

B. Construction Methods

Coated reinforcement shall not be flame-cut but shall be sawn or shear-cut only when approved. Cut ends shall be coated as specified in Section C, "Repair of Coating".

Coated reinforcement steel shall not be welded or mechanically coupled except where specifically indicated on the drawings. When welding or coupling is indicated on the drawing, the epoxy coating shall be removed at least 6 in. (150 mm) beyond the weld limits before welding and 2 in. (50 mm) beyond the limits of the mechanical coupler before assembly. After the welding or coupling operation is completed the steel shall be cleaned of oil, grease, moisture, dirt, welding contamination (slag or

acid residue) and rust to a near-white finish. The existing epoxy coating shall be examined for damage and any damaged or loose epoxy shall be removed to expose sound epoxy coating.

After cleaning the coated-steel, the splice area shall be coated with epoxy repair material to a thickness of 7 to 17 mils (0.18 to 0.43 mm) after curing. A second application of the repair material shall be applied to the bar and coupler interface to ensure complete sealing of the joint.

C. Repair of Coating

The material used for coating repair shall comply with the requirements of this Item and ASTM D3963/D3963M, "Specification for Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars". Repairs shall be made in accordance with procedures recommended by the manufacturer of the epoxy coating powder. For areas to be patched, a minimum coating thickness as required for the original coating shall be applied. All visible damage to the coating shall be repaired.

Sawed and sheared ends, cuts, breaks and other damage shall be promptly repaired before additional oxidation occurs. The areas to be repaired shall be cleaned to ensure that they free from surface contaminants. Repairs shall be made in the shop or in the field as required.

406S.10 - Measurement

The measurement of quantities of reinforcement furnished and placed will be based on the calculated weight of the steel actually placed as indicated on the drawings, with no allowance made for added bar lengths for splices requested by the Contractor nor for extra steel used when bars larger than those indicated on the drawings are used or for a higher grade of steel that is substituted with the permission of the Engineer or designated representative. Tie wires and supporting devices will not be included in the calculated weights. The calculated weight of bar reinforcement will be determined using the theoretical bar weight set forth in this item.

Measurement required by a change in design will be computed as described above for the actual steel required to complete the work.

406S.11 - Payment

This item shall be paid for at the contract unit price bid per pound of "Reinforcing Steel". The unit bid price shall include full compensation for all work specified herein including furnishing, bending, fabricating, welding and placing reinforcement, for all clips, blocks, metal spacers, ties, chairs, wire or other materials used for fastening reinforcement in place and for all tools, labor, equipment and incidentals necessary to complete the work.

Reinforcing steel will generally not be paid for directly, but shall be included in the unit price bid for the items of construction in which the reinforcing steel is used.

When specified in the contract bid form as a separate pay item, this item shall be paid for at the contract unit price bid per pound of "Reinforcing Steel". The unit bid price shall include full compensation for all work specified herein including furnishing, bending, fabricating, welding and placing reinforcement, for all clips, blocks, metal spacers, ties, chairs, wire or other materials used for fastening reinforcement in place and for all tools, labor, equipment and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 406S-RC:	Reinforcing Steel	Per Pound.
Pay Item No. 406S-ERC:	Epoxy-Coated Reinforcing Steel	Per Pound.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 406S, "Reinforcing Steel"	
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM A 36/A 36M	Carbon Structural Steel
ASTM A 82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 496	Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	Deformed and Plain Billet-steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	Low- Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 775/A 775M	Epoxy-Coated Reinforcing Steel Bars
ASTM A 884/A 884M	Epoxy-Coated Steel Wire and Welded Wire Fabric For Reinforcement
ASTM A 934/A 934M	Epoxy-Coated Prefabricated Reinforcing Steel Bars
ASTM A 996/A 996M	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM D3963/D3963M	Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars
Texas Department of Transportation: Manual of Testing Procedures	

Designation	Description
Tex-739-I	Sampling and Testing Epoxy Coated Reinforcing Steel

City of Austin Standard (Details)	
Designation	Description
Standard 406S-1	Reinforced Steel Tolerances

Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS 8130	Epoxy Powder Coating for Reinforcing Steel

American Welding Society	
Designation	Description
AWS D1.1/D1.1M	Structural Welding Code

RELATED CROSS REFERENCE MATERIALS	
Standard Specification Item 406S, "Reinforcing Steel"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 360	Concrete Pavement
Item No. 403S	Concrete for Structures
Item No. 410S	Concrete Structures

Item No. 414S	Concrete Retaining Walls
Item No. 420S	Drilled Shaft Foundations
Item No. 830S	Traffic Signal Controller Foundation
Item No. 831S	Traffic Signal Drilled Shaft Foundation

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 360	Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Hydraulic Cement Concrete
Item No. 422	Reinforced Concrete Slab
Item No. 423	Retaining Walls
Item No. 440	Reinforcing Steels

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ITEM NO. 409S - MEMBRANE CURING 11-13-07

409S.1 - Description

This item shall govern curing concrete pavement, concrete base, pavement, curbs, gutters, retards, sidewalks, driveways, medians, islands, concrete riprap, cement stabilized riprap, concrete structures and other concrete as indicated by applying an impervious liquid membrane forming material.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

409S.2 - Submittals

The submittal requirements of this specification item include:

A. Type and manufacturer for all membrane curing materials proposed.

B. Proposed curing procedures.

409S.3 - Material

The liquid forming membrane curing compound shall comply with the "Standard Specification for Liquid Membrane-forming Compounds for Curing Concrete", ASTM C 309, Type 1-D clear or translucent, with fugitive dye or Type 2 white pigmented. The material shall have a minimum flash point of 80°F (26.7°C) when tested by the "Pensky-Martin Closed Cup Tester", ASTM D 93.

It shall be of such consistency that it can be satisfactorily applied as a fine mist through an atomizing nozzle by means of approved pressure spraying equipment at atmospheric temperatures above 40°F (4.4°C).

It shall be of such nature that it will not produce permanent discoloration of concrete surfaces nor react deleteriously with the concrete or its components. Type 1 compound shall contain a fugitive dye that will be distinctly visible not less than 4 hours nor more than 7 days after application.

Type 2 compound shall not settle out excessively or cake in the container and shall be capable of being mixed to a uniform consistency by moderate stirring and shall exhibit a daylight reflectance of not less than 60 percent of that of magnesium oxide when tested as indicated.

The compound shall produce a firm, continuous, uniform moisture impermeable film, free from pinholes and shall adhere satisfactorily to the surfaces of damp concrete. When applied to the damp concrete surface at the rate of coverage indicated, the compound shall dry to the touch in not more than 4 hours and shall not be tacky or track off concrete after 12 hours.

It shall adhere to horizontal and vertical surfaces in a tenacious film and shall not run off or show an appreciable sag, disintegrate, check, peel or crack during the required curing period.

Under traffic, the compound shall not pick up or peel and shall gradually disintegrate from the surface.

The compound shall be delivered to the job only in the manufacturer's original containers, which shall be clearly labeled with the manufacturer's name, the trade name of the material and a batch number or symbol with which test samples may be correlated.

The water retention test shall be in accordance with the following:

Percentage loss shall be defined as the water lost after the application of the curing material was applied. The permissible percentage moisture loss (at the rate of coverage specified herein) shall not exceed the following:

24 hours after application	2 percent
72 hours after application	4 percent

409S.4 - Measurement and Payment

The membrane curing compound shall be applied after the surface finishing has been completed and immediately after the free surface moisture has disappeared. The surface shall be sealed with a single uniform coating of the specified type of curing compound applied at the rate of coverage recommended by the manufacturer and directed by the Engineer or designated representative, but not less than 1 gallon per 180 square feet (3.8 liters per 16.7 square meters) of area. The Contractor shall provide satisfactory means and facilities to properly control and check the rate of application of the compound.

The compounds shall not be applied before the surface has become dry, but shall be applied just after free moisture has disappeared.

The compound shall be thoroughly agitated during its use and shall be applied by means of approved mechanical power pressure sprayers for street and bridge applications. The sprayers used to apply the membrane to concrete exposed surfaces shall travel at a uniform speed along the forms and be mechanically driven. The equipment shall be of such design that it will insure uniform and even application of the membrane material. The sprayers shall be equipped with satisfactory atomizing nozzles. On small miscellaneous items or on interim bridge deck curing will the Contractor be permitted to use hand-powered spray equipment. For all spraying equipment, the Contractor shall provide facilities to prevent the loss of the compound between the nozzle and the concrete surface during the spraying operations.

At locations where the coating shows discontinuities, pinholes or other defects or if rain falls on the newly coated surface before the film has dried sufficiently to resist damage, an additional coat of the compound shall be applied immediately at the same rate of coverage specified herein.

To insure proper coverage, the Engineer or designated representative shall inspect all treated areas after application of the compound for the period of time designated in the specification for curing, either for membrane curing or for other methods. Dry areas are identifiable because of the lighter color of dry concrete as compared to damp concrete. All suspected areas shall be tested by placing a few drops of water on the suspected areas. If the water stands in rounded beads or small pools which can be blown along the surface of the concrete without wetting the surface, the water impervious film is present. If the water wets the surface of the concrete as determined by obvious darkening of the surface or by visible soaking into the surface, no water-impervious film is present. Should the foregoing test indicate that any area during the curing period is not protected by the required water-impervious film an additional coat or coats of the compound shall be applied immediately and the rate of application of the membrane compound shall be increased until all areas are uniformly covered by the required water-impervious film.

The compounds shall not be applied to a dry surface and if the surface of the concrete has become dry, it shall be thoroughly moistened prior to the application of the membrane by fogging or mist application. Sprinkling or coarse spraying will not be allowed.

When temperatures are such as to warrant protection against freezing, curing by this method shall be supplemented with an approved insulating material capable of protecting the concrete for the specified curing period.

If at any time there is reason to believe that this method of curing is unsatisfactory or is detrimental to the work, the Contractor, when notified, shall immediately cease the use of this method and shall change to curing by one of the other methods specified under this contract.

Curing compounds shall be compatible with the adhesion of toppings or overlays where curing has been applied to the concrete base surface in order to assure adequate bond.

When forms are stripped before the 4 minimum curing days have passed, curing shall continue by an approved method.

409S.5 - Measurement and Payment

Membrane curing will not be measured for payment. The work and materials prescribed herein will not be paid for directly, but shall be included in the unit price bid for the item of construction in which these materials are used.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 409S, "Membrane Curing"	
American Society for Testing and Materials (ASTM)	
Designation	Description
C 309	Liquid Membrane-forming Compounds for Curing Concrete
D 93	Pensky-Martin Closed Cup Tester

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 409S, "Membrane Curing"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description

Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 437	Concrete Admixtures
Item 520	Weighing and Measuring Equipment
Item 522	Portland Cement Concrete Plants
Item 524	Hydraulic Cement

ITEM NO. 410S - CONCRETE STRUCTURES 9-26-12

410S.1 - Description

This item shall govern the construction of all types of structures involving the use of structural concrete, except where the requirements are waived or revised by other governing specifications.

All concrete structures shall be constructed in accordance with the design requirements and details indicated on the drawings, in conformity with the pertinent provisions of the items contracted for, the incidental items referred to and in conformity with the requirements herein.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

410S.2 - Submittals

The submittal requirements of this specification item may include:

Appropriate mix designs for class of concrete for each type of structure or unit;

Appropriate mortar and grout mix designs;

Product name, description, technical information and supplier of any acrylic-polymer latex admixture;

Type, supplier and certified test results for expansion joint materials;

Type of waterstop and confirmation that the product conforms to TxDoT DMS-6160;

Type and manufacturer of proposed evaporation retardant and confirmation that it meets the requirements of test results for TxDoT DMS-4650;

Type and manufacturer of proposed chemical admixtures and confirmation that it meets the requirements of test results for TxDoT DMS-4640;

Type and manufacturer of proposed curing admixtures and confirmation that it meets the requirements of test results for TxDoT DMS-4640;

Type and manufacturer of proposed chemical admixtures and confirmation that it meets the requirements of test results for TxDoT DMS-4640;

Type and manufacturer of proposed epoxy and/or adhesives and confirmation that it meets the requirements of test results for TxDoT DMS-6100;

Reinforcing steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

Contractors formwork plan for placing and consolidating concrete around wall penetrations and at locations designated as having congested reinforcing steel.

410S.3 - Materials

A. Concrete

Concrete shall conform to Item No. 403S, "Concrete for Structures".

The class of concrete for each type of structure or unit shall be as indicated on the drawings or by pertinent governing specifications.

B. Grout or Mortar

When required or shown on the drawings, mortar and grout consisting of 1 part hydraulic cement and 2 parts sand with sufficient water to provide the desired consistency shall be provided. Mortar shall be provided with a consistency that can be handled easily and spread by a trowel. Grout shall be provided with a consistency that will flow into and completely fill all voids.

C. Latex

When required an acrylic-polymer latex admixture (acrylic resin emulsion in accordance with TxDoT DMS-4640, "Chemical Admixtures for Concrete") suitable for producing polymer-modified concrete or mortar shall be provided. The latex shall not be allowed to freeze.

The following information shall be submitted for latex:

Name and information of company contact personnel,

Product name and polymer description, and

The latex shall meet the following requirements.

Table 1: LATEX ADDITIVE REQUIREMENTS

Property	Value
Total Solids, minimum, percent	47
PH	9.0 to 11.0
Brookfield viscosity (# 1 spindle @ 10 rpm), mPas, maximum	60
Butadiene Content, percent	30 to 40
Freeze-thaw stability, 2 cycles. maximum	0.1

Specification targets and production tolerances shall also be provided for the following properties.

1. viscosity (including test method and temperature reference),
2. percent solids,
3. pH,
4. specific gravity, and
5. styrene/butadiene ratio.

D. Reinforcing Steel

Reinforcing steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

E. Expansion Joint Material

The expansion joint material shall conform to the requirements of TxDoT DMS-6310, "Joint Materials and Fillers".

1. Preformed Fiber Sheets

   Unless otherwise indicated on the drawings preformed bituminous fiber material shall be provided. The preformed fiber material shall conform to the dimensions indicated on the drawings. Preformed fiber sheets shall meet the requirements of ASTM D-1751, "Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types). The requirements related to bitumen content, density and water absorption shall not apply to nonbituminous materials.

2. Joint Sealing Material

   Unless otherwise indicated on the drawings a Class 4, 5 or 7 low-modulus silicone sealant shall be provided that conforms to the requirements of TxDoT DMS-6310, "Joint Sealants and Fillers".

3. Timber Boards

   Timber boards shall be made from redwood or cypress and must be free from sapwood, knots, clustered bird's eye, checks and splits. When oven dried at 230°F (110°C) to a constant weight (mass), the density of the board shall be between 20 and 35 lbs. Per cubic foot (between 320 and 560 kgs per cubic meter)

4. Asphalt Board

   Asphalt Board shall conform to the dimensions indicated on the drawings and shall meet the description, general requirements and distortion testing of ASTM D-994, "Preformed Expansion Joint Filler for Concrete (bituminous Type)".

5. Rebonded Neoprene Filler Sheet

   Rebonded neoprene filler shall consist of ground closed cell neoprene particles, rebonded and molded into sheets of uniform thickness of the dimensions indicated on the drawings. These sheets shall meet the requirements of ASTM D-1752, Type I.

   The manufacturer shall furnish the Engineer or designated representative with certified test results as to the compliance with the above requirements.

F. Waterstop

Unless otherwise indicated on the drawings, rubber waterstops or Polyvinyl Chloride (PVC) waterstops that conform to TxDoT DMS-6160, "Waterstops, Nylon Reinforced Neoprene Sheet, and Elastomeric Pads" shall be provided.

G. Evaporation Retardants

Evaporation retardants shall conform to the requirements of TxDoT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants". The evaporation retardant must be a commercially available monomolecular film compound. The evaporation retardant shall have no adverse effect on the cement hydration process or the concrete and shall reduce surface moisture evaporation from the concrete when performing concrete operations in direct sun, wind, high temperatures, or low relative humidity. The producer of the evaporation retardant shall certify that it meets these specified requirements.

H. Curing Materials

1. Liquid Membrane Forming compounds

   Liquid Membrane Forming compounds shall conform to the requirements of TxDoT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants". The compound shall

be applied to damp concrete as a fine mist through atomizing nozzles at a wet film thickness of 8 to 9 mils (200 to 230 µm). The liquid membrane-forming compound must not react deleteriously with concrete or its components. It must produce a firm, continuous, uniform moisture-impermeable film that is free of pinholes, cracks, or other film defects. It must also exhibit satisfactory adhesion.

The consistency must be such that the compound can be applied satisfactorily by conventional or airless spray at atmospheric and material temperatures above 40°F (5°C) without thinning. When applied at the manufacturer's recommended thickness, not less than 8 mils (200 µm) wet, to vertical surfaces of damp concrete, the compound must not run off or appreciably sag. The liquid membrane-forming compound must not disintegrate, check, peel, or crack during the required curing period. It must not peel or pick up under traffic, and must disappear from the surface of the cured concrete by gradual disintegration.

2. Cotton Mats

Cotton mats shall consist of a filling material of cotton "bat" or "bats" [at least 12 oz. Per square yard (400 grams per square meter)] completely covered with unsized cloth [at least 6 oz. Per square yard (200 grams per square meter)] stitched longitudinally with continuous parallel rows of stitching spaced at less than 4 in. (100 mm), or tuft both longitudinally and transversely at intervals less than 3 in. (75 mm).

The cotton mats shall be free from tears and in good general condition. A flap at least 6 in. (150 mm) wide with two (2) thicknesses of the covering that extends along one side of the mat shall be provided.

3. Polyethylene Sheeting

The polyethylene sheeting shall be at least 4 mils thick (0.1 mm) and free from visible defects. Clear or opaque white sheeting shall be provided when the ambient temperature during curing exceeds 60°F (15°C) or when applicable to control temperature during mass pours.

4. Burlap-Polyethylene Mats

The burlap-polyethylene mats shall be made from burlap impregnated on 1 side with a film of opaque white-pigmented polyethylene, free from visible defects. The laminated mats shall have at least 1 layer of an impervious material such as polyethylene, vinyl plastic, or other acceptable material (either as a solid sheet or impregnated into another fabric) and shall be free of visible defects.

I. Chemical Admixtures

Chemical admixtures including water reducing, placticizers and air entrainment shall conform to TxDoT DMS-4640, "Chemical Admixtures for Concrete" Calcium chloride shall not be used. Admixtures shall be included in the prequalified concrete admixtures list maintained by TxDot's Construction Division.

J. City of Austin Survey Monuments

The Public Works Department may furnish permanent survey monuments to be cast in concrete as indicated on the drawings or as directed by the Engineer or designated representative.

K. Epoxy

Unless indicated otherwise on the drawings, epoxy materials shall conform to TxDoT DMS-6100, "Epoxy and Adhesives".

410S.4 - General Requirements

Before starting work, the Contractor shall inform the Engineer or designated representative fully of the construction methods the Contractor proposes to use, the adequacy of which shall be subject to the review

by the Engineer or designated representative. Drawings for forms and falsework for piers and superstructure spans over 20 feet (6 meters) long, bracing systems for girders when the overhang exceeds 3 ft. 6 in. (1 meter) and for all bridge widening details shall be submitted to the Engineer or designated representative for review, if requested. Similar drawings shall be submitted for other units of the structure, if requested by the Engineer or designated representative. The drawings shall be prepared on standard 22 inch by 36-inch (550mm by 900 mm) sheets and shall show all essential details of the proposed forms, falsework and bracing to permit a structural analysis. Four sets of such drawings will be required.

Concurrence on the part of the Engineer or designated representative in any proposed construction methods, approval of equipment or of form and falsework drawings does not relieve the Contractor of the responsibility for the safety or correctness of the Contractor's methods, adequacy of equipment or from carrying out the work in full accordance with the contract.

Unless otherwise indicated on the drawings, the requirements in the succeeding paragraphs shall govern the time sequence in which construction operations may be carried on and for the opening of completed structures to traffic:

Superstructure members, forms, falsework or erection equipment shall not be placed on the substructure before the concrete therein has attained a 3000 psi (20.7 MPa) compressive strength.

Storage of materials on completed portions of a structure will not be permitted until all curing requirements for those particular portions have been met.

No forms shall be erected on concrete footings supported by piling or drilled shafts until the concrete therein has attained a minimum compressive strength of 2500 psi (17.2 MPa). Such work may begin on spread footings after the therein has aged at least 2 curing days. Concrete may be placed as soon as the forms and reinforcing steel are approved by the Engineer or designated representative.

The support of tie beam and/or forms by falsework placed on previously placed tie beams is permissible provided such beams have attained 3000 psi (20.7 MPa) compressive strength, curing requirements are completed and the beams are properly supported to eliminate stresses not provided for in the design.

Bridges and direct traffic culverts shall not be opened to construction traffic or to the traveling public until authorized by the Engineer or designated representative in accordance with the following:

Authorization may be given after the last slab concrete has been in place at least 14 days for light construction traffic not to exceed a ¾-ton (0.68 Mg) vehicle. Authorization to place embankments to allow normal construction traffic and when necessary to the traveling public, may be given after the last slab concrete has been in place 30 days or when the minimum compressive strength (fc') has reached the 28 day strength conforming to Item No. 403S, "Concrete for Structures" or as indicated on the drawings.

410S.5 - Drains

Weep holes and roadway drains shall be installed and constructed as indicated on the drawings.

410S.6 - Expansion Joints

Joints and devices shall be used to provide for expansion and contraction of concrete slabs and shall be constructed as indicated on the drawings.

The bearing area under the expansion ends of concrete slabs and slab and girder spans shall be given a steel trowel finish and finished to the exact grades required on the drawings. The material used to separate expansion surfaces shall be as indicated on the drawings and placed so that concrete or mortar cannot be subsequently worked around or under it. The bridging of concrete or mortar around expansion joint material in bearings and expansion joints shall be prevented.

Concrete adjacent to armor joints and finger joints shall be placed carefully to avoid defective anchorage and porous or honeycombed concrete in such areas.

All open joints and joints to be filled with expansion joint material shall be constructed using forms adaptable to loosening or early removal. To avoid expansion or contraction damage to the adjacent concrete, these forms shall be loosened as soon as possible after final concrete set to permit free movement of the span without requiring full form removal.

Preformed fiber joint material or other material indicated shall be used in the vertical joints of the roadway slab, curb, median or sidewalk. The top 1-inch (25 mm) thereof shall be filled with joint sealing material, as specified herein. The sealer shall be installed in accordance with Standard Specification Item No. 413S, "Cleaning and/or Sealing Joints and Cracks (PC Concrete)" and the manufacturer's recommendations.

Prior to placing the sealing material, the vertical faces of the joint shall be cleaned of all laitance by sandblasting or by mechanical routing. Cracked or spalled edges shall be repaired. The joint shall be blown clean of all foreign material and sealed.

Where preformed fiber joint material is used, it shall be anchored to the concrete on one side of the joint by light wire or nails to prevent the material from falling out.

Finished joints shall conform to the drawing details with the concrete sections completely separated by the specified opening or joint material.

Soon after form removal and where necessary after surface finishing, all projecting concrete shall be removed along exposed edges to secure full effectiveness of the expansion joints.

410S.7 - Construction Joints

The joint formed by placing plastic concrete in direct contact with concrete that has attained its initial set shall be deemed a construction joint. The term monolithic placement shall be interpreted to mean that the manner and sequence of concrete placing shall not create construction joints.

Construction joints shall be of the type and at the locations indicated on the drawings. Additional joints will not be permitted without written authorization from the Engineer or designated representative and when authorized, shall have details equivalent to those indicated for joints in similar locations.

Unless otherwise provided, construction joints shall be square and normal to the forms. Bulkheads shall be provided in the forms for all joints, except when horizontal. All vertical construction joints shall be chamfered. All horizontal construction joints shall be routed or grooved.

Construction joints requiring the use of joint sealing material shall be as indicated on the drawings or as directed by the Engineer or designated representative. The material will be indicated on the drawings without reference to joint type.

A concrete placement terminating at a horizontal construction joint shall have the top surface roughened thoroughly as soon as practicable after initial set is attained. The surfaces at bulkheads shall be roughened as soon as the forms are removed.

The hardened concrete surface shall be thoroughly cleaned of all loose material, laitance, dirt or foreign matter and saturated with water so it is moist when placing fresh concrete against it. Remove all free water and moisten the surface before concrete or bonding grout is placed against it. Forms shall be drawn tight against the existing concrete and the joint surface flushed with grout just prior to placing the fresh concrete.

The joint surface shall be coated with bonding mortar, grout, epoxy or other material as indicated on the drawings or other items. A Type V epoxy shall be provided in accordance with TxDoT DMS-6100, "Epoxies and Adhesives" for bonding fresh concrete to hardened concrete. The epoxy shall be placed on a clean dry surface and the fresh concrete shall be placed while the epoxy is still tacky. Bonding mortar or grout shall

be placed on a surface that is saturated surface dry and the concrete shall be placed before the bonding mortar or grout dries. Other bonding agents shall be placed in accordance with the manufacturer's recommendations.

410S.8 - Foundation and Substructure

Excavation for foundations and substructure shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill".

Concrete for foundation seals, unless otherwise indicated on the drawings, shall be Class C Concrete with a coarse aggregate grade of 2, 3, 4 or 5 and placed in accordance with the requirements herein. The top of the completed seal shall not vary from plan grade or the grade established by the Engineer or designated representative.

Where a concrete seal is indicated on the Drawings, the design will be based on the normal water elevation as indicated on the Drawings. If the foundation concrete can be placed in the dry at the time of construction, the seal will not be required. If additional seal is necessary for the conditions existing during the time of construction, its thickness shall be increased as deemed necessary by the Contractor and at the Contractor's expense. If the conditions existing at the time of construction require a seal for placing the foundation concrete in the dry and none is indicated on the Drawings, the Contractor shall place an adequate seal at the Contractor's expense.

The seal shall be allowed to set for at least 36 hours before the caisson or cofferdam is dewatered, after which the top of the seal shall be cleaned of all laitance or other soft material and all high spots exceeding the above limitation shall be cut off and removed.

410S.9 - Falsework

The Contractor is totally responsible for all falsework. The Contractor shall design and construct it to safely carry the maximum anticipated loads and to provide the necessary rigidity. Details of falsework construction shall be subject to review by the Engineer or designated representative, but Engineer's review shall in no way relieve the Contractor of responsibility of the adequacy and safety of the falsework design.

All timber used in falsework centering shall be sound, in good condition and free from defects which will impair its strength. When wedges are used to adjust falsework to desired elevations, they shall be used in pairs to insure even bearing.

Sills or grillages shall be large enough to support the superimposed load without settlement and unless founded on solid rock, shale or other hard materials, precautions shall be taken to prevent yielding of the supporting material.

Falsework, which cannot be founded on a satisfactory spread footing, shall be placed on piling driven to a bearing capacity sufficient to support the superimposed load without settlement. The safe bearing capacity of piling shall be determined by test loads or by such other methods that may be required or acceptable to the Engineer or designated representative.

In general, each falsework bent shall be capped transversely by a member of proper size. A short cap section forming a T-head may be substituted to permit the removal of portions of the forms without disturbing the falsework. Caps shall be securely fastened to each pile or column in the bent and set at the proper elevation to produce, in conjunction with the use of approved wedges or jacks, permanent camber indicated on the Drawings, plus a construction camber covering allowance for deformation of the forms and falsework. The use of wedges to compensate for incorrectly cut bearing surfaces will not be permitted. Each falsework bent shall be securely braced to provide the stiffness required with the bracing securely fastened to each pile or column it crosses.

In setting falsework for arches, allowances shall be made for settlement of falsework, deflection of the arch and permanent camber. Provision shall be made by suitable wedges, sand jacks or other acceptable

devices for the controlled lowering of falsework when the arch is swung. Falsework may be required to be placed on jacks to provide for settlement correction during concrete placement.

When the falsework is no longer required, it shall be removed. Falsework piling shall be pulled or cut off not less than 2 feet (0.6 meter) below finished ground level. Falsework and piling in a stream, lake or bay shall be completely removed to a point specified by the Engineer or designated representative to prevent any obstruction to the waterway.

410S.10 - Forms

Forms for precast prestressed concrete members and for prestressed piling shall be constructed conforming to Item No. 425S, "Prestressed Concrete Structures".

A. General

Except where otherwise indicated on the drawings, forms may be of either timber or metal.

Forms for round columns exposed to view shall be of steel, except that other materials will be allowed with written permission of the Engineer or designated representative.

Forming plans shall be submitted for approval by the Engineer or designated representative. Forms shall be designed for the pressure exerted by a liquid weighing 150 pounds per cubic foot (2.4 Mega grams per cubic meter). The rate of placing the concrete shall be taken into consideration in determining the depth of the equivalent liquid. For job-fabricated forms an additional live load of 50 pounds per square foot (1.675 MPa) shall be allowed on horizontal surfaces. The maximum unit stresses shall not exceed 125 percent of the allowable stresses used by the Engineer or designated representative for the design of structures.

Formwork for wall and/or column pours equal or exceeding 8 feet (2.44 meters) shall be designed in accordance with ACI 347, "Guide to Formwork for Concrete" and sealed by a Registered Civil Engineer Licensed in the State of Texas, who is experienced in formwork design.

Commercially produced structural units used in formwork shall not exceed the manufacturer's maximum allowable working load for moment, shear or end reaction. The maximum working load shall include a live load of 35 pounds per square foot (1.175 MPa) of horizontal form surface and sufficient details and data shall be submitted for use in checking formwork details for approval.

Forms shall be practically mortar-tight, rigidly braced and strong enough to prevent bulging between supports and maintained to the proper line and grade during concrete placement. Forms shall be maintained in a manner that will prevent warping and shrinkage.

Deflections due to cast-in-place slab concrete and railing shown in the dead load deflection diagram shall be taken into account in the setting of slab forms.

All forms and footing areas shall be cleaned of any extraneous matter before placing concrete.

Permission to place concrete will not be given until all of such work is complete to the satisfaction of the Engineer or designated representative.

If, at any stage of the work, the forms show signs of bulging or sagging, the portion of the concrete causing such condition shall be removed immediately, if necessary and the forms shall be reset and securely braced against further movement.

B. Timber Forms

Lumber for forms shall be properly seasoned, of good quality and free from imperfections, which would affect its strength or impair the finished surface of the concrete. The lumber used for facing or sheathing shall be finished on at least 1 side and 2 edges and shall be sized to uniform thickness.

Form or form lumber that will be reused shall be maintained clean and in good condition. Lumber that is split, warped, bulged, or marred or that has defects that will produce inferior forms shall not be used but shall be removed from the work.

Form lining will be required for all formed surfaces, except for the inside of culvert barrels, inlets, manholes and box girders, the bottom of bridge decks between beams or girders, surfaces that are subsequently covered by backfill material or are completely enclosed and any surface formed by a single finished board. Lining will not be required when plywood forms are used.

Form lining shall be of an approved type such as masonite or plywood. Thin membrane sheeting such as polyethylene sheets shall not be used for form lining.

Forms may be constructed of plywood not less than ¾ inch (19 mm) in thickness, with no form lining required. The grain of the face plies on plywood forms shall be placed parallel to the span between the supporting studs or joists.

Plywood used for forming surfaces, which remain exposed, shall be equal to that specified as B-B Plyform Class I or Class II Exterior of the U.S. Department of Commerce Voluntary Product Standard, PS 1.

Studs and joists shall be spaced so that the facing form material remains in true alignment under the imposed loads.

Wales shall be spaced close enough to hold forms securely to the designated lines and scabbed at least 4 feet (1.22 meters) on each side of joints to provide continuity. A row of wales shall be placed near the bottom of each placement.

Facing material shall be placed with parallel and square joints and securely fastened to supporting studs.

Forms for surfaces receiving only an ordinary finish and exposed to view shall be placed with the form panels symmetrical, i.e., long dimensions set in the same direction. Horizontal joints shall be continuous.

Molding specified for chamfer strips or other uses shall be made of materials of a grade that will not split when nailed and which can be maintained to a true line without warping. Wood molding shall be mill cut and dressed on all faces. Unless indicated otherwise on the drawings, forms shall be filleted at all sharp corners and edges with triangular chamfer strips measuring ¾ inch (19 mm) on the sides.

Forms for railings and ornamental work shall be constructed to standards equivalent to first class millwork. All moldings, panel work and bevel strips shall be straight and true with neatly mitered joints designed so the finish work is true, sharp and clean cut. All forms shall be constructed to permit their removal without marring or damaging the concrete. The forms may be given a slight draft to permit ease of removal.

Metal form ties of an approved type or a satisfactory substitute shall be used to hold forms in place and shall be of a type that permits ease of removal of the metal as hereinafter specified.

All metal appliances used inside of forms for alignment purposes shall be removed to a depth of at least ½ inch (13 mm) from the concrete surface. They shall be made so the metal may be removed without undue chipping or spalling and when removed, shall leave a smooth opening in the concrete surface. Burning off of rods, bolts or ties will not be permitted.

Any wire ties used shall be cut back at least ½ inch (13 mm) from the face of the concrete and properly patched.

Devices holding metal ties in place shall be capable of developing the strength of the tie and adjustable to allow for proper alignment.

Metal and wooden spreaders, which are separate from the forms, shall be removed entirely as the concrete is being placed.

Adequate clean-out openings shall be provided for narrow walls and other locations where access to the bottom of the forms is not readily attainable.

Prior to placing concrete, the facing of all forms shall be treated with oil or other bond breaking coating of such composition that it will not discolor or otherwise injuriously affect the concrete surface. Care shall be exercised to prevent coating of the reinforcing steel.

C. Metal Forms

The foregoing requirements for timber forms as regards design, mortar-tightness, filleted corners, beveled projections, bracing, alignment, removal, reuse and wetting shall also apply to metal forms, except that these will not require lining, unless specifically indicated on the drawings.

The thickness of form metal shall be as required to maintain the true shape without warping or bulging. All bolt and rivet heads on the facing sides shall be countersunk. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete. Metal forms, which do not present a smooth surface or line up properly, shall not be used. Metal shall be kept free from rust, grease or other foreign materials.

D. Form Supports for Overhang Slabs

Form supports which transmit a horizontal force to a steel girder or beam or to a prestressed concrete beam will be permitted, but shall not be used unless a structural analysis has been made of the affect on the girder or beam and approval is granted by the Engineer or designated representative.

In normal or skewed spans with standard overhangs not exceeding 3 feet, 1 ½ inches (0.95 meter), beam bracing as shown in the drawings shall be used.

Spans in which the overhang width exceeds 3 feet, 1½ inches (0.95 meter) will require additional support for the outside beams to resist torsion. Details of the Contractor's proposed method of providing additional support shall be included with the slab forming plans submitted to the Engineer or designated representative for review and approval.

Holes in steel members for support of overhang brackets may be punched or drilled full size or may be torch cut to ¼ inch (6 mm) under size and reamed full size. In no case shall the holes be burned full size. The hole shall be left open unless indicated to be filled with a button head bolt. They shall never be filled by welding.

410S.11 - Placing Reinforcement

Reinforcement in concrete structures shall be placed carefully and accurately and rigidly supported as provided in Standard Specification Item No. 406S, "Reinforcing Steel". Reinforcing steel supports shall not be welded to I-beams or girders or stirrups of prestressed concrete beams.

410S.12 - Placing Concrete

A. General

Concrete shall not be placed when impending weather conditions would impair the quality of the finished work. If conditions of wind, humidity and temperature are such that concrete cannot be placed without the potential for shrinkage cracking, the concrete should be placed in early morning, at night or on a schedule with more favorable weather. When mixing, placing and finishing concrete is scheduled during non-daylight hours; the entire placement site should be illuminated to the satisfaction of the Engineer or designated representative.

If changes in weather conditions require protective measures after work starts, adequate shelter shall be provided to protect the concrete against damage from rainfall or from freezing temperatures as outlined in this Item. Operations during rainfall shall only be continued if approved by the Engineer or designated representative. Aggregate stockpiles shall be covered to the extent necessary to control the moisture conditions in the aggregates.

Slab concrete shall be mixed in a plant located off the structure. Carting or wheeling concrete batches over completed slabs will not be permitted until they have aged at least 4 full curing days or timber planking placed on top of the slab for the carts to traverse along. Carts shall be equipped with pneumatic tires. Curing operations shall not be interrupted for the purpose of wheeling concrete over finished slabs.

Exposed concrete surfaces, while still plastic, shall be stamped with an impression having the Contractor's name, the month and year. The stamp shall be of an approved design.

At least 1 day of curing shall be allowed after the concrete has achieved initial set before placing strain on projecting reinforcement to prevent damage to the concrete.

The storing of reinforcing or structural steel on completed roadway slabs generally shall be avoided and when permitted, shall be limited to quantities and distribution that will not induce excessive stresses.

B. Preparation of Surfaces

All forms, prestressed concrete panels, T-beams and concrete box beams on which concrete will be placed shall be thoroughly wetted before the placement of concrete. Puddles of excess water shall be removed before placing the concrete. The various surfaces shall be in a moist, saturated surface dry condition when concrete is placed on or against them.

The subgrade or foundation shall be moist before placing concrete for bridge approach slabs or other concrete placed on grade. If dry the subgrade shall be lightly sprinkled.

C. Placing Temperature

The minimum temperature of all concrete at the time of placement shall not be less than 50°F (10°C). The maximum temperature of any concrete, unless otherwise indicated on the drawings, shall not exceed 95°F (35°C) when placed. The maximum temperature of cast-in-place concrete in bridge superstructures, diaphragms, parapets, concrete portions of railing, curbs and sidewalks and direct traffic box culverts shall not exceed 85°F (30°C) when placed. Other portions of structures, when indicated on the drawings, shall require the temperature control specified.

For continuous placement of the deck on continuous steel units, the initial set of the concrete shall be retarded sufficiently to insure that it remains plastic in not less than 3 spans immediately preceding the one being placed. For simple spans, retardation shall be required only if necessary to complete finishing operations.

The consistency of the concrete as placed should allow the completion of all finishing operations without the addition of water to the surface. When conditions are such that additional moisture is needed for finishing, the required water shall be applied to the surface by fog spray only and shall be held to a minimum amount. Fog spray for this purpose may be applied with hand operated fogging equipment.

The height of free fall of concrete shall be limited to 5 feet (1.575 meters) to prevent segregation.

D. Transporting Time

The maximum time interval between the addition of cement to the batch and the placing of concrete in the forms shall not exceed the following:

Table 2: Allowable Transportation Times			
Air or Concrete Temperature whichever is higher	Maximum Time w/o Retarder	Maximum Time with Retarder	
		*Specific Applications	All others
Non-agitated Concrete			
35°F to 79°F (2°C to 26°C)	45 minutes	45 minutes	45 minutes
Over 80°F (Over 25°C)	30 minutes	45 minutes	45 minutes
Agitated Concrete			
90°F (32°C) or above	45 minutes	75 minutes	105 minutes
75°F to 89°F (24°C to 32°C)	60 minutes	90 minutes	120 minutes
35°F to 74°F (2°C to 23°C)	90 minutes	120 minutes	150 minutes

* Specific applications include Bridge decks, cased drilled shafts and slabs of direct traffic culverts

The use of an approved retarding agent in the concrete will permit the extension of each of the above temperature-time maximums by 30 minutes for bridge decks, top slabs of direct traffic culverts and cased drilled shafts and 1 hour for all other concrete except that the maximum time shall not exceed 45 minutes for non-agitated concrete.

E. Handling and Placing

The Contractor shall give the Engineer or designated representative sufficient advance notice before placing concrete in any unit of the structure to permit the review of forms, reinforcing steel placement and other preparations. Concrete shall not be placed in any unit prior to the completion of formwork and placement of reinforcement therein.

The sequence for placing concrete shall be as indicated on the drawings or as required herein. The placing shall be regulated so the pressures caused by the plastic concrete shall not exceed the loads used in the form design.

The method of handling, placing and consolidation of concrete shall minimize segregation and displacement of the reinforcement and produce a uniformly dense and compact mass. Concrete shall not have a free fall of more than 5 feet (1.5 meters), except in the case of drilled shafts, thin wall sections such as in culverts, or as allowed by other Items. Any hardened concrete spatter ahead of the plastic concrete shall be removed.

Each part of the forms shall be filled by depositing concrete as near its final position as possible. The coarse aggregate shall be worked back from the face and the concrete forced under and around the reinforcement bars without displacing them. Depositing large quantities at one point and running or working it along the forms will not be allowed.

Concrete shall be deposited in the forms in layers of suitable depth but not more than 36 inches (0.9 meter) in thickness, unless otherwise directed by the Engineer or designated representative.

Cold joints in a monolithic placement shall be avoided. The sequence of successive layers or adjacent portions of concrete shall be such that they can be vibrated into a homogeneous mass with the previously placed concrete without a cold joint. Not more than 1 hour (1 ½ hours if a normal dosage of retarding admixture is used) shall elapse between adjacent or successive placements of concrete. Unauthorized construction joints shall be avoided by placing all concrete between the authorized joints in one continuous operation.

An approved retarding agent shall be used to control stress cracks and/or authorized cold joints in mass placements where differential settlement and/or setting time may induce stress cracking, such as on false work, in deep girder stems, etc.

Openings in forms shall be provided, if needed, for the removal of laitance or foreign matter of any kind.

All forms shall be wetted thoroughly before the concrete is placed therein.

F. Consolidation

All concrete shall be carefully consolidated and the mortar flushed to the form surfaces by continuous working with immersion type vibrators. Vibrators which operate by attachment to forms or reinforcement will not be permitted, except on steel forms. At least 1 standby vibrator shall be provided for emergency use in addition to the ones required for placement. For lightweight concrete, vibrators of the high frequency type, which produce a minimum of 7000 impulses per minute, will be required.

The concrete shall be vibrated immediately after deposition. Prior to the beginning of work, a systematic spacing of the points of vibration shall be established to insure complete consolidation and thorough working of the concrete around the reinforcement, embedded fixtures and into the corners and angles of the forms. Immersion type vibrators shall be inserted vertically, at points 18 to 30 inches (450 to 750 mm) apart and slowly withdrawn. The vibrator may only be inserted in a sloping or horizontal position in shallow slabs. The entire depth of each lift shall be vibrated, allowing the vibrator to penetrate several inches (several cms) into the preceding lift. The vibrator shall not be used to move the concrete to other locations. In addition the vibrator shall not be dragged through the concrete. Concrete along construction joints shall be thoroughly consolidated by operating the vibrator along and close to but not against the joint surface. The vibration shall continue until thorough consolidation and complete embedment of reinforcement and fixtures is produced, but not long enough to cause segregation. Vibration may be supplemented by hand spading or rodding, if necessary, to insure the flushing of mortar to the surface of all forms.

G. Finishing

From the time of initial strike off until final finish is completed and required interim curing is in place, the unformed surfaces of slab concrete in bridge decks and top slab of direct traffic culverts and concrete slabs, shall be kept damp, not wet, to offset the effects of rapid evaporation of mixing water from the concrete due to wind, temperature, low humidity or combinations thereof. Fogging equipment

capable of applying water in the form of a fine fog mist, not a spray, will be required. Fogging will be applied at the times and in the manner directed by the Engineer or designated representative.

Fogging equipment may be either water pumped under high pressure or a combination of air and water, either system in combination with a proper atomizing nozzle. The equipment shall be sufficiently portable for use in the direction of any prevailing winds. The equipment shall be adapted for intermittent use to prevent excessive wetting of the surfaces.

Upon completion of the final finish, interim curing will be required for slab concrete in bridge decks and top slabs of direct traffic culverts as follows:

(1) Required water curing shall begin as soon as it can be done without damaging the concrete finish.

(2) Unless otherwise indicated on the Drawings, Type 1-D membrane curing compound that conforms to TxDoT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" shall be applied to the slab surface.

H. Installation of Dowels and Anchor Bolts

Dowels and anchor bolts shall be installed by casting them in place or by grouting with grout, epoxy, or epoxy mortar unless indicated otherwise on the drawings.

Holes for grouting shall be formed or drilled. Holes for anchor bolts shall be drilled to accommodate the bolt embedment required on the drawings. Holes for dowels shall be made at least 12 in. (300 mm) deep unless indicated otherwise on the drawings. When grout or epoxy mortar is specified the diameter of the hole shall be at least twice the dowel or bolt diameter but shall not exceed the dowel or bolt diameter plus 1 ½ in (38 mm). When epoxy is specified the hole diameter should be 1/16 to ¼ in. (1.6 to 6.35 mm) greater than the dowel or bolt diameter.

Holes for anchor bolts in piers, abutments, bents or pedestals may be drilled or formed by the insertion of oiled wooden plugs or metal sleeves in the plastic concrete. Formed holes shall be large enough to permit horizontal adjustments of the bolts. The bolts shall be carefully set in mortar. In lieu of the above, anchor bolts may be set to exact locations when the concrete is placed.

The holes shall be thoroughly cleaned of all loose material, oil, grease or other bond-breaking substance and blow them clean with filtered compressed air. When an epoxy type material is used the holes shall be in a surface dry condition. When hydraulic cement grout is used the holes shall be in a surface moist condition. The void space between the hole and the dowel or bolt shall be completely filled with grouting material. The requirements for cleaning outlined in the product specification for prepackaged systems shall be followed exactly.

The following should be used as a guide in selection of an appropriate grout, mortar, epoxy or epoxy grout.

Table 3: Guide for Selection of Epoxy, Epoxy Mortar, Grout and Epoxy Grout

Material Type	Recommendation
Epoxy, Epoxy Mortar or other prepackaged Mortar	As Approved
Cast-in-place or Grouted system	1 part hydraulic cement, 2 parts sand and sufficient water for desired consistency

Neat Epoxy	Type III epoxy per TxDoT DMS-6100, "Epoxies and Adhesives"
Epoxy Grout	Type III epoxy per TxDoT DMS-6100, "Epoxies and Adhesives"Provide grout, epoxy or epoxy mortar as the binding agent unless otherwise indicated on the drawings

410S.13 - Placing Concrete in Cold Weather

A. General

The Contractor is responsible for the protection of concrete placed under any and all weather conditions and is responsible for producing concrete equal in quality to that placed under normal conditions. Permission given by the Engineer or designated representative to allow placement of the concrete during cold weather does not relieve the Contractor of the responsibility for producing concrete equal in quality to that placed under normal conditions. Concrete placed under adverse weather conditions that proves to be unsatisfactory shall be removed and replaced at Contractor' expense.

B. Cast-in-Place Concrete

Concrete may be placed when the ambient temperature is not less than 35°F (2°C) in the shade and rising or above 40°F (4°C). Concrete shall not be placed when the ambient temperature in the shade is below 40°F (4°C) and falling unless approved by the Engineer or designated representative. Concrete shall not be placed in contact with any material coated with frost or having a temperature less than 32°F (0°C).

Aggregates shall be free from ice, frost and frozen lumps. When required, in order to produce the minimum specified concrete temperature; the aggregate and/or the water shall be heated uniformly, in accordance with the following:

The water temperature shall not exceed 180°F(82°C) and/or the aggregate temperature shall not exceed 150°F(66°C). The heating apparatus shall heat the mass of aggregate uniformly. The temperature of the mixture of aggregates and water shall be between 50°F(10°C) and 85°F(29°C) before introduction of the cement.

All concrete shall be effectively protected as follows:

1. The temperature of slab concrete of all unformed surfaces shall be maintained at 50°F(10°C) or above for a period of 72 hours from time of placement and above 40°F(4°C) for an additional 72 hours.
2. The temperature at the surface of all concrete in bents, piers, culvert walls, retaining walls, parapets, wingwalls, bottom of slabs and other similar forms shall be maintained at 40°F(4°C) or above for a period of 72 hours from time of placement.
3. The temperature of all concrete, including the bottom slabs of culverts placed on or in the ground, shall be maintained above 32°F(0°C) for a period of 72 hours from time of placement.

   Protection shall consist of providing additional covering, insulated forms or other means and if necessary, supplementing such covering with artificial heating. Avoid applying heat directly to concrete surfaces. Curing shall be provided during this period until all requirements for curing have been satisfied.

When impending weather conditions indicate the possibility of the need for such temperature protection, all necessary heating and covering material shall be on hand ready for use before permission is granted to begin placement.

Sufficient extra test specimens will be made and cured with the placement to ascertain the condition of the concrete as placed prior to form removal and acceptance.

C. Precast Concrete

A fabricating plant for precast products which has adequate protection from cold weather in the form of permanent or portable framework and covering, which protects the concrete when placed the forms and is equipped with approved steam curing facilities may place concrete under any low temperature conditions provided:

1. The framework and covering are placed and heat is provided for the concrete and the forms within 1 hour after the concrete is placed. This shall not be construed to be 1 hour after the last concrete is placed, but that no concrete shall remain unprotected longer than 1 hour.
2. Steam heat shall keep the air surrounding the concrete between 50°F (10°C) and 85°F(29°C) for a minimum of 3 hours prior to beginning the temperature rise, which is required for steam curing.

410S.14 - Placing Concrete in Hot Weather

When the temperature of the air is above 85°F (29°C), an approved retarding agent will be required in all exposed concrete, concrete used in superstructures, top slabs of direct traffic culverts and all cased drilled shafts regardless of temperatures. Concrete mix temperatures shall not exceed 90°F (32°C) except for mixes that include high range water reducers where a maximum mix temperature of 100°F (38°C) will be allowed.

If the concrete mix temperature is expected to exceed 90°F (32°C) (or 100°F (38°C) in mixes with high range water reducers) ice may be utilized to lower the concrete mix temperature. Ice may be added to the concrete mix as a portion by weight of the mix water. However the addition of ice shall not exceed 50% of the total mix water weight.

When weather conditions are such that the addition of ice at 50% of the mix water is not sufficient to reduce the concrete mix temperature to an acceptable temperature, concrete work shall not be allowed.

When ice is to be used in hot weather concrete placement, the Contractor shall furnish a mix design (Section 4.4 of Standard Specification Item 360S, "Concrete Pavement" and Section 6 of Standard Specification Item No. 403S, "Concrete for Structures") acceptable to the Engineer or designated representative for class of concrete specified on the drawings.

410S.15 - Placing Concrete in Water

Concrete shall be deposited in water only when indicated on the drawings or with written permission of the Engineer or designated representative. The forms, cofferdams or caissons shall be sufficiently tight to prevent any water current passing through the space in which the concrete is being deposited. Pumping will not be permitted during the concrete placing nor until it has set for at least 36 hours.

The concrete shall be placed with a tremie, pump or other approved method and shall not be permitted to fall freely through the water nor shall it be disturbed after it has been placed. Its surface shall be kept approximately level during placement.

The tremie shall be supported or the pump operated so that it can be easily moved horizontally to cover all the work area and vertically to control the concrete flow. The lower end of the tremie or pump hose shall be submerged in the concrete at all times.

The placing operations shall be continuous until the work is complete.

For concrete to be placed under water, the concrete mix shall be designed in accordance with Standard Specification Item No. 403S, "Concrete For Structures" with a minimum cement content of 650 lb. Per cubic yard (10.4 Mg per cubic meter). An anti-wash admixture may be included in the mix design as necessary to produce a satisfactory finished product.

410S.16 - Placing Concrete in Superstructure

A. General

Unless otherwise indicated on the drawings, simple span roadway slabs shall be placed without transverse construction joints by using a mechanical longitudinal screed or a self-propelled transverse finishing machine or a mechanical longitudinal screed. For small placements or unusual conditions such as narrow widening, variable cross-slopes, or transitions, manually operated screeding equipment may be used if approved by the Engineer or designated representative.

B. Transverse Screeding

Unless otherwise indicated on the drawings, slabs on continuous units shall be placed in one continuous operation without transverse construction joints using a longitudinal screed or a self-propelled transverse finishing machine. Rails for transverse finishing machines supported from the beams or girders shall be installed so they may be removed without damage to the slab. Bond between removable supports and the concrete shall be prevented in a manner acceptable to the Engineer or designated representative. Rail support parts, which remain embedded in the slab, shall not project above the upper mat of reinforcing steel. Rail or screed supports attached to I-beams or girders shall be subject to "General Requirements" stated above. Unless indicated otherwise on the drawings, the minimum rate of concrete placement is 30 lineal feet (9.144 lineal meters) of bridge slab per hour. The concrete shall be deposited parallel to the skew of the bridge so that all girders are loaded uniformly along their length. Slab concrete shall be deposited between the exterior beam and the adjacent beam before placing concrete in the overhang portion of the slab. Personnel and equipment shall be furnished that is capable of placing, finishing and curing the slab at an acceptable rate to ensure compliance with this Item. Concrete shall be placed in transverse strips. On profile grades greater than 1.5 %, placement shall be started at the lower end.

C. Longitudinal Screeding

The screed shall be adequately supported on a header or rail system sufficiently stable to withstand the longitudinal or lateral thrust of the equipment. Unless otherwise indicated on the drawings, temporary intermediate headers will be permitted for placements exceeding 50 feet (15.24 meters) in length for the longitudinal screed, provided the rate of placement is rapid enough to prevent a cold joint and these headers are designed for early removal to permit satisfactory consolidation and finish of the concrete at their locations. The slab concrete shall be deposited between the exterior beam and the adjacent beam before placing concrete in the overhang portion of the slab.

For longitudinal screeding, concrete shall be placed in longitudinal strips starting at a point in the center of the segment adjacent to one side, except as provided herein and the strip completed by placing uniformly in both directions toward the ends except that for spans on a grade of 1.5 percent or more, placing shall start at the lower end. The width of strips shall be such that the concrete therein will remain plastic until the adjacent strip is placed. Where monolithic curb construction is specified, the concrete shall be placed therein in proper sequence to be monolithic with the adjacent longitudinal strips of the slabs.

D. Placements on Continuous Steel Units

Unless otherwise indicated on the drawings, slabs on continuous steel units shall be placed in a single continuous operation without transverse construction joints using a mechanical longitudinal screed or a self-propelled transverse finishing machine. The initial set of the concrete shall be retarded sufficiently to ensure that concrete remains plastic in at least 3 spans immediately preceding the slab being placed. Construction joints shall be used, when required for slab placements on steel beams or

girders, as shown on the drawings. When staged placement of a slab is specified in the drawings, it shall be necessary to ensure that the previously placed concrete attains a compressive strength of 3000 psi (20.7 MPa) before placing the next stage concrete. Multiple stages may be placed in a single day if approved by the Engineer or designated representative. When drawings permit staged concrete placement without specifying a particular order of placement, a placing sequence that will not overstress any of the supporting members shall be submitted for the approval of the Engineer or designated representative.

E. Slab and Girder Units

Unless indicated otherwise on the drawings, girders, slab and curbs of slab and girder spans shall be placed monolithically. Concrete girders shall be filled first, and the slab concrete placed within the time limits specified in this Item. If a transverse screed is used, the concrete shall be placed in the stem for a short distance and then the concrete placed in transverse strips. If a longitudinal screed is used, the concrete shall be placed in the outside girder stem first beginning at the low end or side, and then continue the concrete placed in longitudinal strips.

410S.17 - Placing Concrete in Concrete Arches

Concrete shall be placed in arch rings so the loading is kept symmetrical on the falsework. The arch rings and ribs shall be placed in one continuous operation unless otherwise indicated on the drawings or permitted by the Engineer or designated representative. The spandrel walls or columns and the beams shall not be placed until the arch is swung. Floor slab, railing, parapet walls, etc., shall not be placed until all spandrels are complete. Slab placement shall be symmetrical about the transverse centerline so the loading of the arch is kept approximately symmetrical.

The placing sequence shall be as indicated on the drawings.

410S.18 - Placing Concrete in Box Culverts

In general, construction joints will be permitted only where indicated on the drawings.

Where the top slab and walls are placed monolithically in culverts more than 4 feet (1.22 meters) in clear height, an interval of not less than 1 nor more than 2 hours shall elapse before placing the top slab to allow for settlement and shrinkage in the concrete wall.

The base slab shall be trowel finished accurately at the proper time to provide a smooth uniform surface. Top slabs, which carry traffic, shall be finished as specified for roadway slabs in "Finish of Roadway Slabs", below. Top slabs of fill type culverts shall be given a reasonably smooth float finish.

410S.19 - Placing Concrete in Foundations and Substructure

Concrete shall not be placed in footings until the depth and character of the foundation has been inspected by the Engineer or designated representative and permission has been given to proceed.

Placing of concrete footings upon seal courses will be permitted after the caissons or cofferdams are free from water and the seal course cleaned. Any necessary pumping or bailing during the concrete placement shall be done from a suitable sump located outside the forms.

All temporary wales or braces inside cofferdams or caissons shall be constructed or adjusted as the work proceeds to prevent unauthorized construction joints in footings or shafts.

When footings can be placed in a dry excavation without the use of cofferdams or caissons, forms may be omitted if desired by the Contractor and approved by the Engineer or designated representative and the entire excavation filled with concrete to the elevation of the top of footing.

Concrete in columns shall be placed monolithically unless otherwise indicated on the drawings. Columns and caps and/or tie beams supported thereon may be placed in the same operation or separately. To allow for settlement and shrinkage of the column concrete, it shall be placed o the lower level of the cap or tie beam and placement delayed for not less than 1 hour nor more than 2 before proceeding with the cap or tie beam placement.

410S.20 - Treatment and Finishing of Horizontal Surfaces Except Bridge Slabs

All unformed upper surfaces shall be struck off to grade and finished. The use of mortar topping for surfaces under this classification will not be permitted.

After the concrete has been struck off, the surface shall be floated with a suitable float. Bridge sidewalks shall be given a wood float or broom finish or may be striped with a brush as specified by the Engineer or designated representative.

The tops of caps and piers between bearing areas shall be sloped slightly from the center toward the edge and the tops of abutments and transition bents sloped from the back wall to the edge, as directed by the Engineer or designated representative, so that water will drain from the surface. The concrete shall be given a smooth trowel finish. Bearing areas for steel units shall be constructed in such a manner to have a full and even bearing upon the concrete. When the concrete is placed below grade, bearing areas may be raised to grade on beds of Portland cement mortar consisting of 1 part cement, 2 parts sand and a minimum amount of water.

Bearing seat buildups or pedestals for concrete units shall be cast integrally with the cap or with a construction joint. The construction joint area under the bearing shall have the surface roughened thoroughly as soon as practical after initial set is obtained. The bearing seat buildups shall be placed using a latex based grout, an epoxy grout, or an approved proprietary bearing mortar, mixed in accordance with the manufacturer's recommendation. Pedestals shall be placed using Class C concrete, reinforced as indicated on the drawings.

The bearing area under the expansion end of concrete slabs and slab and girder spans shall be given a steel-trowel finish to the exact grades required on the drawings. Bearing areas under elastomeric bearing pads or nonreinforced bearing seat buildups shall be given a textured wood float finish. The bearing area shall not vary from a level plane more than 1/16 in. (1.6 mm) in all directions.

410S.21 - Finish of Bridge Slabs

In all roadway slab-finishing operations, camber for specified vertical curvature and transverse slopes shall be provided.

For concrete flat slab and concrete slab and girder spans cast in place on falsework, an additional amount of camber shall be provided to offset the initial and final deflections of the span indicated in the drawings. For concrete slab and girder spans using pan forms, a camber of approximately 3/8 in. for 30 ft. (9.5 mm for 9.14 meter) spans and ½ in. for 40 ft. (12.7 mm for 12.19 meter) spans shall be provided to offset initial and final deflections unless otherwise directed by the Engineer or designated representative. When dead load deflection requirements for concrete flat slab and concrete slab and girder spans not using pan forms is not indicated on the drawings, the additional amount of camber shall be 1/8 inch per 10 foot (3.2 mm per 3 meter) of span length but not to exceed ½ inch (12.7 mm).

Bridge slabs supported on prestressed concrete beams, steel beams or girders shall receive no additional camber, except that for slabs without vertical curvature, the longitudinal camber shall be approximately ¼ inch (6.35 mm).

Work bridges or other suitable facilities shall be provided from which to perform all finishing operations and to provide access, if necessary, for the Engineer or designated representative to check measurements for slab thickness and reinforcement cover.

As soon as the concrete has been placed and vibrated in a section of sufficient width to permit working, the surface shall be struck off, leveled and screeded, carrying a slight excess of concrete ahead of the screed to insure filling of all low spots. The screed shall be designed rigid enough to hold true to shape and shall have sufficient adjustments to provide for the required camber. A vibrating screed shall be used in all slabs more than 20 feet (6.1 meters) in width. A vibrating screed may be used if heavy enough to prevent undue distortion. The screeds shall be provided with a metal edge.

Longitudinal screeds shall be moved across the concrete with a saw like motion while their ends rest on headers or templates set true to the roadway grade or on the adjacent finished slab. The transverse screeds shall be moved longitudinally approximately 1/5 of the drum length for each complete out-and-back pass of the carriage.

The surface of the concrete shall be screeded a sufficient number of times and at such intervals to produce a uniform surface, true to grade and free of voids. If necessary, the screeded surface shall be worked to a smooth finish with a long handled wood or metal float of the proper size or hand floated from bridges over the slab. Floating may not be necessary if the pan float attached to a transverse screed produces an acceptable finish. Overworking the concrete surface and overuse of finish water shall be avoided.

The Contractor shall perform in the presence of the Engineer or designated representative sufficient checks with a long handled 16-foot (5 meter) straightedge on the plastic concrete to insure that the final surface will be within the specified tolerances. The check shall be made with the straightedge parallel to the centerline. Each pass thereof shall lap half of the preceding pass. All high spots shall be removed and all depressions over 1/16 inch (1.6 mm) in depth shall be filled with fresh concrete and floated. The checking and floating shall be continued until the surface is true to grade and free of depressions, high spots, voids or rough spots.

Screed-rail support holes shall be filled with concrete and finished to match the top of the slab.

The concrete surface shall be finished to a uniform texture using a carpet drag, burlap drag or broom finish. The surface shall be finished to a smooth sandy texture without blemishes, marks or scratches deeper than 1/16 inch (1.6 mm). The surface texturing shall be applied using a work bridge or platform immediately after completing the straightedge checks. The carpet or burlap drag shall be drug longitudinally along the concrete surface, adjusting the surface contact area or pressure to provide a satisfactory coarsely textured surface. A broom finish may be performed using a fine bristle broom transversely.

The concrete surface shall be coated immediately after the carpet or burlay drag, or broom finish with a single application of evaporation retardant at a rate recommended by the manufacturer. The time between the texturing at any location and subsequent application of evaporation retardant shall not exceed 10 minutes. The evaporation retardant may be applied using the same workbridge used for surface texturing. The concrete surface shall not be worked once the evaporation retardant has been applied.

Interim and final curing shall be applied in accordance with Section P410S.23, "Curing Concrete".

The Contractor is responsible for the ride quality of the finished bridge slab. The Engineer or designated representative will use a 10-ft. (3.05 meter) straightedge to verify ride quality [1/8 in. or less in 10 ft (3.2 mm or less in 3.05 meters)] and to determine locations where corrections are needed. If the Engineer or designated representative determines that the ride quality is unacceptable, then the Contractor shall submit to the Engineer or designated representative for approval a plan to produce a ride of acceptable quality. All corrections for ride-quality shall be made before saw-cutting grooves.

At the option of the Contractor or when indicated on the drawings, the hardened concrete surface of bridge slabs, bridge approach slabs and direct-traffic culverts shall be given its final texture by saw grooving to meet the above requirements after completion of the required curing period. Grooves shall be cut perpendicular to the structure centerline. The grooves shall be cut continuously across the slab to within 18 in. (450 mm) of the barrier rail, curb or median divider. At skewed metal expansion joints in bridge slabs, groove cutting shall be adjusted by using narrow-width cutting heads so that all grooves end within 6 in. (150 mm) of the joint, measured perpendicular to the centerline of the metal joint. There should not be any

ungrooved surface wider than 6 in. (150 mm) adjacent to either side of the joint. The minimum distance to the first groove, measured perpendicular to the edge of the concrete joint or from the junction between the concrete and the metal leg of the joint shall be 1 in. (25 mm), Grooves shall be continuously cut across construction joints or other joints in the concrete that are less than ½ in. (13 mm) wide. The same procedure described above shall be used where barrier rails, curbs or median dividers are not parallel to the structure centerline in order to maintain the 18-in. (450-mm) maximum dimension from the end of the grooves to the gutter line. The grooves shall be cut continuously across formed concrete joints.

When the plans require that a concrete overlay be placed on the slab (new construction) or on prestressed concrete box beams or other precast elements, a carpet drag, burlap drag or broom finish shall be given to all concrete surfaces to be overlaid. Saw grooving is not necessary in this case. An average texture depth for the finish of approximately 0.035 in. (0.9 mm) shall be provided with no individual test falling below 0.020 in. (0.5 mm), unless otherwise indicated on the drawings, when tested in accordance with TxDoT's Tex-436-A, "Measurement of Texture Depth by the Sand Patch Method". If the texture depth falls below what is specified, the finishing procedure shall be revised to produce the desired texture.

When the drawings require an asphalt seal with or without overlay on the slab (new construction), on prestressed concrete box beams or on other precast elements, all concrete surfaces to be covered shall be given a lightly textured broom or carpet drag finish, similar to a sidewalk finish having an average texture depth of approximately 0.025 inch (0.635 mm), when tested in accordance with TxDoT's Tex-436-A, ".

410S.22 - Placing Survey Monuments

The Contractor shall obtain City Survey Monuments, for a fee of 10 dollars, from the Department of Public Works, Construction Inspection Division. Monuments shall be embedded in freshly poured concrete at locations indicated on the drawings and accessible to survey equipment at the completion of the project. The monuments shall be installed flush with the adjacent concrete.

410S.23 - Curing Concrete

The Contractor shall inform the Engineer or designated representative fully of the methods and procedures proposed for curing, shall provide the proper equipment and material in adequate amounts and shall have the proposed method, equipment and material approved by the Engineer or designated representative prior to placing concrete.

Inadequate curing and/or facilities therefore shall be cause for the Engineer or designated representative to notify the Contractor, in writing, that the work is unsatisfactory and the concrete will have to be removed and replaced.

All concrete shall be cured for a period of 4 curing days except as noted herein. A curing day is a calendar day when the temperature, taken in the shade away from artificial heat is above 50°F (10°C) for at least 19 hours or on colder days if the temperature of all surfaces of the concrete is maintained above 40°F (4°C) for the entire 24 hours. The required curing shall begin when all concrete has attained its initial set. TxDoT's Tex-440-A, "Initial Time-of-Set of Fresh Concrete" may be used to establish when the concrete has attained its initial set.

Table 4: Exceptions to 4-Day Curing

Description	Type of Cement	Required Curing Days
	I or II	8

Upper Surfaces of Bridge Slabs, Top Slabs of Direct Traffic Culverts and Concrete Overlays	II or I/II	10
	All types with supplementary cementing materials	10
Concrete Piling buildups		6

For upper surfaces of bridge slabs, bridge support slabs, median and sidewalk slabs and culvert top slabs constructed using Class S Concrete (Standard Specification Item No. 403S, "Concrete for Structures") interim curing using a Type 1-D curing compound shall be applied as soon as possible after application of the evaporation retardant and after the water sheen has disappeared, but no more than 45 minutes after application of the evaporation retardant. Membrane interim curing shall be applied using a work bridge or other approved apparatus to ensure a uniform application. Final curing with water cure in accordance with this section shall start as soon as possible without damaging the surface finish. Water curing shall be maintained for the duration noted in the table above. Polyethylene sheeting, burlap-polyethylene blankets, laminated mats or insulating curing mats shall be placed in direct contact with the slab when the ambient temperature is expected to drop below 40°F (4°C) during the first 72 hours of the curing period. The curing materials will be weighed down with dry mats to maintain direct contact with the concrete and to provide insulation against cold weather. Supplemental heating or insulation may be required in cold and wet weather if the insulating cotton mats become wet or if the concrete temperature drops below the specified curing temperature. Application of heat directly to concrete surfaces shall be avoided.

For the top surface of any concrete unit upon which concrete is to be placed and bonded at a later date (i.e. stub walls, risers, etc.), only water-cure in accordance with this Section shall be used.

All other concrete shall be cured as specified in pertinent Items.

The following methods are permitted for curing concrete subject to the restrictions of this Item .

A. Form Curing

When forms are left in intimate contact with the concrete, other curing methods will not be required except for exposed surfaces and for cold weather protection.

When forms are striped before the 4-day minimum curing time has elapsed, curing shall continue by an approved method.

B. Water Curing

All exposed surfaces of the concrete shall be kept wet continuously for the required curing time. The water used for curing shall meet the requirements for concrete mixing water as indicated in Item No. 403S, "Concrete for Structures". Seawater will not be permitted. Water, which stains or leaves an unsightly residue, shall not be used.

1. Wet Mats

Wet cotton mats placed in direct contact with the slab shall be maintained for the required curing time. If needed damp burlap blankets made from 9-ounce (255 gm) stock may be placed on the damp concrete surface for temporary protection prior to the application of the cotton mats, which may be placed dry and wetted down after placement.

The mats shall be weighted down adequately to provide continuous contact with all concrete surfaces where possible. The surfaces of the concrete shall be kept wet for the required curing time. Surfaces, which cannot be cured by contact, shall be enclosed with mats, anchored positively to the forms or to the ground, so that outside air cannot enter the enclosure. Sufficient moisture shall be provided inside the enclosure to keep all surfaces of the concrete wet.

2. Water Spray

This method shall consist of overlapping sprays or sprinklers that keep all unformed surfaces continuously wet.

3. Ponding

This method requires the covering of the surfaces with a minimum of 2 inches (50 mm) of clean granular material, kept wet at all times or a minimum of 1 inch (25 mm) depth of water. Satisfactory provisions shall be made to provide a dam to retain the water or saturated granular material.

C. Membrane Curing

Unless otherwise indicated on the drawings, either Type 1-D or Type 2 membrane curing compound may be used where permitted except that Type 1-D (Resin Base Only) will be permitted for slab concrete in bridge decks and top slabs of direct traffic culverts and all other surfaces that require a higher grade of surface finish. For substructure concrete, only one Type of curing compound will be permitted on any one structure.

TABLE 5

	REQUIRED		PERMITTED	
STRUCTURE UNIT DESCRIPTION	**Water for Complete Curing**	**Membrane for Interim Curing**	**Water for Complete Curing**	**Membrane for Complete Curing**
1. Upper surfaces of Bridge Roadway, Median and Side walk Slabs, Top Slabs of Direct Traffic, and Culverts.	X	X (resin base)		
2.Top Surface of any Concrete Unit upon which Concrete is to be placed and bonded at a later interval (Stub Walls, Risers, etc.). Other Super-structure Concrete (curbs, wing- walls, Parapet Walls, etc.).	X		*X	*X
3. Top Surface of Precast and/or Pre-stressed Piling.	X	X		

4. All Substructure Concrete Culverts. Box Sewers, Inlets, Manholes, Retaining Walls, Riprap.			*X	*X

* Polyethylene Sheeting, Burlap-Polyethylene Mats or Laminated Mats in close intimate contact with the concrete surfaces, will be considered equivalent to water or membrane curing for items under 4.

The membrane curing shall be applied just after free moisture has disappeared in a single, uniform coating at the rate of coverage recommended by the manufacturer and as approved by the Engineer or designated representative, but not less than 1 gallon per 180 square feet (1 liter per 4.4 square meters) of area. Tests for acceptance shall be at this specified rate.

Membrane curing shall not be applied to dry surfaces, but shall be applied just after free moisture has disappeared. Formed surfaces and surfaces which have given a first rub shall be dampened and shall be moist at the time of application of the membrane.

When membrane is used for complete curing, the film shall remain unbroken for the minimum curing period specified. Membrane, which is damaged, shall be corrected immediately by reapplication of membrane. Polyethylene sheeting, burlap-polyethylene mats or laminated mats in close intimate contact with the concrete surfaces, will be considered equivalent to membrane curing. Unless otherwise indicated on the drawing, the choice of membrane type shall be at the option of the Contractor, except that the Engineer or designated representative may require the same curing method for like portions of a single structure.

410S.24 - Removal of Forms and Falsework

Unless otherwise indicated on the drawing, forms for vertical surfaces may be removed when the concrete has aged 12 hours after initial set, provided it can be done without damage to the concrete. Forms for mass concrete placements shall be maintained in place for 4-days following concrete placement. Mass placements are defined as concrete placements with a least dimension greater than equal to 5 ft. (1.575 meters), or those designated as such on the drawings.

Forms for inside curb faces may be removed in approximately 3 hours provided it can be done without damage to the curb.

Unless indicated otherwise on the drawings weight supporting forms and falsework spanning more than 1 ft. (300 mm) for structures, bridge components and culvert slabs shall remain in place until the concrete has attained a minimum compressive strength of 2500 psi (17.25 MPa). Forms for other structural components may be removed as specified by the Engineer or designated representative.

Inside forms (walls and top slabs) for inlets, box culverts and sewers may be removed after the concrete has attained a minimum compressive strength of 1800 psi (12.4 MPa), provided an overhead support system, approved by the Engineer or designated representative, is used to transfer the weight (mass) of the top slab to the walls of the box culvert or sewer before the support provided by the forms is removed.

If all test cylinders made for the purpose of form removal have been broken without attaining the required strength, forms shall remain in place for a total of 14 curing days.

The above provisions relative to form removal shall apply only to forms or parts thereof which are constructed to permit removal without disturbing forms or falsework required to be left in place for a longer period on other portions of the structure.

Remove all metal appliances used inside forms for alignment shall be removed to a depth of at least ½ in. (13 mm) from the concrete surface. The appliances shall be manufactured to allow the removal without undue chipping or spalling of the concrete, and so that it leaves a smooth opening in the concrete surface when removed. Rods, bolts and ties shall not be burned-off.

Backfilling against walls of Type I or Type II cement shall not take place for a minimum of 7 days. Backfilling against walls of Type III cement shall not take place until the cylinder compressive strength has reached 3000 psi (20.7 MPa) or the wall has cured for 5 days.

All forms and falsework shall be removed unless indicated otherwise on the drawings.

410S.25 - Defective Work

Any defective work discovered after the forms have been removed shall be repaired as soon as possible in accordance with "Finishing Exposed Surfaces", below.

If the surface of the concrete is bulged, uneven or shows excess honeycombing or form marks, which in the opinion of the Engineer or designated representative, cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

410S.26 - Finishing Exposed Surfaces

A. Ordinary Surface Finish

An Ordinary Surface Finish shall be applied to all concrete surfaces either as a final finish or preparatory to a higher grade or class of finish. Higher grades and classes of finish shall conform to Item No. 411S, "Surface Finishes for Concrete". Where neither a grade or class of finish is specified, an Ordinary Surface Finish only, will be required.

Ordinary Surface Finish shall be provided as follows:

1. After formal removal, all porous, honeycombed areas and spalled areas shall be corrected by chipping away all loose or broken material to sound concrete.
2. Featheredges shall be eliminated by saw-cutting and chipping spalled areas to a depth at least ½ in. (13 mm) deep perpendicular to the surface. Shallow cavities shall be repaired using a latex adhesive grout, cement mortar or epoxy grout approved by the Engineer or designated representative. If judged repairable by the Engineer or designated representative, large defective areas shall be corrected using concrete or other material approved by the Engineer or designated representative.
3. Holes and spalls caused by removal of form ties, etc., shall be cleaned and filled with latex adhesive grout, cement mortar or epoxy grout approved by the Engineer or designated representative. Only the holes shall be filled. The patch shall not be blended with the surrounding concrete. On surfaces to receive a rub finish in accordance with Standard Specification Item No. 411S, "Surface Finishes for Concrete" the exposed parts of metal chairs shall be chipped out to a depth of ½ inch (13 mm) and the surface repaired.
4. All fins, runs, drips or mortar that will be exposed shall be removed from surfaces. Form marks and chamfer edges shall be smoothed by grinding and/or dry rubbing.
5. Grease, oil, dirt, curing compound, etc., shall be removed from surfaces requiring a higher grade of finish. Discolorations resulting from spillage or splashing of asphalt, paint or other similar material shall be removed.
6. Repairs shall be dense, well bonded and properly cured and when made on surfaces, which remain exposed and do not require a higher finish, shall be finished to blend with the surrounding concrete.

Unless otherwise indicated on the drawings Ordinary Surface Finish shall be the final finish for the following exposed surfaces:

1. inside and top of inlets,
2. inside and top of manholes,
3. inside of sewer appurtenances,
4. inside of culvert barrels,
5. bottom of bridge decks between beams or girders,
6. vertical and bottom surfaces of interior concrete beams or girders.

B. Rubbed Finish

In general, the following areas shall require a rubbed finish and shall receive a first and second rubbing:

1. The top, exterior and roadway facia of curbs and parapet walls.
2. All concrete surfaces of railing.
3. The exterior vertical facia of slab spans, rigid frames, arches and box girders.
4. The outside and bottom surfaces of facia beams or girders (except precast concrete beams).
5. The underside of overhanging slabs to the point of juncture of the supporting beams.
6. All vertical surfaces of piers, columns, bent caps, abutments, wing walls and retaining walls which are exposed to view after all backfill and embankments is placed.
7. Exposed formed surfaces of inlet and outlet structures on culverts, transition structures, headwalls and inlets.
8. Such other surfaces specified elsewhere to receive a rubbed finish and such additional surfaces required by the Engineer or designated representative to receive a rubbed finish.

After removal of forms and as soon as the mortar used in pointing has set sufficiently, surfaces to be rubbed shall be wet with a brush and given a first surface rubbing with a medium coarse carborundum stone. This rubbing shall be done before the concrete has cured more than 48 hours.

The second rubbing shall present a cleaned uniform appearance free from drip marks and discoloration. It shall be given with a No.30 carborundum stone or an abrasive of equal quality.

If the Contractor elects to use epoxy paint in lieu of the second rubbings the Contractor may do so upon approval of the Engineer or designated representative.

C. Special Surface Finishes

Striated, exposed aggregate and other special surface finishes shall conform to Standard Specification Item No. 411S, "Surface Finishes for Concrete" and/or with the requirements indicated on the drawings.

410S.27 - Measurement and Payment

No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 410S, "Concrete Structures"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 360S	Concrete Pavement
Item No. 401S	Structural Excavation and Backfill
Item No. 403S	Concrete for Structures
Item No. 406S	Reinforcing Steel
Item No. 411S	Surface Finishes for Concrete
Item No. 413S	Cleaning and/or Sealing Joints and Cracks (PC Concrete)
Item No. 425S	Prestressed Concrete Structures
U.S. Department of Commerce Voluntary Product Standard, PS 1 American Concrete Institute	
Designation	Description
ACI 347	Guide to Formwork for Concrete
American Society for Testing and Materials (ASTM)	
Designation	Description

ASTM D-994	Preformed Expansion Joint Filler for Concrete (bituminous Type)
ASTM D-1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D-1752	Prefprmed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

Texas Department of Transportation: Departmental Material Specifications

Designation	Description
DMS-4640	Chemical Admixtures for Concrete
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants"
DMS-6100	Epoxy and Adhesives
DMS-6160	Waterstops, Nylon Reinforced Neoprene Sheet, and Elastomeric Pads
DMS-6310	Joint Materials and Fillers

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-436-A	Measurement of Texture Depth by the Sand Patch Method
Tex-440-A	Initial Time-of-Set of Fresh Concrete

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 410S, "Concrete Structures"

American Society for Testing and Materials, ASTM

Designation	Description
A 36/A 36M	Carbon Structural Steel
A 82	Steel Wire, Plain, for Concrete Reinforcement
A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A 496	Steel Wire, Deformed, for Concrete Reinforcement
A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
A 615/A 615M	Deformed and Plain Billet-steel Bars for Concrete Reinforcement
A 675/A 675M	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
A 706/A 706M	Low- Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A 775/A 775M	Epoxy-Coated Reinforcing Steel Bars
A 884/A 884M	Epoxy-Coated Steel Wire and Welded Wire Fabric For Reinforcement
A 934/A 934M	Epoxy-Coated Prefabricated Reinforcing Steel Bars
A 996/A 996M	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
D3963/D3963M	Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-739-I	Sampling and Testing Epoxy Coated Reinforcing Steel

City of Austin Standard (Details)

Designation	Description
Standard 406S-1	Reinforced Steel Tolerances

Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS 8130	Epoxy Powder Coating for Reinforcing Steel

City of Austin Standard Specification Items	
Designation	Description
Item No. 404S	Pneumatically Placed Concrete
Item No. 407S	Fibrous Concrete
Item No. 414S	Concrete Retaining Walls
Item No. 420S	Drilled Shaft Foundations

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 360	Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Hydraulic Cement Concrete
Item No. 422	Reinforced Concrete Slab
Item No. 423	Retaining Walls
Item No. 440	Reinforcing Steels

ITEM NO. 720S - METAL FOR STRUCTURES 9-26-12

720S.1 - Description

This item shall govern all structural and miscellaneous steel, anchor bolts, and miscellaneous metals used in structures. Reinforcing steel (Item 406S) and other structural materials are not included.

This specification is optional and is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

720S.2 - Submittals

The submittal requirements of this specification item include:

A. Certification or mill test reports indicating that all materials supplied are in accordance with this specification.

B. Any material proposed for use and not designated herein, including type and trade name for any material not generically specified by the American Society for Testing and Materials (ASTM). Submittal shall include material specification and technical data as required to show that the proposed material meets the intent of those specified herein.

C. When SI unit bolts are proposed for use on a project, submit sizing of bolt(s) and the U.S. Customary Unit (USCU) bolt size(s) the SI unit bolt(s) will be substituted for. Note: although this specification includes ASTM standards for both USCU and SI, there is no conversion between these standards; each contains a different set of bolts with different physical size characteristics. When SI unit bolts are used, appropriately sized SI unit nuts and washers shall also be provided.

720S.3 - Structural Steel for Main Members

Unless otherwise indicated, structural steel for main members shall conform to the longitudinal Charpy V-notch (CVN) requirements in accordance with Table A. Sampling and testing shall be in accordance with ASTM A673 (A673M).

A. Structural Steel

When indicated as Structural Steel, the material shall conform to ASTM A 36 (A36M), with a minimum specified yield strength of 36 ksi (250 MPa).

B. High Strength Structural Steel (HS)

When indicated as Structural Steel-HS, the material shall have a minimum required yield strength of 50 ksi (345 MPa), conforming to one of the following ASTM specifications:

1. ASTM A 572 (A572M).
2. ASTM A 588 (A588M).
3. ASTM A709 (A709M).
4. ASTM A992 (A992M).

C. Extra High Strength Structural Steel (XHS)

When indicated as Structural Steel-XHS, the material shall have a minimum specified yield strength of 90 ksi (620 MPa), conforming to one of the following ASTM specifications:

1. ASTM A 514 (A514M). Structural shapes and seamless tubing, meeting the requirements of A514 (A514M) will be permitted with a maximum tensile strength of 140 ksi (965 MPa) for structural shapes and 145 ksi (1,000 MPa) for seamless tubing.
2. ASTM A 517 (A517M).

   ASTM A514 (A514M) and ASTM A517 (A517M) steels are considered weldable.

TABLE A

Min. Spec. Yield Strength, Fy [ksi (MPa)]	Thickness, t [in. (mm)]	Welded	Mech. Fastened	Min. CVN Toughness [ft. lb. @ °F (J @ °C)]
Fy ≤ 40 (275)	t ≤ 4 (100)	X	X	15 @ 70 (20 @ 21)
40 (275)< Fy ≤ 65 (450)	t ≤ 2 (50) 2 (50) < t ≤ 4 (100) >2 (50) < t ≤ 4 (100)	X X	X X	15 @ 70 (20 @ 21) 15 @ 70 (20 @ 21) 20 @ 70 (27 @ 21)
65 (450)< Fy ≤ 90 (620) (Refer to note 3 below)	t ≤ 2.5 (65) 2.5 (65) < t ≤ 4 (100) 2.5 (65) < t ≤ 4 (100)	X X	X X	20 @ 50 (27 @ 10) 20 @ 50 (27 @ 10) 25 @ 50 (34 @ 10)

Notes for Table A:

1. For Fy ≤ 50 ksi (345 MPa), use the (H) frequency of testing in accordance with ASTM A673 (A673M).
2. For Fy > 50 ksi (345 MPa), use the (P) frequency of testing in accordance with ASTM A673 (A673M).
3. If the yield strength of the material exceeds 90 ksi (585 MPa), the testing temperature shall be reduced 15°F (8.3°C) per 10 ksi (69 MPa) increment, or portion thereof.

720S.4 - Miscellaneous Steel

A. High Strength Bolts

High strength bolts shall conform to ASTM A325, A325M, A490, or A490M, unless otherwise indicated. For submittal requirements of SI unit bolts, refer to 720S.3 C. Nuts for high strength bolts shall conform to ASTM A563 or A563M and washers shall conform to ASTM F436 or F436M.

B. Unless otherwise indicated, structural steel for secondary members such as shoes, diaphragms, stiffeners, bearing stiffeners, lateral bracing, diagonals, armor joints, and finger joints shall conform to one of the following:

1. ASTM A36 (A36M), with a minimum specified yield strength of 36 ksi (250 MPa).
2. ASTM A500, with a minimum specified yield strength of 46 ksi (315 MPa).

Structural steels used for secondary or nonstress-carrying members will not be subject to impact requirements.

All steels greater than 0.5 inch (13 mm) in thickness used for structural supports for highway signs, luminaries, and traffic signals shall conform to the longitudinal Charpy V-notch requirements of Table A.

C. Stud shear connectors, slab anchors, and anchors on armor and finger joints shall conform to ASTM A108, Grades 1015, 1018, or 1020, either semi- or fully-killed, with a minimum specified yield strength of 50 ksi (345 MPa).

D. Piling

Steel piling shall conform to one of the following:

1. ASTM A36 (A36M), with a minimum specified yield strength of 36 ksi (250 MPa).
2. ASTM A252, greater than or equal to 10 gauge, with a minimum specified yield strength of 35 ksi (240 MPa).
3. ASTM A328 (A328M), with a minimum specified yield strength of 39 ksi (270 MPa).
4. ASTM A1011 (A1011M), with a minimum specified yield strength of 33 ksi (230 MPa).

E. Deck Plates

Material for deck plates shall be corrosive-resistant structural steel conforming to ASTM A242 (A242M). The material must be of weldable quality and shall contain alloying elements that furnish corrosion resistance at least twice that of copper bearing structural steel. The type and trade name shall be submitted for review.

F. Rail Posts

Material for rail posts shall conform to ASTM A36 (A36M), with a minimum specified yield strength of 36 ksi (250 MPa).

G. Forgings

Steel forgings from which pins, rollers, trunnions, or other forged parts are to be fabricated shall conform to ASTM A668 (A668M), class C, D, F, or G, with a minimum specified yield strength of 33 ksi (230 MPa). As an alternate for pins four (4) inches in diameter or less, ASTM A108, grades 1016-1030, with a minimum specified yield strength of 36 ksi (250 MPa) may be used.

H. Castings

Steel castings shall conform to ASTM A27 (A27M), Grade 70-36, with a minimum specified yield strength of 36 ksi (250 MPa).

I. Anchor Bolts

Anchor bolts shall conform to one of the following:

1. Plain and threaded bars used for anchorage purposes, ASTM A36 (A36M).
2. Headed bolts and nuts, ASTM A307, Grade A.

3. High strength anchor bolts, ASTM A193 (A193M). Nuts for high strength anchor bolts shall conform to ASTM A194 (A194M).

Anchor bolts shall not be galvanized unless otherwise indicated. When galvanized, anchor bolts and nuts shall be tapped or chased after galvanizing.

When heat treated material is specified or required, the test report for certification shall include the necessary certification relative to the heat treating process.

J. Steel Pipe

Steel pipe shall conform to Item No. 510, "Pipe".

K. Tubing

Steel tubing shall conform to one of the following:

1. ASTM A500, Grade B.
2. API Standard 5L, Grade X52, except as noted herein, may be used if produced by a mill recognized as authorized to produce pipe with the API monogram and listed as such in the standard API specifications. Hydrostatic tests will not be required.

In lieu of the mill test report, a certificate from the manufacturer will be required for each lot or shipment certifying that the tubing meets the requirements stated above.

L. Pipe Rail

Pipe rail shall be construed to include special extruded and bent shapes and shall be of the section indicated. Pipe may be rolled or extruded to the shape indicated or may be cold pressed from a round pipe or flat plate.

If cold pressed, the design of the press and dies shall result in a pipe of uniform section and free from die marks. After the pipe has been formed to the required section, it shall be cut to the lengths required. The end cuts and notches shall be made at such angles with the axis of the pipe as required to produce vertical end faces and plumb posts when indicated. Cutting and notching of pipe shall be done with a saw or machine guided torch or other means that will insure a neat and uniform finish.

M. Deep Beam Rail

Deep beam rail shall conform to AASHTO M180, 10 or 12 gage (exclusive of protective coating). The terminal connector shall be of the same material, not less than 10 gage. Unless otherwise indicated, the rail element shall be galvanized.

720S.5 - Miscellaneous Metals

A. Iron

All iron castings shall be true to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended. Castings shall conform to the following ASTM designations:

1. Malleable iron, ASTM A47 (A47M), grade 35018.
2. Gray iron, ASTM A48 (A48M), class 30 or 35.
3. Ductile iron, ASTM A536, grade 60-40-18 or 65-45-12.

B. Lead

Sheet lead shall conform to ASTM B29, refined lead or pig.

C. Copper

Copper strip or sheet shall conform to the following:

1. ASTM B100, alloy 510 or 511.
2. ASTM B152 (B152M).

D. Aluminum

Unless otherwise indicated, aluminum materials shall conform to the following:

1. Castings, ASTM B108, alloy A444-T4.
2. Extrusions, ASTM B221, alloy 6061-T6.
3. Sheet and plate, ASTM B209, alloy 2024-T3. If welding is required, alloy 6061-T6 can be substituted, but must be heat treated after fabrication and welding.
4. Deep beam rail, ASTM B209, alloy 2024-T3. The minimum thickness of the rail element shall be 0.156 inch (nominal) unless otherwise indicated.

E. Bronze

Bronze bearing and expansion plates shall conform to ASTM B22, alloy 911.

720S.6 - Fabrication, Erection and Painting

Fabrication, erection and painting of metal for structures shall conform to the following:

A. Item No. 721S, "Steel Structures".

B. Item No. 722S, "Paint and Painting". Aluminum or galvanized steel members shall not require painting.

C. Item No. 723, "Structural Welding".

720S.7 - Galvanizing

Galvanizing, where indicated, shall conform to the following:

A. Fabricated items, rolled, pressed or forged steel shapes, plates, pipes, tubular items, and bars, ASTM A123 (A123M).

B. Steel or iron castings, ASTM A153 (A153M).

C. Bolts, nuts, screws, washers, and other miscellaneous hardware, ASTM A153 (A153M), Class C or D or ASTM B695, Class 50.

The measurements of thickness and weight of galvanized coating shall be in accordance with TxDOT test method Tex-728-I.

720S.8 - Measurement

Measurement shall be in accordance with the following:

A. Weights of supplied metal for structures shall be determined in accordance with Table B:

TABLE B	
Material	**Weight [lb./cu. ft. (kg/cu. m)]**

Steel	490 (7,849)
Iron, cast	450 (7,208)
Iron, wrought	485 (7,769)
Lead	710 (11,373)
Copper	556 (8,906)
Aluminum	165 (2,643)
Bronze	509 (8,153)

B. Weights of bolts, nuts, and washers shall be in accordance with the American Institute of Steel Construction's "Steel Construction Manual".

C. The quantity of metal for structures furnished and placed will be based on the weight of metal in the fabricated structure. The weight of erection bolts, paint or weld metal shall be excluded.

D. The weights of secondary metals in steel or concrete structures (such as castings, bearing plates, anchor bolts, drains, deck plates, armor joints, and finger joints) for which no separate measurement is specified, shall be in accordance with this specification.

E. The weights of rolled shapes and plates shall be computed on the basis of their normal weights and dimensions.

F. The weights of castings will be computed from the dimensions indicated.

G. Deductions will be made for all cuts, copes, perforations, and all holes except bolt holes.

Splices will be measured as follows:

A. No additional weight will be allowed for weld metal in a welded splice.

B. Where a bolted splice is permitted as an alternate for a welded splice, measurement will be made on the basis of a welded splice.

C. Where a bolted splice is required, the weight of splice material, bolt heads, washers and nuts, with no deduction for holes, will be measured.

A change in design may be required and approved by the Engineer or designated representative, due to unforeseen conditions or other reason, which either increases or decreases the quantity of metal in the completed structure; the increase or decrease in weight will be measured in accordance with this specification and shall be included as a change from the original quantity computed. No adjustment will be made for a change which has not been approved by the Engineer or designated representative and which either increases or decreases the quantity of metal in the completed structure. These changes are subject to approval by the Engineer or designated representative nonetheless to assure that the completed structure is in accordance with the original design intent.

720S.9 - Payment

Structural steel for main members will be paid for at the unit price bid per pound for "Structural Steel", "Structural Steel-HS", "Structural Steel-XHS", or such other classification(s) of metal indicated.

Shipping invoice or acceptance slip weights will not be used as basis for payment.

Payment will be made based on the quantity indicated, except as may be modified by the following:

A. Either party to the contract may request an adjustment of the quantities indicated (by each separate bid item), if the weights calculated in accordance with this specification vary from those indicated by more than the following:

   1. Over 500 tons - 0.5 percent.
   2. 50 tons through 500 tons - 1 percent.
   3. Less than 50 tons - 1.5 percent.

   When adjustment is required, the Contractor shall furnish the Engineer or designated representative three sets of shop bills showing the calculated weights of all parts of the structure. The weights shall be computed from the approved shop drawings, except as noted above. When this quantity is certified correct by the Engineer or designated representative, it will become the revised plan quantity. Quantities revised in this manner will not be subject to the provisions of the "General Conditions".

B. When quantities are revised by a change in design, the plan quantity will be increased or decreased by the amount involved in the design change. Quantities revised in this manner will be subject to the provisions of the "General Conditions".

The unit bid price(s) shall include full compensation for furnishing all materials and for all fabrication, shopwork, transportation, erection, paint, painting, galvanizing, and for furnishing all equipment, tools, labor, and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 720S-A:	Structural Steel	Per Pound.
Pay Item No. 720S-B:	Structural Steel-HS	Per Pound.
Pay Item No. 720S-C:	Structural Steel-XHS	Per Pound.

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification Item 720S, "Metal for Structures"
City of Austin Standard Specification Items

Designation	Description
Item 510	Pipe
Item 721S	Steel Structures
Item 722S	Paint and Painting
Item 723	Structural Welding

American Association of State Highway and Transportation Officials (AASHTO)

Designation	Description
M180	Standard Specification for Corrugated Sheet Steel Beams for Highway Guardrail

American Petroleum Institute (API)

Designation	Description
5L	Line Pipe

American Society for Testing and Materials (ASTM)

Designation	Description
A27/A27M	Standard Specification for Steel Castings, Carbon, for General Application
A36/A36M	Standard Specification for Carbon Structural Steel
A47/A47M	Standard Specification for Ferritic Malleable Iron Castings
A48/A48M	Standard Specification for Gray Iron Castings
A108	Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
A123/A123M	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A153/A153M	Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A193/A193M	Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications
A194/A194M	Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both
A242/A242M	Standard Specification for High-Strength Low-Alloy Structural Steel
A252	Standard Specification for Welded and Seamless Steel Pipe Piles
A307	Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
A325	Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A325M	Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength [Metric]
A328/A328M	Standard Specification for Steel Sheet Piling
A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
A490	Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
A490M	Standard Specification for High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints [Metric]
A500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A514/A514M	Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
A517/A517M	Standard Specification for Pressure Vessel Plates, Alloy Steel, High-Strength, Quenched and Tempered
A536	Standard Specification for Ductile Iron Castings

A563	Standard Specification for Carbon and Alloy Steel Nuts
A563M	Standard Specification for Carbon and Alloy Steel Nuts [Metric)
A572/A572M	Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A588/A588M	Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 MPa] Minimum Yield Point to 4-in. [100-mm] Thick
A668/A668M	Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
A673/A673M	Standard Specification for Sampling Procedure for Impact Testing of Structural Steel
A709/A709M	Standard Specification for Structural Steel for Bridges
A992/A992M	Standard Specification for Structural Steel Shapes
A1011/A1011M	Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
B22	Standard Specification for Bronze Castings for Bridges and Turntables
B29	Standard Specification for Refined Lead
B100	Standard Specification for Wrought Copper-Alloy Bearing and Expansion Plates and Sheets for Bridge and Other Structural Use
B152/B152M	Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar
B108	Standard Specification for Aluminum-Alloy Permanent Mold Castings
B209/B209M	Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
B221/B221M	Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
B695	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel

F436	Standard Specification for Hardened Steel Washers
F436M	Standard Specification for Hardened Steel Washers [Metric]

TxDOT Specifications

Designation	Description
Tex-728-I	Measurements of Dry Film Coating Thickness on Steel

RELATED CROSS REFERENCE MATERIALS

Specification Item 720S, "Metal for Structures"

City of Austin Standard Specification Items

Designation	Description
Item 406S	Reinforcing Steel

American Society for Testing and Materials (ASTM)

Designation	Description
A370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products

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ITEM NO. 721S - STEEL STRUCTURES 9-26-12

721S.1 - Description

This item shall govern the furnishing, fabricating, erecting and painting steel and other metals for structures or portions of structures. The materials related to this specification are specified in Item 720S, "Metal for Structures" unless otherwise noted. Reinforcing steel (Item 406S) and other structural materials are not included.

This specification is optional and is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

721S.2 - Submittals

The submittal requirements of this specification item include:

A. Shop Drawings

1. The Contractor shall prepare and submit seven (7) copies of detailed shop drawings (or as required by the Contract Documents) for each detail of the Contract Drawings requiring the use of materials specified herein or in Item No. 720S, "Metal for Structures".
2. Shop drawings shall include complete details and schedules for fabrication and assembly, as well as camber and erection diagrams for all structures, bridges, plate girders, and other structural members as indicated on the drawings. The equipment, sequence of erection, location and type(s) of falsework (including calculations), location of splices, and proposed method of support to determine any overstress caused by the erection procedure shall also be included.
3. The drawings shall be prepared on sheets 22 x 36 inches (A1 sheet size or 559 x 914 mm) or larger. Each sheet shall include the following:
    a. Project name and location
    b. Name of structure or detail. For details, include structure name or location of detail within the project.
    c. Fabricator name and person responsible for preparation of drawing.
    d. Contractor name.
    e. Sheet numbering.
4. Preparation and submission of shop drawings may be on 11 × 17 inch sheets (A3 sheet size or 279 × 432 mm) or full size drawings may be reduced to half scale size if they are completely clear and legible.
5. Field Verification
    a. The Contractor shall be responsible for field verification of design information and shall inform the Fabricator of any discrepancies with the Contract Documents.
    b. When discrepancies are more than minor dimensional changes, the Contractor shall resolve with the Architect/Engineer.
    c. Any changes from the Contract Documents due to field verification of information shall be clearly noted on the shop drawings.
6. All shop drawings shall be checked by the Fabricator before submitting them to the City of Austin. The Contractor shall also be responsible for reviewing the shop drawings prior to submittal to

assure correctness and completeness and to coordinate ship fit and field connections. Resolution of problems and corrections to drawings, if necessary, shall be done prior to submittal.

7. Changes in section(s), as allowed per this specification (P721S.4 C), shall be clearly noted on the shop drawings.

8. Color coding for any grade of steel to be used on the project and not listed in ASTM A6 (A6M).

B. Painting shall conform to Item No. 722S, "Paint and Painting". Submit any proposed shop primers or paints that are not otherwise specified.

C. Connections

1. When structural members are to be fabricated by welding, a welding procedure shall be submitted. A welding procedure shall include the standard AWS symbol, size, length, type of weld, and any other pertinent information. Upon approval, the welding procedure will be assigned a Welding Procedure Number and the Shop Drawings shall include this number adjacent to the appropriate welding symbol.

2. When structural members with calculated stress are to fabricated by bolting, a fabrication procedure shall be submitted. A fabrication procedure shall include a list of equipment to be used, sequence of assembly, sequence and detail of connections made, special processes such as planing, facing, etc., detail of heat treating procedures, when applicable and any other information concerning fabrication, as may be required by the Engineer/Architect.

3. Submit seven (7) copies of connection procedures along with the shop drawings.

4. Provide calculations for all standard connections, sealed by a Licensed Professional Engineer registered in the state of Texas.

D. Production Data

1. Submit product data for all items in accordance with this specification and those materials specified in Item No. 720S, "Metal for Structures". Include certification, mill test reports, or other data as required. Mill test reports will not be required for miscellaneous hardware.

2. Quality Control

a. The Contractor shall provide, if requested, facilities in the shop and as many helpers as needed, for the Inspector to properly inspect the materials and work quality. The Inspector shall be allowed free access to the necessary parts of the work.

b. The Inspector will have the authority to reject any material or work which does not meet the requirement of this specification. In case of dispute, the Contractor may appeal to the Engineer or designated representative, whose decision will be final.

c. The acceptance of any material or finished members by the inspector will not prohibit subsequent rejection if found defective. Rejected material shall be replaced promptly, or made good by the Contractor to the satisfaction of the Engineer or designated representative.

3. As materials are shipped, the Fabricator shall furnish the Engineer or designated representativewith four (4) copies of the shipping invoice. The Fabricator's shipping invoice shall include:

a. Member piece mark identification.

b. Number of pieces shipped.

c. Total calculated or scale weight for each shipment per bid item.

4. Final payment for structural steel will not be made until shipping invoices indicating total weight of material used have been received and checked by the Engineer or designated representative. Shipping weights will not be used as measurement for payment.

E. Notice of Beginning Fabrication Work

1. The Contractor shall give the Engineer or designated representative seven (7) days notice prior to the beginning of fabrication work in the shop.

2. No work shall be performed in the shop before the Engineer or designated representative has authorized fabrication. Any purchases of material prior to authorization shall be at the Contractor's risk.

F. Material Safety Data Sheets (MSDS)

Submit MSDS for materials as required and keep on the project job site.

G. Welder Certifications

Provide certification that welders working on the project have satisfactorily passed qualification tests in accordance with AWS D1.1 (D1.1M). If recertification is required, retesting will be at the Contractor's expense.

H. Repair Procedures

Submit repair procedures in accordance with the requirements herein.

721S.3 - Delivery, Storage, and Handling

A. Delivery

1. Deliver materials to the site at such intervals as required so as to ensure uninterrupted progress of work.

2. Anchor bolts, anchorages, and other embedded items shall be delivered to the site in ample time so as not to delay related work. Also, provide setting drawings, templates, and directions for installation as required to properly install these items.

B. Storage and Handling

1. Store materials so as to permit easy access for inspection and identification. Do not store materials in a manner that might cause distortion or damage to materials or support.

2. Keep materials off the ground using pallets, platforms or other supports.

3. Protect materials from corrosion and deterioration.

4. If bolts and nuts become dry or rusty, clean and lubricate them before use.

C. Repair or replace damaged materials, structures, or portions of structures as directed.

D. The handling of material, fabrication, blocking of partially completed members, and movement of completed members shall be done in such a manner that the safety of workers and inspection personnel will not be impaired at any time.

E. The storage, handling, and cleaning of corrosion resistant ("weathering") steel shall be in accordance with ASTM A242 (A242M), ASTM A588 (A588M), or the requirements of the proprietary manufacturer as applicable.

721S.4 - Quality of Work

A. Fabrication and Assembly

1. Fabrication shall be in accordance with either AISC 325 or 360.

2. Fabricate and assemble structural assemblies in the shop when possible. When shop fabrication is not practical, provide markings as required to facilitate assembly.

3. Fabricate in such a manner so as to limit storage and handling and not to hinder construction progress.

B. Fabrication tolerances for rolled shapes, plate girders, plates, bars, wide flange sections, and miscellaneous steel shall be in accordance with ASTM A 6 (A6M) or AWS D1.5 (D1.5M).

C. Rolled fabricated sections of slightly different dimensions and weight than the standard sections shown will be acceptable, provided they have equal or greater Moment of Inertia and Section Modulus than the sections(s) detailed. Changes in section(s) shall be clearly noted on the shop drawings.

D. Maximum deviation from flatness for webs of wide flange sections shall be the same as for built-up girders.

E. Shoes shall be fabricated with a tolerance not greater than the following:

1. The top bolster shall have the center 75 percent of the long dimension true to 1/32 inch (0.8 mm), with the remainder true to 1/16 inch (1.6 mm) and shall be true to 1/32 inch (0.8 mm) across its entire width in the short dimension.

2. For a pin and rocker type expansion shoe, the axis of rotation shall coincide with the central axis of the pin.

3. When the shoe is completely assembled and the top bolster is moved horizontally simulating the movement of the shoe in the finished structure, no point in the plane of the top bolster shall change elevation by more than 1/16 inch (1.6 mm) for the full possible travel of the rocker both ways from the neutral position nor shall the top bolster change inclination with respect to the horizontal by more than 1 degree during this same travel.

F. I-beams and girders shall be fabricated with a tolerance not greater than the following:

1. The plane of the bearing area of beams and girders shall be perpendicular to the vertical axis of the beam within 1/16 inch (1.6 mm).

2. Correction of bearing areas of shoes, beams and girders to the above tolerances shall be with heat and/or external pressure. Grinding or milling will be permitted if reduction of required thickness of member is not reduced by more than 1/16 inch (1.6 mm).

3. Rolled material must be straight before being laid off or worked.

4. If straightening is necessary, it shall be done by procedures submitted to and approved by the Engineer or designated representative. Sharp kinks and bends will be cause for rejection of the material unless corrected to the satisfaction of the Engineer or designated representative.

721S.5 - Execution

A. Finishing

1. Finishing details of materials specified herein and Item No. 720S, unless noted otherwise, shall be in accordance with AISC 325, Steel Construction Manual, and AISC 360, Specification for Structural Steel Buildings.

2. Surface finishes shall be in accordance with ASME B46.1 and as indicated in Table A:

TABLE A

Condition	Roughness Value [micro inches (micrometers)]
Member ends not subject to calculated stress	2000 (50.8)

Cut surfaces 4 inches (100 mm) to 8 inches (200 mm) thick	1500 (38.1)
Cut surfaces up to 4 inches (100 mm) thick	1000 (25.4)
Milled ends of compression members, stiffeners, and fillers	500 (12.7)
Top surfaces of steel slabs, base plates, column cap plates, and pedestal cap plates	250 (6.4)
Surfaces of bearing plates intended for sliding contact, pins, and pin holes	125 (3.2)

3. Sheared edges of plates greater than 5/8 inch (15.9 mm) thickness and carrying calculated stress shall be planed to a depth of ¼ inch (6.4 mm).
4. Re-entrant cuts shall be filleted to a minimum radius of ¾ inch (19.1 mm), except for the corners of welding access cope holes adjacent to a flange.
5. Oxygen cutting shall be in accordance with AWS D1.1 and D1.5. Hand cutting shall be done only where approved by the Engineer or designated representative.
6. Edges of all main members, which are sheared or oxygen cut, and all other exposed edges to be painted shall be rounded or chamfered to an approximate 1/16 inch (1.6 mm) dimension by grinding.
7. Unless otherwise indicated, steel plates for main members shall be cut and fabricated so that the primary direction of rolling is parallel to the direction of the main tensile and/or compressive stresses.
8. In all oxygen cutting, the flame shall be adjusted and manipulated to avoid cutting inside the prescribed lines. Roughness exceeding the values of Table A and occasional notches or gouges not more than 3/16 inch (4.8 mm) deep on otherwise satisfactory surfaces shall be removed by machining or grinding. Cut edges shall be left free of slag. Correction of defects shall be faired to the oxygen cut edges with a slope not exceeding 1 in 10.
9. Air carbon-arc or oxygen gouging, oxygen cutting, chipping or grinding may be used for joint preparation or the removal of defective work or material. Oxygen gouging shall not be used on ASTM A 514 (A514M), A517 (A517M), A242 (A242M), and A588 (A588M) corrosion resistant ("weathering") steels.
10. The top and bottom surfaces of steel slabs, base plates and cap plates of columns and pedestals shall be planed or else the steel slabs and base plates hot-straightened. Parts of members in contact with plates shall be faced to fit.
11. In planning the surfaces of expansion bearings, the cut of the tool shall be in the direction of expansion.
12. Stiffeners shall provide an even bearing against flanges. Tight-fit, when indicated, shall have at least 1 point bearing on the flange surface and the remainder with a maximum clearance of 1/16 inch (1.6 mm) at any point. Where stiffeners are to be welded to the flange, the opening prior to shall not exceed 3/16 inch (4.8 mm) with the fillet weld size increased by the amount of the opening.

13. Structural members which are indicated on the Contract Documents to be annealed or normalized shall have finish machining, boring, and straightening done subsequent to heat treatment. Normalizing and annealing shall be as defined by ASTM A941. The temperatures during the heating and cooling process shall be maintained uniformly throughout the furnace so that the temperature a any two points on the member will not differ by more than 100°F (38°C) at any one time.

14. Special requirements for ASTM A 514 (A514M) and A517 (A517M) shall be as follows:

    a. Annealing and normalizing is not allowed.

    b. Stress relieve only with the approval of the Engineer or designated representative.

    c. Allowance for springback should be about three (3) times that of carbon steel.

    d. For break press forming, the lower die span should be at least sixteen (16) times the plate thickness.

    e. If steel plates to be bent are heated to a temperature greater than 1125°F (605°C), they must be requenched and tempered in accordance with the producing mill's practice.

    f. The holding temperature for stress relieving shall not exceed 1100°F (595°C), except that 950°F (510°C) shall be maximum for welds and six (6) inches (150 mm) surrounding welds.

15. Short radii on steel plates shall be hot bent at a temperature not greater than 1200°F (650°C).

16. When indicated, bridge shoes, pedestals or other parts which are built up by welding sections of plate together shall be stress relieved in accordance with approved procedures.

B. Repair of Defects

1. Correction of cutting defects and of occasional notches or gouges less than 7/16 inch (11.1 mm) deep for material up to 4 inches (100 mm) thick and less than 5/8 inch (15.9 mm)for material over 4 inches (100 mm) thick may be made on steel with yield strengths up through 65 ksi (450 Mpa) by welding.

2. Discontinuities or defects in plate edges which form the faces of groove welds shall be removed to a depth of 5/8 inch (15.9 mm) and repaired by welding. Laminations opening to these edges shall be removed. Weld repairs shall be made by suitably preparing the defect, welding in accordance with AWS D1.1 (D1.1M), and grinding the completed weld smooth and flush with the adjacent surfaces.

3. Occasional notches, gouges or defects in oxygen cut edges of ASTM A514 (A514M) and ASTM A517 (A517M) steel may be repaired by welding, when approved by the Engineer or designated representative under the following conditions:

    a. Cutting defects not more than 3/16 inch (4.8 mm) deep in plate edges which will form the faces of a groove weld joint and which will subsequently be completely fused with the weld may be repaired by welding. Discontinuities or defects to these edges shall be removed to a depth of ¼ inch (6.4 mm) below the surface by grinding or chipping and the gouge repaired by welding. Laminations opening to these edges shall be removed.

    b. Cutting defects not more than 3/16 inch (4.8 mm) deep in plate edges which will form a fillet-welded corner joint shall be repaired by welding only on the part of the edge which will become the faying surface for the joint and the fusion zone of the fillet weld. The part of the defect outside the toe of the completed fillet weld shall be removed by machining or grinding and faired to the oxygen cut surface with a slope not exceeding 1 in 10. If the actual net cross-sectional area which would remain after removal of the discontinuity is 98 percent or greater than the area of the plate based on nominal dimensions, weld repairs shall be made as specified above using E-11018-M electrodes and grinding the completed weld smooth and flush with the adjacent surface to produce a proper finish.

4. Straightening Bent Material

a. The straightening of plates, angles, miscellaneous shapes, and built up members, when approved by the Engineer or designated representative be done by methods that will not produce fracture or other damage. A detailed procedure for straightening bent materials shall be submitted to the Engineer or designated representative for approval.

b. Straightening of individual pieces shall be done prior to assembly into a built-up member.

c. The temperature for heat straightening of steel members shall not exceed 1200°F (650°C).

d. Heat straightening or correction of errors in camber of ASTM A514 (A514M) and A517 (A517M) steel members shall be done only under rigidly controlled procedures, each application subject to the approval of the Engineer or designated representative. The temperature shall not exceed 1100°F (595°C) nor shall the temperature exceed 950°F (510°C) at the weld metal or within 6 inches (150 mm) thereof.

e. The temperature of the steel shall be controlled by approved temperature indicating devices, such as crayons, liquids or bimetal thermometers.

f. Heat shall not be applied directly on weld metal.

g. Following straightening, the metal shall be carefully inspected for evidence of fracture.

5. Pins, Pinholes, and Rockers

a. Pinholes shall be bored true to the specified diameter, smooth and straight, at right angles with the axis of the member and parallel with each other, unless otherwise indicated. Pins and pinholes shall be finished to an ASME B46.1 value of 125.

b. The diameter of the pinhole shall not exceed that of the pin by more than 1/50 inch (0.5 mm) for pins 5 inches (127 mm) or less in diameter or 1/32 inch (0.8 mm) for larger pins.

c. Rockers shall be finished to an ASME B36.1 value of 250.

6. The limits of acceptability and repair of surface imperfections for all steels shall be in accordance with ASTM a6 (A6M).

7. Discontinuities

a. Roughness exceeding an ASME B46.1 value of 2000 in oxygen cut surfaces and occasional notches or gouges not more than 3/16 inch (4.8 mm) deep on otherwise satisfactory surfaces, shall be removed by machining or grinding to a slope not exceeding 1 in 10.

b. In the repair and determination of limits of internal discontinuities visually observed on rolled, sheared or oxygen cut edges and caused by entrapped slag or refractory, deoxidation products, gas pocket or blow holes, the metal removed shall be the minimum necessary to remove the defect or to determine that the permissible limit is not exceeded. All repairs made by welding shall be approved by the Engineer and shall conform to the applicable provisions of AWS D1.1 (D1.1M).

c. The limits of acceptability and the repair of visually observed edge discontinuities in plates 4 inches (100 mm) or less in thickness shall be in accordance with Table B where the length of defect is the visible long dimension on the plate edge and the depth is the distance the defect extends into the plate from the edge.

Table B

Description of Discontinuity	Repair Required
Any discontinuity 1 inch (25 mm) in length or less	None - need not be explored.

Any discontinuity over 1 inch (25 mm) in length and 1/8 inch (3.2 mm) maximum depth.	None - depth should be explored.
Any discontinuity over 1 inch (25 mm) in length with depth over 1/8 inch (3.2 mm) but not greater than ¼ inch (6.4 mm).	Remove - need not weld.
Any discontinuity over 1 inch (25 mm) in length with depth over ¼ inch (6.4 mm)but not greater than 1 inch (25 mm).	Completely remove and weld. Aggregate length of welding not over 20 percent of plate edge length being repaired.
Any discontinuity over 1 inch (25 mm) in length with depth greater than 1 inch (25 mm).	Subject to approval by the Engineer. Gouge out to 1 inch (25 mm) and block off by welding. Aggregate length of welding not over 20 percent of plate edge length being repaired unless approved by the Engineer.

d. Removal of metal by gouging shall be done in a manner assuring adequate width and slope for welding.

e. Multiple discontinuities should be considered continuous when located in the same plane within 5 percent of the plate thickness and separated by a distance less than the length of the smaller of two adjacent continuities.

C. Heat Curving

The Contractor shall submit a list of steel members proposed for heat curving and a detailed procedure for this work to be completed. Heat curving shall not proceed prior to written approval by the Engineer or designated representative.

D. Color Coding

1. For each steel approved for use on the project, a distinct color code shall be required. The color code shall be as specified in ASTM A6 (A6M). White shall be required for A 36 steel.

2. The color code used for any steels not specified by ASTM A6 (A6M) must be submitted to and approved by the Engineer or designated representative.

3. The appropriate color(s) shall be placed on the material upon entry into the shop and shall be carried on all pieces to final fabrication. Loss of color code marking on any piece and with no other positive identification shall require testing thereof prior to its use to re-establish positive identity of the material to the satisfaction of the Engineer or designated representative.

E. Shop Painting

Preparation of surfaces and shop painting shall conform to Item No. 722S, "Paint and Painting."

F. Marking and Shipping

1. All structural members shall be marked in accordance with the erection diagram.
2. The markings shall be over the painted surface. In no case shall shop paint be left off in order to preserve original markings on steel to be painted.
3. Members weighing more than 3 tons (2.7 MT) shall have the weight marked thereon.
4. The loading, transporting, unloading and storing of material shall be conducted so it will be kept clean and free from injury.
5. Bolts of each length and diameter and loose nuts or washers of each size, shall be packed separately and shipped in boxes, crates, kegs or barrels. A list and description of the contents shall be plainly marked on the outside of each package.

721S.6 - Bolted Members

A. Detailing

Detailing of bolted connections, where not indicated on the drawings or specified herein, shall conform to the latest edition of AISC 325, Steel Construction.

B. Bolts

Bolts shall be in accordance with Item No. 720S, "Metal for Structures".

C. Bolt Holes

1. All holes for bolts shall be either punched or drilled. Material forming parts of a member composed of not more than five (5) thicknesses of metal may be punched 1/16 inch (1.6 mm) larger than the nominal diameter of the bolts, if the thickness of the metal is not greater than ¾ inch for carbon steel, 5/8 inch (16.9 mm) for HS or ½ inch (12.7 mm) for XHS steel. For more than five (5) thicknesses or when any of the main material is thicker than shown herein, all the holes shall be subpunched or subdrilled 3/16 inch (4.8 mm) smaller and after assembling, reamed 1/16 inch (1.6 mm) larger or drilled from the solid to 1/16 inch (1.6 mm) larger than the nominal diameter of the bolts.
2. For punched holes, the diameter of the die shall not exceed that of the punch by more than 1/16 inch (1.6 mm). If any holes must be enlarged to admit the bolts, they shall be reamed. Holes shall be clean cut without torn or ragged edges. Poor matching of holes will be cause for rejection.
3. Reamed, punched and drilled holes shall be cylindrical, perpendicular to the member and 1/16 inch (1.6 mm) larger than the nominal diameter of the bolts. Reamers and drills shall be guided by mechanical means. Only holes which are not accessible to mechanically guided equipment shall be done by hand. Reaming and drilling shall be done with twist drills, except that for poorly aligned holes tapered reamers shall be used in conjunction with a template so placed and held so as to force the reaming to the best center of holes for that group. Connecting parts shall be assembled and held securely during reaming or drilling operations and match-marked before disassembling.

D. Preparation of Holes for Field Bolting

1. Holes in all field splices of main truss members, box girders, continuous I-beams and plate girders shall be subpunched and reamed while assembled or drilled full size with all parts assembled, taking into account their relative position in the finished structure due to grade, camber, and curvature. The assembly, including camber, alignment, accuracy of holes, and milled joints shall be approved by the Engineer before reaming or drilling full size is started.
2. All holes for floor beams and stringer end connections shall be subpunched and reamed to a steel template of not less than 1 inch (25 mm) thickness or reamed while assembled.

3. Holes for secondary members such as diaphragms, laterals, sway bracing, etc. may be punched full size unless subpunching or subdrilling.

E. Accuracy of Holes

1. Accuracy of all holes punched full size, subpunched, or subdrilled shall be such that a cylindrical pin 1/8 inch (3.2 mm) smaller in diameter than the nominal size of the punched hole may be entered perpendicular to the face of the member, without drifting, in at least 75 percent of the adjoining holes in the same plane after assembling and prior to any reaming. Pieces not meeting this requirement will be rejected. Any hole which will not pass a pin 3/16 inch (4.8 mm) smaller in diameter than the nominal size of the punched hole will be cause for rejection.

2. After reaming or drilling, 85 percent of the holes in any adjoining group shall show no offset greater than 1/32 inch (0.8 mm) between adjacent thickness of metal.

3. Layout of shop work shall be done so that gage lines for bolts shall not vary from plan dimensions more than 1/16 inch (1.6 mm). Full size holes in any adjoining group or line shall not vary more than the following:

   a. At least 8 percent of the holes shall be within 1/16 inch (1.6 mm) of plan gage.

   b. Not more than 10 percent of the holes may vary as much as 1/8 inch (3.2 mm) from plan gage.

   c. Holes varying more than 1/8 inch (3.2 mm) from plan gage will not be accepted.

F. Shop Assembly

1. Each truss or box girder section shall be assembled in its relative position in the shop before reaming is started. Match-marks shall be stamped in the metal at all field connections, conforming to erection diagrams, at the time reaming is done.

2. Surfaces of metal to be in contact shall be cleaned before assembling.

3. Disassembling after reaming will be required to remove shavings, burrs, etc.

4. When bolting is required, shop or field, faying surfaces of all joints including splice plates, shall be cleaned in accordance with AISC 325, Steel Construction Manual, and AISC 360, Specification for Structural Steel Buildings.

5. The members shall be free from twists, bends and other deformations. In no case shall tack welding be used in assembly for bolting without prior approval of the Engineer or designated representative..

6. If necessary, the bolt holes shall be spear-reamed for the admission of bolts preparatory to the shop bolting of full-sized punched material. The spear reamer used for this purpose shall be not more than 1/16 inch (1.6 mm) larger than the nominal diameter of the bolts.

7. Parts not completely bolted in the shop shall be secured by temporary bolts, where practicable, to prevent damage in shipment and handling.

8. The drifting done during assembling shall be only that required to bring the parts into position and not sufficient to enlarge the holes or distort the metal. If any holes must be enlarged to admit bolts, they shall be reamed.

G. Preparation and Fit of Members

1. When indicated, abutting joints shall be milled and brought to an even bearing. Where joints are not milled, the openings shall not exceed ¼ inch (6.4 mm).

2. Floor beams and girders with end connection angles shall be built to exact length back to back of connection angles. If end connections are faced, the finished thickness of the angles shall be not less than that indicated.

721S.7 - Welded Members

A. General

1. All welding operations, processes, equipment, materials, qualifications of welders, quality of work, nondestructive testing, and inspection shall conform to Item No. 723S, "Structural Welding", AWS D1.1 (D1.1M), AWS D1.5 (D1.5M), and the Shop Drawings.

2. Unless otherwise indicated, nondestructive testing (magnetic particle and radiographic) required in the shop will be done by, and at the expense of, the Contractor. This will include furnishing all materials, equipment, tools, labor and incidentals necessary to perform the required testing.

3. All magnetic particle inspection and all radiographic inspection shall be done in the presence of and at the locations selected by the Engineer or designated representative. The Engineer or designated representative shall examine and interpret all tests made.

4. Magnetic particle inspection shall conform to ASTM E 709 and the following unless otherwise indicated:

   a. For built-up members, 100 percent of the web to flange and bearing stiffener fillet welds on not less than 1 fabricated piece for each 15 pieces or fraction thereof when the maximum flange thickness is less than 2 ½ inches (63.5 mm).

   b. For built-up members, 100 percent of the web to flange and bearing stiffener fillet welds on not less than 1 fabricated piece for each 10 pieces or fraction thereof when the maximum flange thickness is 2 ½ inches (63.5 mm) or greater.

   c. Welds requiring repairs shall be retested by magnetic particle inspection after the repairs are made.

   d. No magnetic particle inspection will be required for rolled sections.

5. Radiographic inspection shall conform to ASTM E94, AWS B1.10, and the following unless indicated otherwise on the Drawings:

   a. For shop welds of material 65 ksi (450 Mpa) yield strength and less, radiographic inspection will be made as follows:

      1. The full flange width of 35 percent of all flange splices where the plate thickness at the weld is 2 inches (50 mm) or less.

      2. The full flange width of 50 percent of all flange splices where the plate thickness at the weld is greater than 2 inches (50 mm).

      3. 1/5 the depth of the web of 50 percent of the web splices on each structure.

      4. If unacceptable work is found, additional radiographs will be made on sections welded by the same equipment and/or operator just prior to and just after the section containing the defect.

   b. For shop welds of material greater than 65 ksi (450 Mpa) yield strength, radiographic inspection shall be made on all groove welds. These welds shall be inspected not less than 48 hours after they are completed.

   c. Welds requiring repairs shall be retested by radiography after repairs are made. All radiographic inspection and necessary repairs shall be done prior to assembly.

   d. When radiographic inspection of particular welds is required by the plans, this shall be in addition to the radiographic inspection required herein.

B. Surface Preparation for Welding

1. Surfaces to be welded shall be smooth, uniform and free from fins, tears and other defects which would adversely affect the quality of the weld. Surfaces to be welded shall be free from loose scale, slag, rust, grease, or other material. Mill scale that withstands vigorous wire brushing or a light film of drying oil or rust inhibitive coating may remain. Finish of bevels of groove welds shall be milled or ground. Oxygen cut bevels without grinding will not be allowed.

2. When a zinc-rich paint is specified, surfaces within 4 inches (100 mm) of a groove weld joining main stress carrying members and within 2 inches (50 mm) of fillet welds joining diaphragms or lateral bracing to stiffeners or gusset plates shall be sandblast cleaned and coated with linseed oil. After welding is completed, the areas shall be sandblast cleaned and painted as required for the specified paint system.

3. For other paint systems, surfaces within 2 inches (50 mm) of any weld joining main stress carrying members shall be free from any paint or other material that would prevent proper welding.

4. Sheared plates for webs of built-up members shall be wide enough to allow for trimming of edges where built-in camber is required. Plates with rolled edges used for webs shall be trimmed by oxygen cutting.

5. The faying surfaces of the web and flange plates and the adjacent surfaces that are to be fillet welded shall be cleaned by grinding prior to assembly and welding of web to flange.

C. Assembly of Parts

1. Parts to be joined by fillet welds shall be brought into as close contact as possible, with a maximum separation of 3/16 inch (4.8 mm). If the separation is 1/16 inch (1.6 mm) or greater, the leg of the fillet weld shall be increased by an equivalent amount. The separation between faying surfaces of lap joints and of butt joints landing on a backing strip shall not exceed 1/16 inch (1.6 mm). The fit of joints not sealed by welds throughout their length shall be close enough to exclude water after painting. Where irregularities in rolled shapes or plates after straightening prevents this, the procedure necessary to bring them within the above limits shall be approved by the Engineer or designated representative. The use of fillers is prohibited, except as indicated or as approved by the Engineer.

2. Members to be welded shall be brought into correct alignment and held in position by clamping, welding, or tacking until the joint has been welded.

3. Adequate clamps must be provided to prevent cupping or warping of the parts when welding them to the web. The clamping devices must be designed to not interfere with the operation or guiding of automatic welding equipment.

4. Temporary stiffeners used for jigs and/or warpage control shall not be tack welded to the flange material. Tacking to the web is permissible if the welds are at least d/6 distance away from the flange, where "d" is the web depth. The tack weld shall be removed by grinding flush with the parent metal prior to acceptance.

5. Suitable allowance shall be made for shrinkage. The joint shall never be restrained on both sides when welding.

6. Abutting parts to be joined by groove welds shall be aligned carefully. All shop groove welds in flange plates shall be ground smooth and flush with the base metal on all surfaces. This shall apply both to parts of equal thickness and parts of unequal thickness.

7. The surfaces shall be ground so that the radii at the points of transition will be 4 inches (100 mm) minimum.

8. When groove welds are used to join materials of different thickness or width, there shall be a smooth transition between offset surfaces with a slope of not greater than 1 in 4 in thickness transition and to the proper radii in the case of width transition.

9. Groove welds in web plates need not be ground unless indicated.

10. Grinding shall be done in the direction of stress and in a manner that keeps the metal below the blue brittle range of 350°F (177°C).

11. Intermediate stiffeners within 12 inches (300 mm) of a splice point shall be shipped tack welded in place. Final welding shall be done in the field.

D. Surface Preparation and Shop Assembly for Field Welds

1. Ends of beams and girders shall be prepared in accordance with the requirements herein or as indicated. The centerline of the land of opposing web and flange bevels shall not deviate from each other by more than 1/16 inch (1.6 mm).

2. For Shop Assembly, members should be brought into abutting contact in accordance with the shop drawings. Root faces shall not vary in excess of 1/16 inch (1.6 mm) from contact. Corrections by additional cutting and/or grinding shall be made to bring the splice within this tolerance. Finish of bevels for groove welds shall be milled or ground. Oxygen cut bevels without grinding will not be allowed.

3. Ends of beams or girders to be welded shall be prepared in the shop taking into account their relative positions in the finished structure due to grade, camber, and curvature. Each splice shall be completely shop assembled, checked and match-marked while assembled.

721S.8 - Field Erection

A. General

1. Field erection shall be in accordance with the approved shop drawings. Such approval shall not relieve the Contractor of responsibility for the safety or adequacy of methods or equipment, or from carrying out the work in full as indicated. No work shall be done without the approval of the Engineer or designated representative.

2. Field erection plans for beam units will not be required unless indicated.

3. Spot welding for the purpose of eliminating field erection bolts or for holding steel parts together while bolting will not be permitted.

4. The Contractor shall provide falsework and all tools, machinery, and appliances (including drift pins and fit-up bolts) necessary for the expeditious handling of field erection work. Drift pins sufficient to fill at least ¼ of the field holes for main connections shall be provided.

5. When railroad or roadway traffic must be maintained beneath girders or beams already placed, traffic shall be protected against falling objects during the erection of diaphragms and other structural members, during the placing of cast-in-place concrete, and during the erection and dismantling of forms thereof. The protection shall consist of safety nets of 1 inch (25 mm) mesh maximum or a flooring with openings not larger than 1 inch (25 mm).

B. Storing, Handling, and Assembling Materials

1. All material shall be handled in a manner that prevents damage.

2. Stored material shall be placed on skids above the ground and kept clean and properly drained. Girders and beams shall be placed upright and shored. Long members, such as columns, shall be supported on skids placed closely enough to prevent excessive deflection.

3. The parts shall be match-marked and assembled accurately as indicated on the approved erection drawings.

4. Hammering which will injure or distort the members is not allowed.

5. All bearing and faying surfaces of structural steel in bolted connections shall be cleaned before the connection members are assembled. When ASTM A588 (A588M) steel is used these, surfaces shall receive a Class B blast cleaning conforming to Item No. 722S, "Paint and Painting", prior to assembly of the connection members. The areas of the outside ply under washers, nuts, or bolt heads shall be cleaned prior to installation of the bolts.

6. Unless erected by the cantilever method, truss spans shall be erected on blocking located so as to provide proper camber. The blocking shall be left in place until the tension chord splices are fully connected and all other truss connections pinned and bolted. Main connections shall have ½ of the holes filled with bolts and erection pins (½ bolts and ½ pins) before swinging the span. Splices and connections carrying traffic during erection shall have ¾ of the holes so filled.

7. Fit-up bolts shall be of the same nominal diameter as the connection bolts. Erection pins shall be 1/32 inch (1 mm) larger diameter.

8. There shall be no temporary welds for transportation, erection, or other purposes on main members, except at approved locations more than 1/6 the depth of the web from the flanges of beams and girders, unless otherwise approved by the Engineer or designated representative.

C. Falsework

1. Falsework shall be properly designed for the loads to be supported and shall be substantially constructed and properly maintained. The Contractor shall prepare and submit to the Engineer falsework plans, including calculations.

2. The falsework plans shall include all details of members, connections, equipment, etc., so that a structural check can be made of them.

3. Approval of the falsework plans does not relieve the Contractor of responsibility/liability for the falsework during field erection.

D. Welding and Nondestructive Testing

Welding and nondestructive testing shall conform to Item No. 723S, "Structural Welding".

E. Ancillary Items

All ancillary items such as castings, bearing plates, etc. shall be in accordance with the drawings or as specified elsewhere.

F. Errors in Shop Work

1. Any errors in shop work which prevent the proper assembling and fit-up of parats by the moderate use of drift pins or a moderate amount of reaming and slight chipping or cutting shall be reported immediately to the Engineer or designated representative, along with the proposed method(s) of correction.

2. Corrections of minor misfits and a reasonable amount of reaming will be considered a legitimate part of the work.

3. Corrections shall be made in the presence of the Engineer or designated representative, unless otherwise directed. Such work is to be done at the entire expense of the Contractor.

721S.9 - Paint and Painting

Unless otherwise indicated, painting shall conform to Item No. 722S, "Paint and Painting".

721S.10 - Measurement and Payment

No direct compensation will be made for "Steel Structures". Measurement and payment for quantities of metals, concrete, reinforcement, railing, ancillary items, and other bid items which constitute the completed and accepted structure(s) shall conform to pertinent specifications.

End

Ref: 204S, TxDoT 447, 720, 722, 723, TxDoT Bulletin C-5, ASTM E 44, ASTM A 6, AS TM A 514/A 517, AS TM A 588

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 721S, "Steel Structures"	

City of Austin Standard Specification Items	
Designation	Description
Item 406S	Reinforcing Steel
Item 720S	Metal for Structure
Item 722S	Paint and Painting
Item 723	Structural Welding

American Institute of Steel Construction (AISC)	
Designation	Description
325	Steel Construction Manual
360	Specification for Structural Steel Buildings

American Society for Testing and Materials (ASTM)	
Designation	Description
A6/A6M	Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
A242/A242M	Standard Specification for High-Strength Low-Alloy Structural Steel
A588/A588M	Standard Specification for High-Strength Low-Alloy Structural Steel with 50 ksi [345 Mpa] Minimum Yield Point to 4-in. [100-mm] Thick
A941	Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys
E94	Standard Guide for Radiographic Examination
E709	Standard Guide for Magnetic Particle Examination

American Society of Mechanical Engineers (ASME)

Designation	Description
B46.1	Surface Texture (Surface Roughness, Waviness & Lay)

American Welding Society (AWS)

Designation	Description
B1.10	Guide for Nondestructive Inspection of Welds
D1.1/D1.1M	Structural Welding Code - Steel
D1.5/D1.5M	Bridge Welding Code

RELATED CROSS REFERENCE MATERIALS

Specification Item 721S, "Steel Structures"

City of Austin Standard Specification Items

Designation	Description
Item 406S	Reinforcing Steel

TxDOT Specifications

Designation	Description
Item 441	Steel Structures
Item 442	Metal for Structures
Item 447	Structural Bolting
Item 448	Structural Field Welding

END

ITEM NO. 723 - STRUCTURAL WELDING 9-26-12

723.1 - Description

This item shall consist of field welding of structural steel and reinforcing steel.

Provisions are made herein for the welding of the types of steel listed in Table 2, using the manual shielded metal-arc process, semiautomatic (manual) gas metal-arc welding and flux cored arc welding processes. Other welding processes may be permitted with the specific approval of the Engineer and with qualification of the welding procedure.

Shop fabrication and welding shall conform to Item No. 721, "Steel Structures" and TXDOT Bulletin C-5.

723.2 - General

All welds including tack welds to be incorporated shall be made by a certified welder. Tack welds shall be cleaned and fused thoroughly with the final weld. Defective, cracked or broken tack welds shall be removed.

Certification for welders shall conform to TXDOT Bulletin C-6. Miscellaneous welds may be made by a welder qualified conforming to "Welder Qualification", below.

Welds shall be as indicated. The location or size shall not be changed without approval of the Engineer.

The welder shall identify groove welds made by the welder with paint or indelible ink.

Welding will not be allowed when air temperature is lower than 20°F, surfaces are wet or exposed to rain, snow or wind or when operators are exposed to inclement conditions that will hamper their performance.

Moisture present at the point of welding shall be driven off conforming with Table 3, before welding commences. Wind breaks shall be required for the protection of all welding operations.

There shall be no temporary welds for transportation, erection or other purposes on main members, except at locations more than 1/6 the depth of the web from the flanges of beams and girders as indicated or as approved by the Engineer.

ASTM A 514/517 steels shall maintain all groove welds in main members and in flanges of beams and girders subject to tensile stress or reversals of stress shall be finished smooth and flush on all surfaces, including edges, by grinding in the direction of applied stress leaving the surface free from depressions. Chipping may be used provided it is followed by such grinding. Parts joined by groove welds connecting plates of unequal thickness or width shall have a smooth transition between offset surfaces at a slope not greater than 1 in 4 with the surface of either part. The surfaces shall be ground so that the radii at the points of transition shall be 4 inches minimum.

All groove welds, except when produced with the aid of backing, shall have the root of the initial weld gouged, chipped or other-wise removed to sound metal before welding is started from the second side, except that back gouging will not be required when welding steel piling or armor joints with E 6010 electrodes. The back side shall be thoroughly cleaned before placing backup pass.

When backing for welds is left in place to become a part of the structure, it shall be a single length insofar as possible. Where more than a single length is needed, they shall be joined by full penetration butt welds. The surfaces of this butt weld shall be ground flush as necessary to obtain proper fit-up in the weld joint.

Before welding over previously deposited metal, all slag shall be removed and the weld and adjacent base metal shall be cleaned. This requirement shall apply equally to successive layers, successive beads and the crater area.

Arc strikes outside the area of permanent weld must be avoided on all steels. Where they do occur, resulting cracks and blemishes shall be ground out to a smooth contour and checked to insure soundness.

Stringer bead technique shall be used where possible for groove welds on all types of steel. Weaving will not be permitted for ASTM A 514/517 steel except in vertical welding, where a weave not exceeding 2 electrode diameters is permissible for manual shielded metal-arc process.

In all welding processes the progression for all passes in vertical welding shall be upward using a back step sequence.

Groove welds shall begin and terminate at the ends of a joint on extension bars. Edge preparation and thickness of extension bars shall be the same as that of the member being welded and shall extend a minimum of ¾ inch beyond the joint. Extension bars shall be removed with a cutting torch or arc-air gouging upon completion of the weld and the flange edges shall be ground smooth.

Any defects exposed by the grinding shall be cleaned, filled with weld metal and reground to a uniform finish. All grinding shall be parallel to the flange. Excess grinding of the parent metal shall be avoided.

723.3 - Materials

Electrodes for manual shielded metal arc welding shall conform to the requirements of the latest edition of "Specification for Mild Steel Covered Arc-Welding Electrodes", AWS A5.1 or to the requirements of the latest edition of "Specifications for Low Alloy Steel Covered Arc-Welding Electrodes", ASW A5.5.

All electrodes and combination of electrode shielding for gas metal-arc welding for producing weld metal with a minimum specified yield point not exceeding 60,000 psi shall conform to the requirements in the latest edition, "Specification for Mild Steel Electrodes for Gas Metal-Arc Welding", AWS A5.18, AWS A5.28 or "Specification for Mild Steel Electrodes for Flux Cored Arc Welding", AWS A5.20, applicable for the classifications producing weld metal having a minimum impact strength of 20 ft/lb, Charpy V-notch, at a temperature of 0 F or below.

For weld metal with a minimum specified yield strength exceeding 60,000 psi, the Contractor shall demonstrate that each electrode and flux or combination of electrode and shielding medium proposed for use will produce low alloy weld metal having the mechanical properties listed in Table 1 in the as welded condition.

The mechanical properties shall be determined from a multiple pass weld made in accordance with the test requirements of the latest edition of AWS A5.18, AWS A5.20 or AWS A5.28 as applicable.

Table 1
Required Mechanical Properties for GMAW and FCAW Electrodes

GMAW Grade	FCAW Grade	Tensile Strength psi - Minimum	Yield Strength psi - Minimum	Elongation, % in 2 inches Minimum	Strength ft-lb at 0 F -Minimum
ER80S	E80T	80,000	65,000	18	20
ER90S	E90T	90,000	78,000	17	20
ER100S	E100T	100,000	90,000	16	20

ER110S	E110T	110,000	98,000	15	20

The mechanical property tests for Grades ER100S, E100T and E110T shall be made using ASTM A 514/517 base metal.

All electrodes used on City projects shall be approved by the Engineer. Tests shall be made on electrodes of the same class, size and brand which were manufactured by the same process and with the same materials as the electrodes to be furnished. Tests must be made and approval renewed every 12 months.

For sizes of electrodes not requiring tests by AWS Specifications, test reports shall be furnished for electrodes of the nearest size and of the same classification. The request for approval shall include the manufacturer's certification that the process and material requirements were the same for manufacturing the tested electrodes and those to be furnished and new test reports, shall be submitted if any changes are made in process or materials during the effective period.

Class of electrodes required will be shown in Table 2. Electrodes shall be used with the type of current, the polarity and in the positions permitted by AWS A5.1 and A5.5 for manual shielded metal-arc welding. AWS A5.18 or A5.20 and A5.28 Specifications shall govern for gas metal-arc welding and flux cored arc welding.

Table 2
Classifications of Electrodes Permitted

Type of Steel	**Main Members Groove & Fillet Welds**			**Secondary Members Groove & Fillet Welds**	
Steel Piling,	E6010	E60T-8	E60XX	E60T-8	ER70S-2
A 53 Pipe,	E6011	E70S-1B	E70XX	E7XT-1	ER70S-3
A 500,	E7016	ER70S-2	E702-1B	E7XT-5	ER70S-6
A 501,	E7018	ER70S-3	E70S-2	E7XT-6	ER70S-7
Armor Joints		ER70S-6	E70S-3	E7XT-8	
		ER70S-7	E70S-6		
			E70U-1		
A 36,	E7016	ER70S-2	E7016	ER70S-2	
A 441,	E7018	ER70S-3	E7018	ER70S-3	

A 572 Grade 50	E7XT-1	ER70S-6	E7XT-1	ER70S-6	
A 588,	E7XT-5	ER70S-7	E7XT-5	ER70S-7	
A 242 Deck Plates	E7XT-6		E7Xt-6		
API Pipe	E7XT-8		E7XT-8		
A 514/A 517	E10018M	ER1102	E11018M	ER110S	
2½ inches thick or less	E110T		E110T		
A 514/A 517	E10018M	ER100S	E10018M	ER100S	
Over 2 ½ inches thick	E100T		E100T		
A 588, A 242	E8018, C-3		E8018, C-3		
A 618 Weathering Steel	E80T(3)	ER80S(3)	E80T(3) ER80S(3)		
Reinforcing Steel	E7016	E7018			
A 572 Grades 60 and 65 for Light Towers	E8016				
E8018	E80T				
ER80S					

(1) Use of the same type electrode with the next higher mechanical properties, conforming to AWS A5.1 or A5.5, than those listed will be permitted.

(2) In joints involving base metals of different yield points or strengths, low hydrogen electrodes applicable to the lower strength base metal may be used.

(3) Deposited weld metal for weathering steel shall have the following chemical composition: C, maximum percent, 0.12; Minimum percent, 0.51/1.30; P, maximum percent, 0.03; S, maximum percent, 0.04; Si, percent 0.35/0.80; Cu, percent, 0.30/0.75; Ni, percent, 0.40/0.80; Cr, percent, 0.45/0.70.

Before use, all electrodes with low hydrogen coverings conforming to AWS A5.1 shall be dried for not less than 2 hours between 450 F and 500 F and electrodes with low hydrogen coverings conforming to AWS 5.5 for not less than 1 hour at a temperature between 700 F and 800 F. Immediately after drying, electrodes shall be stored in ovens held at a temperature of at least 250 F. E70 electrodes not used within 4 hours, E80 within 2 hours, E90 within 1 hour, E100 and E110 within 30 minutes after removal from the storage oven shall be redried before use. Electrodes with flux which has been wet, cracked or otherwise damaged, shall not be used. When ASTM A 514/517 steel is used for welding, electrodes shall be dried at least 1 hour at temperatures between 700 F and 800 F before being used. Electrodes may be redried only once.

Suitable facilities for drying and storage of electrodes shall be furnished at the job site, along with thermometers for checking and controlling the oven temperature.

In humid atmospheres, the times allowed for use without redrying may be reduced.

When a gas or gas mixture is used for gas metal-arc or flux cored arc welding, it shall be of a welding grade having a dew point of -40 F or lower. The gas manufacturer shall furnish certification to the Engineer that the gas or gas mixture is suitable for the intended application and will meet the dew point requirements.

Welding wire coils removed from the original package shall be protected or stored to keep their characteristics or welding proper-ties intact. Rusty coils or portions of coils that are rusty shall not be used.

Any deviation from the above electrode designation shall be approved by the Engineer.

723.4 - Construction Methods

For any welding process, the parts to be joined by fillet welds shall be brought into as close as possible and shall not be separated more than 3/16 inch. If the separation is 1/16 inch or greater, the leg of the fillet weld shall be increased by the amount of the separation. The separation between faying surfaces of lap joints and of butt joints landing on backing strips shall not exceed 1/16 inch.

Splices of beams and girders joined by groove welds shall be carefully aligned with the center of gravity of both members coinciding or each flange vertically offset equally. Beams and girders with offset webs shall be fit with the webs aligned and the flanges offset laterally.

When flanges are offset or abutting parts differ a thickness or width by more than 1/8 inch, the joint shall be made with the slope of the weld metal to each surface, with a transition not exceeding 1 in 4.

Suitable allowance shall be made for shrinkage and the joint shall never be restrained on both sides in any welding process.

All butt splices shall be made before welding of diaframs or sway bracing in a particular section of a unit. Diaframs and sway bracing may be welded in a unit behind the splice welding to provide stability except where such welding interferes with butt splice adjustments such as at a drop-in segment of a continuous unit. All splices shall be made before welding of beams or girders to shoes.

For manual shielded metal-arc welding, the fit-up procedure listed below shall be used for manual shielded metal-arc welding of groove welds for butt joints:

Members shall be spaced to provide a 3/16 inch root opening at the nearest point. When at other parts of the joint the spacing provides up to and including a 7/16 inch opening correction may be made by buildup not exceeding 1/8 inch on each bevel nose. Openings exceeding 7/16 inch shall require rebeveling of the joint to bring it within the maximum buildup limits prescribed above. Build must be allowed to cool before proceeding with the welding.

All members shall be brought into correct alignment and held in position by acceptable clamps while being welded.

Deviations from the above fit-up procedure shall be approved by the Engineer.

723.5 - Procedure

Shrinkage and distortion shall be controlled through the use of an approved procedure. Passes shall be made symmetrically and shall alternate between both sides of the joint.

For manual shielded metal-arc welding, beam and girder splices shall be made as indicated. Welds shall be alternated from side to side to prevent heat buildups on 1 flange edge. The passes must be arranged between the top and bottom flange to maintain balance and symmetry.

The sequence used in welding of splices in all I-beams shall be to first place 4 tacks (1½ to 2 inches) in the web.

For I-beam or for built-up girders, place passes 1, 2 and 3 in the top flange, followed by passes 4, 5 and 6 in the bottom flange.

Gouge out and replace passes 1 and 4, which always are placed in the over position before welding on the web. Next, place passes 7 and 8 in the web after aligning girder webs with short tacks at approximately 8 inches on centers.

Alignment clamps may be removed when sufficient weld has been placed to hold the members together and welding is completed using the sequence indicated.

When welding the root passes of beam and girder splices, E7010 electrodes may be used, provided the work is preheated con-forming to Table 3. After the root passes are backed up, the E7010 electrode pass shall be completely removed by arc-air gouging and replaced using low hydrogen electrode.

When this procedure is used, it shall be a continuous operation and back gouging and rewelding shall be completed on each splice before starting on another one. The use of E7010 electrodes will not be permitted for welding ASTM A 514/A 517 steel.

For haunch girder splices adjacent to the haunch section, the welding, once started, shall be continuous until a minimum of 50 percent of the welding in both flanges is completed.

Deviation from the above sequence of weld passes shall be approved by the Engineer.

Procedures for all gas metal-arc and flux cored arc welding shall be submitted to the Engineer for approval and shall be qualified prior to any field welding.

All gas metal-arc and flux cored arc welding procedures shall be qualified conforming to Sections 5 and 7 of TXDOT Bulletin C-5. For each joint to be used in construction, the joint details, electrode classification or grade, electrode diameter, voltage, amperage, travel speed, order and relative position of passes, number and thickness of layers, gas flow, dew point of gas, back gouging, method of cleaning and other pertinent information shall be clearly presented in the Procedure Specification. Fillet welds shall conform to details indicated.

Procedures for welding on ASTM A 514/A 517 steel shall be qualified conforming to TXDOT Bulletin C-5 and approved by the Engineer prior to starting work. Variables to be reported shall include welding process, plate thickness, grade of steel, weld position, joint details, type and size of electrode, number and location of passes, welding sequence, back gouging, current and voltage per pass, welding speed, heat, input and maximum interpass temperature. The heat input and maximum interpass temperature shall not exceed the recommendations of the Steel Producer.

The classification and size of electrode, arc length, voltage and amperage shall be suitable for the thickness of the material, type of groove, welding positions and other circumstances attending the work.

(1) **Manual Shielded Metal-Arc Welding Process**

(a) The maximum size of electrode shall be as follows provided the welder has been certified for its use by the City:

1. 5/16 inch for all welds made in the flat position except root passes.
2. ¼ inch for horizontal fillet welds.
3. ¼ inch for root passes of fillet welds made in the flat position and of groove welds made in the flat position with backing and with a root opening of ¼ inch or more.
4. 5/32 inch for welds made with EXX14 and low hydrogen electrodes in the vertical and overhead positions.
5. 3/16 inch for root passes of groove welds and for all other welds not included under 1, 2, 3 and 4 above.

(b) The root pass size shall be large enough to prevent cracking. The maximum thickness of layers subsequent to the root pass in fillet welds and of all layers in groove welds shall be:

1. ¼ inch for root passes of groove welds.
2. 1/8 inch for subsequent layers of welds made in the flat position.
3. 3/16 inch for subsequent layers of welds made in the vertical, overhead and horizontal positions.

(c) The maximum size fillet weld which may be made in one pass shall be:

1. 3/8 inch in the flat position.
2. 5/16 inch in horizontal or overhead positions.
3. ½ inch in the vertical position.

(2) **Manual (Semiautomatic) Gas Metal-Arc Welding and Flux Cored Arc Welding Process**

(a) The maximum size electrode used shall be as follows:

1. 5/32 inch for the flat and horizontal positions.
2. 3/32 inch for the vertical position.
3. 5/64 inch for the overhead positions.

(b) The thickness of weld layers, except root and surface layers shall not exceed ¼ inch. When the root opening of a groove weld is ½ inch or greater, a multiple pass split-layer technique shall be used. The split-layer technique shall be used. The split-layer technique shall be used in making all multiple pass welds when the width of the layer exceeds 5/8 inch for gas metal-arc welding or ¾ inch for flux cored arc welding.

(c) The welding current, arc voltage, gas flow, mode of metal transfer and speed of travel shall be such that each pass will have complete fusion with adjacent base metal and weld metal and there will be no overlap, excessive porosity or undercutting.

(d) Gas metal-arc welding or flux cored arc welding with external gas shielding shall not be done in a draft or wind. An approved shelter of a material and shape capable of reducing the wind velocity in the vicinity of the welding to a maximum of 5 miles per hour shall be furnished by the Contractor

(e) The maximum size of a fillet weld made in 1 pass shall be:

1. ½ inch for the flat and vertical position.
2. 3/8 inch for the horizontal position.

3. 5/16 inch for the overhead position.

(3) **Preheat**

Preheat ahead of welding both groove and fillet welds (including tack welding) will be required as shown in Table 3.

Preheat and interpass temperatures must be sufficient to prevent crack formation. The preheat temperatures shown in Table 3 are minimums and higher preheats may be necessary in highly restrained welds.

When the base metal is below the required temperature, it shall be preheated so the parts being welded are not less than the specified temperature within 3 inches of the point of welding.

For all groove welds, reheat temperature shall be measured on the side opposite to which the heat is applied at points about 3 inches away from the joint.

Preheating equipment shall be adequate to maintain the entire joint at or above the specified temperature. When possible, a joint shall be completely welded before it is allowed to cool below the specified temperature but shall always be welded sufficiently to prevent cracking before cooling is permitted.

Usually preheat and interpass temperatures shall not exceed 400 F for thickness up to 1 ½ inches and 450 F for greater thickness. These temperatures shall never be exceeded on ASTM A514/517 steels.

The welder shall have and use approved equipment for checking preheat and interpass temperatures at all times while welding is in progress.

Table 3
Minimum Preheat and Interpass Temperature for Manual Shielded Metal-Arc Welding, Flux Cored Arc Welding or Gas Metal-Arc Welding

	Manual or Semiautomatic Gas Metal-Arc Welding, Flux Cored Arc Welding or Manual Shielded Metal-Arc Welding with Low Hydrogen Electrodes	
Thickness of Thickest Part at Point of Welding	**ASTM A 36; A 242; A 441 A 572 Grades 42, 45 and 50; A 588**	**ASTM A 514/517**
To ¾ inch, incl.	50 F	50 F
Over ¾ inch to 1 ½ inches, incl.	70 F	125 F
Over 1 ½ inches to 2 ½ inches, incl.	150 F	175 F
Over 2 ½ inches	225 F	225 F

1. These temperatures are the minimum required for the thinner material shown for each increment and higher preheat on a step basis will be required for the thicker material within each increment. Preheat and interpass temperatures must be sufficient to prevent crack formation and welding shall be carried continuously to completion or to a point that will assure freedom from cracking before the joint is allowed to cool below the minimum specified preheat and interpass temperature. Temperature above those shown may be required for highly restrained welds.
2. When E7010 electrodes are permitted for tacking or temporary root pass, the material shall be pre-heated according to the following:

Thickness of Thickest Part	**Preheat for Tacking or Temporary Root Pass**
½ inch and less	150 F
9/16 inch through ¾ inch	200 F
13/16 inch through 1½ inches	300 F
Over 1½ inches	400 F

3. When joining steels of different strengths or thickness with groove welds, the preheat and interpass temperatures for the higher strength steel and the average plate thickness shall be used. For fillet welds, the preheat shall be used for the higher strength steel and the thickest plate being welded.
4. When the base metal temperature is below 32 F, preheat to at least 70 F and maintain this minimum temperature during welding.
5. Heat input when welding A 514/517 steel shall not exceed the steel producer's recommendations.
6. When moisture is present on the base metal it shall be preheated to 200 F before welding is started.

723.6 - Quality of Welds

Weld metal shall be sound throughout.

There shall be no cracks in any weld or weld pass.

There shall be complete fusion between the weld metal and the base metal and between successive passes throughout the joint.

Welds shall be free from overlap and the base metal free from undercut more than 1/100 inch deep when its direction is transverse to the primary stress in the part that is undercut. Undercut shall not be more than 1/32 inch deep when its direction is parallel to the primary stress in the part that is undercut.

All craters shall be filled to the full cross section of the welds.

All welds on ASTM A 514/517 steel shall be visually examined for longitudinal or transverse cracks not less than 48 hours after completion of welding.

723.7 - Corrections

When the weld quality is unsatisfactory, the following corrective measures will be required by the Engineer whose specific approval shall be obtained for making each correction.

When requirements prescribe the removal of part of the weld or a portion of the base metal, removal shall be by oxygen gouging or arc-air gouging.

Oxygen gouging shall not be used on ASTM A 514/517 steel or for A 588 weathering steel.

Backgouging of splices in beams and girders or cutouts of defective welds shall be done by arc-air gouging by a welder qualified to make beam and girder splices.

Where corrections require the deposition of additional weld metal, the sides of the area to be welded shall have sufficient slope to permit depositing new metal.

Defective or unsound welds shall be corrected either by removing and replacing the entire weld or as follows:

1. Excessive convexity. Reduce to size by grinding off the excess weld metal.
2. Shrinkage cracks. Cracks in base metal, craters and excessive porosity. Remove defective portions of base and weld metal down to sound metal and replace with additional sound weld metal.
3. Undercutting, undersize and excessive concavity. Clean and deposit additional weld metal.
4. Overlapping and incomplete fusion. Remove and replace the defective portion of weld.
5. Slag inclusions. Remove the parts of the weld containing slag and replace with sound weld metal.
6. Removal of adjacent base metal during welding. Clean and form full size by depositing additional weld metal.

Where corrections require the deposition of additional weld metal, the electrode used shall be smaller than that used for making the original weld. Surfaces shall be cleaned thoroughly before rewelding.

A cracked weld shall be removed throughout its length, unless the extent of the crack can be ascertained to be limited, in which case the weld metal shall be removed 2 inches beyond each end of the crack and repairs made.

Where work performed after the making of a deficient weld has made the weld inaccessible or has caused new conditions making the correction of the deficiency dangerous or ineffectual, the original conditions shall be restored by removal of welds or members or both, before making the necessary corrections or else the deficiency shall be compensated by additional work ac-cording to a revised design approved by the Engineer.

Improperly fitted and misaligned parts shall be cut apart and rewelded.

Members distorted by the heat of welding shall be straightened by mechanical means or by the carefully supervised application of a limited amount of localized heat. Heated areas shall not exceed 1200 F as measured by Tempil-sticks or other approved methods for steel up to 65,000 psi yield strength. Parts to be heat straightened shall be substantially free of stress from external forces, except when mechanical means are used in conjunction with the application of heat.

Heat straightening of A 514/517 steel shall be done only under rigidly controlled procedures, subject to the approval of the Engineer. In no case shall the maximum temperature of the steel exceed 1100 F. Sharp kinks and bends shall be cause for rejection of the material.

723.8 - Radiographic Inspection

Radiographic testing required in the field shall be done at the expense of the Contractor by an approved laboratory as defined by "General Conditions" having prior approval of the Engineer. The testing shall include furnishing all materials, equipment, tools, labor and incidentals necessary to perform the required testing. The Owner may require further tests as necessary conforming to "General Conditions" and may perform additional testing including other types.

Radiographic equipment, procedures, resulting radiographs, identification marks, penetrameters, examination, reports and weld surface preparation shall conform to TXDOT Bulletin C-5. The Engineer will examine and interpret the resulting radiographs.

Radiography shall be done within the time interval specified by the Engineer. Field welds on ASTM A 514/517 steel shall not be radiographed until a minimum of 48 hours after completion of the weld.

When so indicated, welded butt splices shall be radiographed. Radiographic testing shall be as indicated in "Radiographic Inspection", above. Weld quality shall be as follows:

There shall be no cracks and the sum of the greatest dimension of porosity and fusion type defects shall not exceed 1/10 of the nominal bar diameter in inches. The Engineer will examine and interpret the resulting radiographs, which shall become the property of the Owner and remain with the Engineer.

For field welds of splices in material with a specified yield strength of less than 65,000 psi, radiographic inspection will be made of the full flange width of 25 percent of all flange splices and of 1/3 the depth of the web of 25 percent of all web splices on each structure (17 inches minimum length). If unacceptable work is found, an additional radiograph (penalty shot) shall be made on a section welded by the same operator just prior to and just following the section containing the defect. Welds requiring repairs shall be retested by radiography after repairs are made. Necessary repairs shall be made prior to any further work being done.

For field welds of splices in material with a specified yield strength greater than 65,000 psi, radiographic inspection shall be made on all flange and web splices. Welds requiring repairs shall be retested by radiography a minimum of 48 hours after repairs are made.

All radiography (penalty shots and retakes) required because of unacceptable welding shall be performed at the expense of the Contractor.

When radiographic inspection of particular welds is indicated, this shall be in addition to the radiographic inspection required herein.

All resulting radiographs shall become the property of the Owner and remain with the Engineer.

All groove welds designed to carry primary stresses shall be subject to radiographic inspection. When subjected to such inspections, the presence of any of the following defects in excess of the limits indicated will result in rejection of the defective weld until corrected.

1. Sections of welds shown to have any cracking, regardless of length or location, incomplete fusion, overlapping or inadequate penetration shall be judged unacceptable.
2. Inclusions less than 1/16 inch in greatest dimension including slag, porosity and other deleterious material, shall be permitted if well dispersed so that the sum of the greatest dimensions of the inclusions in any linear inch of welded joint shall not exceed 3/8 inch.
3. Inclusions 1/16 inch or larger in greatest dimension shall be permitted provided such defects do not exceed the limits indicated or described above.

4. There shall be no inclusion greater than 1/16 inch within 1 inch of the edge of part or member at the joint or point of restraint.

723.9 - Reinforcing Steel

Provisions are made herein for the welding of reinforcing steel by the manual shielded metal-arc process. Other processes may be permitted with the specific approval of the Engineer or may be specified on the plans. When the Cadwell process is permitted, a "C" series splice shall be used with grade 40 reinforcing steel and a "T" series splice shall be used with grade 60 reinforcing steel, unless otherwise indicated.

(1) **Base Metal**

Reinforcing steel to be welded shall be new billet steel conforming to ASTM A 615 and to the following chemical composition:

Maximum Carbon	0.40 Percent
Maximum Manganese	1.30 Percent

Mill test reports will be required conforming to Item No. 406, "Reinforcing Steel".

(2) Filler Metal

Low hydrogen electrodes as specified in Table 1 shall be required for all welding of reinforcing steel. Drying of electrodes shall be as specified in "Materials", above.

723.10 - Preheat and Interpass Temperature

Minimum preheat and interpass temperatures shall be as shown in Table 4.

Table 4
Preheat and Interpass Temperature for Reinforcing Steel

Carbon Range	No. 7 & Smaller	No. 8 & Larger
Up to and including 0.30	None	100
0.31 to 0.35 inclusive	None	150
0.36 to 0.40 inclusive	100	250
Unknown	250	400

For widening projects, use carbon content and bar size of new steel to determine preheat required.

723.11 - Joint Types

For all bars No. 8 and larger, butt splices will be required. For No. 7 bars and smaller, lap splices will be required.

Fillet welds in lap splices shall be a minimum of 4 inches in length and shall be welded on each side of the lap joint. For bars No. 5 and smaller, welding from one side of the lap will be permitted by the Engineer, when it is impractical to weld from both sides of the joint, but in this case the weld shall be a minimum of 6 inches in length.

Lap welds shall conform to Table 5.

Where possible, all butt splices shall be made in the flat position. All welds for butt splices, except horizontal welds on vertical bars shall be as indicated. The backup strip will be required when access to the splice is from the top only. When bars may be rotated or access to the splice is available from two sides the double bevel splice may be made and this type weld requires gouging out the root pass similar to a flange splice on structural steel. The root pass may be made using E7010 electrodes for all double beveled splices and the root pass shall be completely removed prior to welding the opposite side. The steel shall be preheated to 400 F if E7010 electrodes are used. Horizontal splices, on vertical bars, shall be as indicated.

Table 5

Bar Size	a	b Maximum	t Minimum	c Maximum	Electrode Size
No. 4	.04 inch	1/8 inch	1/8 inch	1/16 inch	1/8 inch
No. 5	.05 inch	1/8 inch	3/16 inch	1/16 inch	5/32 inch
No. 6	.06 inch	1/8 inch		1/16 inch	5/32 inch
No. 7	.07 inch	3/16 inch	5/16 inch	1/16 inch	5/32 inch

723.12 - Widening Projects

In general, the new reinforcing steel shall be either lap or butt spliced directly to the bar to be extended. When the reinforcement in the old portion of a structure is found to be of the wrong spacing, dowel bars long enough to develop the welded lap or butt splice and also develop the bar in bond, conforming to Item No. 406, "Reinforcing Steel", shall be welded to the old steel and the new reinforcement placed at the correct spacing without welding to the old steel. No measurement or payment will be made for the dowels but will be included in the unit price bid for other items in the contract.

Both old and new reinforcement shall be cleaned thoroughly prior to the preparation of the joint.

723.13 - Welder Qualification

All welders shall be certified before working on any material which is to be incorporated into a City project, except for miscellaneous welds as defined below. Each welder must have certification papers conforming

to TXDOT Bulletin C-6, showing the type of work the welder is certified to perform. The welder will only be permitted to do work covered by such papers.

Miscellaneous welds of the following types may be made by a welder who is certified for structural or reinforcing steel or a qualified welder:

Armor joints and their supports, Screed Rail and Form Hanger Supports where permitted on Steel units, Reinforcing Steel to R-Bars for lateral stability between Prestressed Beams, Spirals or Bands to reinforcing Bars in Drilled Shaft cages, permanent Metal Deck forms, additional steel added in railing when slip form construction is used and other similar miscellaneous members that have no load carrying capacity in the completed structure.

A qualified welder is an experienced welder who is capable of making welds of sound quality, but does not have certification papers. Prior to welding operations, the Engineer or a representative of the Engineer shall check the welder's ability by a job site Miscellaneous Weld Qualification Test. The Contractor shall furnish all of the material and equipment necessary for the test.

The miscellaneous Weld Qualification Test shall consist of the following:

The welder shall make a single pass fillet weld in the vertical position ¼ inch maximum size approximately 2 inches long on ½ inch plate using 5/32 inch low hydrogen electrodes in the position indicated. The welder shall stop and start again within the 2 inch length of fillet weld.

The specimen shall be visually examined and the fillet weld shall present a reasonably uniform appearance free of cracks, overlap and undercut. There shall be no porosity visible on the surface of the weld.

The specimen shall be ruptured as indicated by the application of a force or by striking with a hammer.

The fractured surface of the weld shall show complete penetration into the root of the joint and shall exhibit no incomplete fusion to the base metal nor any inclusion or porosity larger than 3/32 inch in its greatest dimension.

If a welder fails to meet the requirements of this test, a retest may be allowed under the following conditions:

An immediate retest may be made consisting of 2 test welds, as described above and both test specimens shall meet all of the requirements specified.

A retest may be made after 30 days, provided there is evidence that the welder has had further training or practice. In this case the test shall be a single specimen.

Qualification by the test herein specified for miscellaneous welding shall be effective immediately upon satisfactory completion thereof and shall remain in effect for the duration of the project.

Before welding on ASTM A 514/517 steel, a welder must present evidence, satisfactory to the Engineer, of at least 3 months satisfactory experience welding this type of steel over 1 inch thick. In lieu of such experience, a welder, previously qualified for welding with low-hydrogen electrodes or has used the proposed welding process, shall have completed a training course in welding ASTM A 514/517 steel prior to taking the welder qualification test.

Tests for certification of welders for manual shielded metal-arc welding shall conform to TXDOT Bulletin C-6. Tests shall be given by an approved laboratory. For field welding, certification by an approved laboratory will be accepted for a period of 1 month from the time of certification. During this period, the welder will be permitted to work on City projects provided the welder's work is satisfactory. If the welder's work is satisfactory during this period, the City will issue certification papers which will permit the welder to work on City projects, as long as the welder continues to do satisfactory work.

A welder must have passed the Basic Qualification Test for Structural Welding in the vertical (3G) and overhead position (4G) conforming to TXDOT Bulletin C-6 prior to welding on any load carrying members.

Also, the welder must demonstrate to a City welding inspector a thorough knowledge of, and ability to consistently implement, the required welding procedures and make welds of sound quality and good appearance. Quality of the welds will be checked by radiography.

To work on field splices of beams and girders, a welder must be certified for and be capable of making groove welds in both the vertical and overhead position when using the manual shielded metal-arc process.

For manual (semiautomatic) gas metal-arc welding or flux cored arc welding, welder qualification tests for certification shall qualify conforming to TXDOT Bulletin C-5 and tested conforming to TXDOT Bulletin C-6 as follows:

1. Basic Test Certification for groove welds for unlimited thickness material will also qualify a welder for any equal or lower strength steel or for fillet welding in the position in which the welder is certified, using the same electrode and combination of shielding used for the test.
2. Welders shall be certified in the vertical and overhead position to work on field splices of beams or girders.
3. Tests for certification shall be given by an approved laboratory. Certification papers for gas metal-arc welding or flux cored arc welding issued by an approved laboratory will be handled in a manner similar to that used for the manual shielded metal-arc process.
4. Welders shall be qualified for each process to be used. Qualification for flux cored arc welding will not qualify a welder for gas metal-arc welding or vice versa.
5. Qualification for welding with any grade electrode will automatically qualify a welder for the use of lower grades of electrodes using the same process, i.e., qualification with Grade ER80S/E80S electrode will qualify for Grade ER70S, but not vice versa.

The certification papers issued by the City are the property of the City and may be canceled at any time.

Radiographic inspection shall be made of all qualification test plates of groove welds for the "Basic Qualification Test". If this inspection indicates any lack of fusion, incomplete penetration and defects 1/16 inch or larger in greatest dimension or if the sum of the greatest dimensions of defects less than 1/16 of an inch in greatest dimension exceeds 3/8 inch in any linear inch of weld, the weld shall be considered as failing the soundness test. This radiographic inspection shall apply only to that portion of the welds between the discard strips of the specimens as indicated in Figures 13 and 14 of Appendix B of TXDOT Bulletin C-6. The specimen plates shall be wide enough to provide a minimum of 6 inches of effective weld length for radiographic testing. Mechanical testing shall conform to TXDOT Bulletin C-6.

723.14 - Measurement and Payment

Compensation will not be allowed under this item for the work prescribed but shall be included in the unit price item of construction in which the item is used.

End

Ref: 406, 721

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ITEM NO. 101S - PREPARING RIGHT OF WAY 1-4-11

101S.1 - Description

This item shall govern the preparation of the right of way for construction operations by removal and disposal of all obstructions from the right of way and from designated easements, where removal of such obstructions is not otherwise indicated as a separate pay item.

Such obstructions shall be considered to include, but not be limited to, remains of houses not completely removed by others, foundations, floor slabs, concrete, brick, lumber, plaster, cisterns, water wells, septic tanks and drain fields, basements; abandoned utility pipes, conduits, underground service station tanks, fences, retaining walls, outhouses, shacks and all other debris.

This item shall also include, but not be limited to, the removal of trees, stumps, roots, bushes, shrubs, curb and gutter, driveways, paved parking areas, miscellaneous stone, brick, sidewalks, drainage structures, manholes, inlets, abandoned railroad tracks, scrap iron, and all rubbish and debris whether above or below ground. Care should be taken to identify and protect existing infrastructure.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

101S.2 - Submittals

The submittal requirements of this specification item may include:

A. A permit when utility adjustments are made in the right-of-way, and

B. A plan for removal and deposition of all non-salvageable materials and debris.

101S.3 - Construction Methods

Prior to commencement of this work, all required erosion controls and tree protection measures indicated on the Drawings shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Owner’s Special Condition and/or as specified on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Areas within the construction limits shall be cleared of all obstructions, abandoned structures, and other items as defined above. All vegetation, except trees or shrubs indicated for preservation, shall also be removed. Trees and shrubs, which are scheduled for preservation, shall be carefully trimmed as directed and shall be protected from scarring, barking or other injuries during construction operations in accordance with Item No. 610S, " Preservation of Trees and Other Vegetation". All exposed cuts over 2 inches (50 millimeters) in diameter, exposed ends of pruned limbs or scarred bark shall be treated with an approved asphalt material within 24 hours of the pruning or injury.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings and/or specified in the Contract Documents. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed.

Culverts, storm sewers, manholes and inlets shall be removed in proper sequence for maintenance of traffic and drainage.

Unless otherwise indicated on the Drawings and/or Contract Documents, all underground obstructions, stumps and roots shall be removed to the following depths:

1. In areas to receive 6 inches (150 mm) or more embankment, a minimum of 12 inches (300 mm) below natural ground.
2. In areas to receive less than 6 inches (150 mm) of embankment, a minimum of 18 inches (450 mm) below the lower elevation of embankment, structure or excavation.
3. In areas to be excavated a minimum of 18 inches (450 mm) below the lower elevation of the embankment, structure or excavation.
4. In all other areas, a minimum of 12 inches (300 mm) below natural ground.

Holes remaining after removal of all obstructions, objectionable material, trees, stumps, etc. shall be backfilled with select embankment material and compacted by approved methods.

When a utility in service conflicts with the construction, it shall be modified as specified in the Standard Contract Documents, Owner's Special Condition and/or as specified on the Drawings.

Where an abandoned underground piped utility is found, it shall be cut and plugged with 6 inches (150 mm) of concrete (in accordance with Specification Item 403, "Concrete for Structures") brick and mortar (in accordance with Specification Item 506S, "Manholes") or a precast stopper grouted in place.

Material to be removed will be designated as salvageable or non-salvageable by the Engineer or designated representative prior to removal from the construction site by the Contractor. All material, which is located within the public right of way and is declared by the Engineer as salvageable, will remain the property of the City of Austin and will be stored at the site or loaded on city trucks as directed by the Engineer. All non-salvageable materials and debris shall become the property of the Contractor and shall be removed from the site and deposited at a permitted disposal site.

101S.4 - Measurement

The preparation of right of way for new construction, when included in the contract as a pay item, will be measured by the acre (hectare: 1 hectare equals 2.471 acres), 100 foot (100 feet equals 30.5 meters) stations or lump sum, regardless of the width of the right of way.

Measurement for payment will be made only on areas indicated and classified as "Preparing Right of Way".

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 101S, "PREPARING RIGHT-OF-WAY"	
City of Austin Standard Contract Documents	
Designation	Description
00700	General Conditions

City of Austin Utilities Criteria Manual	
Designation	Description
Section 5.2.0	Permit for Excavation in the Public Right-of-Way

City of Austin Standard Specifications	
Designation	Description
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 403	Concrete for Structures
Item No. 506S	Manholes
Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS	
Specification 101S, "PREPARING RIGHT-OF-WAY"	
City of Austin Standard Contract Documents	
Designation	Description
01500	Temporary Facilities

01550	Public Safety and Convenience

The Code of the City of Austin, Code of Ordinances, Volume 1

Designation	Description
Article 14-11-181	Permit Required
Article 14-11-189	Conditions for Permit Issuance
Article 14-11-190	Permit Term

City of Austin Standard Specifications

Designation	Description
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 201S	Subgrade Preparation
Item No. 203	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)

Item No. 236S	Rolling (Proof)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence

City of Austin Standard Details

Designation	Description
610S-1	Tree Protection Fence Locations
610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B
621S-1	Diversion
622S-1	Diversion Dike
624S-1	Earth Outlet Sediment Trap
625S-1	Grade Stabilization Structure
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale With Stone Center

628S	Triangular Sediment Filter Dike
628S-1	Hay Bale Dike
629S-1	Brush Berm
630S-1	Interceptor Dike
631S-1	Interceptor Swale
632S-1	Storm Inlet Sediment Trap
633S-1	Landgrading
634S-1	Level Spreader
635S-1	Perimeter Dike
636S-1	Perimeter Swale
637S-1	Pipe Slope Drain (Flexible)
637S-2	Pipe Slope Drain (Flexible)
638S-1	Pipe Outlet Sediment Trap
639S-1	Rock Berm
641S-1	Stabilized Construction Entrance
642S-1	Silt Fence
643S-1	Stone Outlet Structure
644S-1	Stone Outlet Sediment Trap

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of

Highways, Streets, and Bridges	
Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 260	Lime Treatment for Materials Used as Subgrade (Road Mixed)
Item No. 265	Lime-Fly Ash (LFA) Treatment for Materials Used as Subgrade

Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

End

ITEM NO. 102S - CLEARING AND GRUBBING 8-20-07

102S.1 - Description

This item shall govern the removal and disposal of all trees, stumps, brush, roots, shrubs, vegetation, logs, rubbish and other objectionable material.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

102S.2 - Submittals

The submittal requirements of this specification item may include:

A. A permit when utility adjustments are made in the right-of-way, and

B. A plan for removal and deposition of all clearing and grubbing materials and debris.

102S.3 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures indicated on the Drawings shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Owner's Special Condition and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Areas within the construction limits indicated on the Drawings shall be cleared of all trees, stumps, brush, etc., as defined in section 102S.1; except trees or shrubs scheduled for preservation which shall be carefully trimmed as directed, in accordance with Item No. 610S, " Preservation of Trees and Other Vegetation" and shall be protected from scarring, barking or other injuries during construction operations. All exposed cuts over 2 inches (50 millimeters) in diameter, exposed ends of pruned limbs or scarred bark shall be treated with an approved asphalt material within 24 hours of the pruning or injury.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings and/or specified in the Contract Documents. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed.

Within the construction limits or areas indicated, all obstructions, stumps, roots, vegetation, abandoned structures, rubbish and objectionable material shall be removed to the following depths:

1. In areas to receive 6 inches (150 mm) or more embankment, a minimum of 12 inches (300 mm) below natural ground.
2. In areas to receive embankment less than 6 inches (150 mm), a minimum of 18 inches (450 mm) below the lower elevation of embankment, structure or excavation.
3. In areas to be excavated a minimum of 18 inches (450 mm) below the lower elevation of the embankment, structure or excavation.
4. In all other areas a minimum of 12 inches (300 mm) below natural ground.

Holes remaining after removal of all obstructions, objectionable material, trees, stumps, etc. shall be backfilled with select embankment material and compacted by approved methods. All cleared and grubbed material shall be disposed of in a manner satisfactory to the Engineer or designated

representative. Unless otherwise provided, all materials as described above shall become the property of the Contractor and removed from the site and disposed of at a permitted disposal site.

Burning materials at the site shall conform to Standard Contract Document Section 01550, "Public Safety and Convenience".

102S.4 - Measurement

"Clearing and Grubbing", when included in the contract as a pay item, will be measured by the acre (hectare: 1 hectare is equal to 2.471 acres), 100 foot (100 feet is equal to 30.5 meters) stations or lump sum, regardless of the width of the right of way.

102S.5 - Payment

The work and materials presented herein will not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used, unless specified as a separate pay item in the contract bid form. When included for payment, it shall be paid for at the unit bid price for "Clearing and Grubbing". This price shall include full compensation for all work herein specified, including the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the Work.

Payment, when included as a contract pay items, will be made under one of the following:

Pay Item No. 102S-A:	Clearing and Grubbing	Per Acre.
Pay Item No. 102S-B:	Clearing and Grubbing	Per 100 foot Station.
Pay Item No. 102S-C:	Clearing and Grubbing	Lump Sum.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 102S, "CLEARING AND GRUBBING"	
City of Austin Standard Contract Documents	
Designation	Description
00700	General Conditions
01550	Public Safety and Convenience

City of Austin Utilities Criteria Manual	
Designation	Description
Section 5.2.0	Permit for Excavation in the Public Right-of-Way
City of Austin Standard Specifications	
Designation	Description
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS	
Specification 102S, "CLEARING AND GRUBBING"	
The Code of the City of Austin, Code of Ordinances, Volume 1	
Designation	Description
Article 15-12-166	Permit Required
Article 15-12-	Conditions for Permit Issuance

173	
Article 15-12-174	Permit Term

City of Austin Standard Contract Documents

Designation	Description
01500	Temporary Facilities

City of Austin Standard Specifications

Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 104S	Removing Portland Cement Concrete
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 203	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)

Item No. 236S	Rolling (Proof)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence

City of Austin Standard Details

Designation	Description
610S-1	Tree Protection Fence Locations
610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B
621S-1	Diversion
622S-1	Diversion Dike
624S-1	Earth Outlet Sediment Trap
625S-1	Grade Stabilization Structure
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale With Stone Center

628S	Triangular Sediment Filter Dike
628S-1	Hay Bale Dike
629S-1	Brush Berm
630S-1	Interceptor Dike
631S-1	Interceptor Swale
632S-1	Storm Inlet Sediment Trap
633S-1	Landgrading
634S-1	Level Spreader
635S-1	Perimeter Dike
636S-1	Perimeter Swale
637S-1	Pipe Slope Drain (Flexible)
637S-2	Pipe Slope Drain (Flexible)
638S-1	Pipe Outlet Sediment Trap
639S-1	Rock Berm
641S-1	Stabilized Construction Entrance
642S-1	Silt Fence
643S-1	Stone Outlet Structure
644S-1	Stone Outlet Sediment Trap

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of

Highways, Streets, and Bridges

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 260	Lime Treatment for Materials Used as Subgrade (Road Mixed)
Item No. 265	Lime-Fly Ash (LFA) Treatment for Materials Used as Subgrade

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-105-E	Determination of Plastic Limit of Soils

Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

End

ITEM NO. 104S - REMOVING PORTLAND CEMENT CONCRETE 9-26-12

104S.1 - Description

This item shall govern the demolition, removal and satisfactory disposal of existing Portland cement concrete, as classified, at locations indicated on the Drawings or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

104S.2 - Submittals

The submittal requirements of this specification item may include:

A. A permit when utility adjustments are made in the right-of-way, and

B. A plan for removal and deposition of all 'broken up' existing Portland cement (p.c.) concrete materials and debris.

104S.3 - Classification

Existing Portland cement concrete, when removed under this section, will be classified as follows:

1. Concrete Curb will include curb, curb and gutter and combinations thereof,
2. Concrete Slabs will include, but not be limited to, house slabs, patio slabs, porch slabs, concrete riprap and concrete pavement,
3. Sidewalks and Driveways will include concrete sidewalks and driveways,
4. Concrete Walls will include all walls, regardless of height, and wall footings,
5. Concrete Steps will include all steps and combinations of walls and steps,
6. Abandoned Foundations will include abandoned utility foundations,
7. Miscellaneous Concrete shall include all other concrete items, which are not identified in items 1 through 6 above.

104S.4 - Materials

Mortar shall conform to mortar specified in Standard Specification Item No. 403, "Concrete for Structures".

104S.5 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Section 00700, "General Conditions". A permit shall be required when utility adjustments are to be made in preparation for highway construction, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

The existing Portland cement concrete shall be broken up, removed in accordance with Item No. 101S, "Preparing Right of Way" and disposed of by the Contractor and deposited at a permitted disposal site.

When it is specified that only a portion of the existing Portland cement (p.c.) concrete is to be removed and that the remaining p.c. concrete will continue to serve its purpose, special care shall be exercised to avoid damage to that portion which will remain in place. Unless otherwise established by the Engineer or designated representative, existing p.c. concrete shall be cut to the neat lines, that are indicated on the Drawings, by sawing with an appropriate type circular type circular concrete saw to a minimum depth of ½ inch (12.5 mm). Any reinforcing steel encountered shall be cut off 1 inch (25 mm) inside of p.c. concrete sawed line. Any existing p.c. concrete, which is damaged or destroyed beyond the neat lines so established, shall be replaced at the Contractor's expense. Remaining p.c. concrete shall be mortared to protect the reinforcing steel and provide a neat clean appearance.

When reinforcement is encountered during the removal of portions of existing structures to be modified, a minimum of 1 foot (300 mm) of steel length shall be cleaned of all old p.c. concrete and left in place to tie into the new construction where applicable. All unsuitable material shall be removed and replaced with approved material. All foundations, walls or other objectionable material shall be removed to a minimum depth of 18 inches (450 mm) below all structures and 12 inches (300 mm) below areas to be vegetated.

104S.6 - Measurement

When included in the contract as a separate pay item, the removal of p.c. concrete curb and p.c. concrete wall as prescribed above will be measured by the lineal foot (meter: 1 meter is equal to 3.281 feet) in its original position regardless of the dimensions or size. The removal of p.c. concrete slabs, p.c concrete sidewalks and driveways, as prescribed above, will be measured by the square foot (square meter: 1 square meter is equal to 10.764 square feet) in original position, regardless of the thickness and existence of reinforcing steel. Portland cement concrete steps removed will be measured per lineal foot (meter: 1 meter is equal to 3.281 feet) of each individual step tread including the bottom step. The removal of p.c. concrete foundations will be measured per each individual foundation. The removal of miscellaneous concrete will be measured per lump sum.

104S.7 - Payment

The work and materials presented herein will generally not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used. When specified in the contract bid form as a separate pay item, the item will be paid for at the contract unit bid price(s) for "Remove P.C. Concrete Curb", "Remove P.C. Concrete Slab", "Remove P.C. Concrete Sidewalks and Driveways", "Remove P.C. Concrete Walls", "Remove P.C. Concrete Steps", "Remove P.C. Concrete Foundations" and "Remove Miscellaneous P.C. Concrete". The bid prices shall include full compensation for all Work herein specified, including the disposal of all material not required in the Work, the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the Work.

Payment will be made under one of the following:

Pay Item No. 104S-A:	Remove P.C. Concrete Curb	Per Lineal foot.
Pay Item No. 104S-B:	Remove P.C. Concrete Slab	Per Square foot.
Pay Item No. 104S-C:	Remove P.C. Concrete Sidewalks and Driveways	Per Square foot
Pay Item No. 104S-D:	Remove P.C. Concrete Wall	Per Lineal foot.
Pay Item No. 104S-E:	Remove P.C. Concrete Steps	Per Lineal foot.

Pay Item No. 104S-F:	Remove P.C. Concrete Foundations	Per Each.
Pay Item No. 104S-G:	Remove Miscellaneous P.C. Concrete	Per Lump Sum.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 104S, "REMOVING CONCRETE"	
City of Austin Standard Contract Documents	
Designation	Description
00700	General Conditions
City of Austin Utilities Criteria Manual	
Designation	Description
Section 5.2.0	Permit for Excavation in the Public Right-of-Way
City of Austin Standard Specifications	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 110S	Street Excavation

Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 403	Concrete for Structures
Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS	
Specification Item 104S, "REMOVING CONCRETE"	
City of Austin Standard Contract Documents	
Designation	Description
01500	Temporary Facilities
01550	Public Safety and Convenience
The Code of the City of Austin, Code of Ordinances, Volume 1	
Designation	Description
Article 15-12-166	Permit Required
Article 15-12-173	Conditions for Permit Issuance
Article 15-12-174	Permit Term

City of Austin Standard Specifications	
Designation	Description
Item No. 201S	Subgrade Preparation
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence
City of Austin Standard Details	
Designation	Description
610S-1	Tree Protection Fence Locations
610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B
621S-1	Diversion
622S-1	Diversion Dike
624S-1	Earth Outlet Sediment Trap

625S-1	Grade Stabilization Structure
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale With Stone Center
628S	Triangular Sediment Filter Dike
628S-1	Hay Bale Dike
629S-1	Brush Berm
630S-1	Interceptor Dike
631S-1	Interceptor Swale
632S-1	Storm Inlet Sediment Trap
633S-1	Landgrading
634S-1	Level Spreader
635S-1	Perimeter Dike
636S-1	Perimeter Swale
637S-1	Pipe Slope Drain (Flexible)
637S-2	Pipe Slope Drain (Flexible)
638S-1	Pipe Outlet Sediment Trap
639S-1	Rock Berm
641S-1	Stabilized Construction Entrance
642S-1	Silt Fence
643S-1	Stone Outlet Structure

644S-1	Stone Outlet Sediment Trap

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 104	Removing Concrete
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 420	Concrete Structures

End

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ITEM NO. 110S - STREET EXCAVATION 11-18-04

110S.1 - Description

This item shall govern: (1) the excavation and proper utilization or otherwise satisfactory disposal of all excavated material, of whatever character, within the right of way or other limits of the work indicated and (2) the construction, compaction, shaping and finishing of all earthwork on the entire project in accordance with the specification requirements herein outlined, in conformity with the required lines, grades and typical cross sections indicated on the Drawings or as directed by the Engineer or designated representative. When not otherwise included in the Contract Documents, this item shall include the Work described in specification Item Nos. 101S, "Preparing Right of Way", 102S, "Clearing and Grubbing", 104S, "Removing Portland Cement Concrete", 132S, "Embankment", 201S, "Subgrade Preparation" and 236S, "Proof Rolling".

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

110S.2 - Submittals

The submittal requirements of this specification item may include:

A. A permit when utility adjustments are made in the right-of-way,

B. A plan for removal and deposition of all 'Waste' materials, and

C. A Blasting Permit if blasting is required and allowed on the project.

110S.3 - Classification

All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

110S.4 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Owner’s Special Condition and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed, that conform to Item No. 610S, " Preservation of Trees and Other Vegetation ".

All street excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections. The Contractor will be required to set blue-tops for the subgrade along centerlines, at quarter points and curb lines or edge of pavement at intervals not exceeding 50 feet (15 meters). Suitable excavated materials shall be utilized, insofar as practicable, in constructing any required embankments. The construction of all embankments shall conform to Item No. 132S, "Embankment".

All earth cuts for base and/or pavement structure construction shall be scarified to a uniform depth of at least 6 inches (150 millimeters) below the required finished subgrade elevation for the entire roadbed width. The material shall be mixed, reshaped by blading, sprinkled and then rolled in accordance with Section 2 of the City of Austin Specification Item 132S, "Embankment".

High PI materials (i.e. PI 20 %) which exhibit a Plasticity Index (PI) greater by 5 % than the surrounding materials or any materials with a moisture content greater than 2 percent (%) in excess of optimum moisture shall be classified as unsuitable and must be removed or manipulated to meet the above criteria before use.

Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor. Unsuitable material encountered below the subgrade elevation in roadway cuts, when declared "Waste" by the Engineer, shall be replaced with material from the roadway excavation or with other suitable material as approved by the Engineer or designated representative. It shall become the Contractor's responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

All blasting shall conform to the General Notes on the Drawings and to the Standard Contract Document Section 01550, "Public Safety and Convenience". In all cases where blasting is permitted, a Blasting Permit must be obtained in advance from the City of Austin Public Works Department.

110S.5 - Measurement

All accepted street excavation will be measured by either Method A or B as follows:

A. Method A

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) by the average end areas. Cross sectional areas shall be computed from the existing ground surface to the established line of the subgrade over the limits of the right of way or other work limits shown on the Drawings, including parkway slopes and sidewalk areas.

B. Method B

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards), based upon the average end areas taken from pre-construction cross sections and planned grades. The planned quantities for street excavation will be used as the measurement for payment of this item.

110S.6 - Payment

This item will be paid for at the contract unit bid price for "Street Excavation", as provided under measurement Method A or B as included in the bid. The bid price shall include full compensation for all work herein specified, including subgrade preparation, unless specified otherwise, and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 110S-A:	Street Excavation	Per Cubic yard.
Pay Item No. 110S-B:	Street Excavation, Plan Quantity	Per Cubic yard.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 110S, "STREET EXCAVATION"	
City of Austin Standard Contract Documents	
Designation	Description
00700	General Conditions
01550	Public Safety and Convenience
City of Austin Utilities Criteria Manual	
Designation	Description
Section 5.2.0	Permit for Excavation in the Public Right-of-Way
City of Austin Standard Specifications	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 236S	Proof Rolling

Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS	
Specification Item 110S, "STREET EXCAVATION"	
City of Austin Standard Contract Documents	
Designation	Description
01500	Temporary Facilities
City of Austin Code of Ordinances, Volume 2	
Designation	Description
Article 14-11-181	Permit Required
Article 14-11-189	Conditions for Permit Issuance
Article 14-11-190	Excavation Sequence and Permit Term
City of Austin Standard Specifications	
Designation	Description
Item No. 111S	Excavation
Item No. 120S	Channel Excavation

Item No. 203S	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)
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Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence

City of Austin Standard Details

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610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B
610S-6	Tree Protection, Tree Wells

621S-1	Diversion
622S-1	Diversion Dike
624S-1	Earth Outlet Sediment Trap
625S-1	Grade Stabilization Structure
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale With Stone Center
628S	Triangular Sediment Filter Dike
628S-1	Hay Bale Dike
629S-1	Brush Berm
630S-1	Interceptor Dike
631S-1	Interceptor Swale
632S-1	Storm Inlet Sediment Trap
633S-1	Landgrading
634S-1	Level Spreader
635S-1	Perimeter Dike
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637S-2	Pipe Slope Drain (Rigid)
638S-1	Pipe Outlet Sediment Trap
639S-1	Rock Berm

641S-1	Stabilized Construction Entrance
642S-1	Silt Fence
643S-1	Stone Outlet Structure
644S-1	Stone Outlet Sediment Trap

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
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Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)

Item No. 260	Lime Treatment for Materials Used as Subgrade (Road Mixed)
Item No. 265	Lime-Fly Ash (LFA) Treatment for Materials Used as Subgrade

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

End

ITEM NO. 111S - EXCAVATION 9-26-12

111S.1 - Description

This item shall govern: (1) the excavation and proper utilization or satisfactory disposal of all excavated materials, of whatever character, within the limits of the Work and (2) construction, compaction, shaping and finishing of all designated earthwork areas in accordance with the specification requirements outlined herein and in conformity with the required lines, grades and typical cross sections indicated on the Drawings or as directed by the Engineer or designated representative. When not otherwise included in the Contract Documents, this item shall include the work described in Specification Item Nos. 101S, "Preparing Right of Way", No. 102S, "Clearing and Grubbing", No. 104S, "Removing Portland Cement Concrete", No. 132S "Embankment" and No. 201S, "Subgrade Preparation".

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

111S.2 - Submittals

The submittal requirements of this specification item may include:

A. A permit when utility adjustments are made in the right-of-way,

B. A plan for removal and deposition of all 'Waste' materials, and

C. A Blasting Permit if blasting is required and allowed on the project.

111S.3 - Classification

All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

111S.4 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures shall be in place. The existing utilities shall be located and shall be protected as specified in the Standard Contracts Document Owner’s Special Condition and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed, that conform to Specification Item No. 610S, "Preservation of Trees and Other Vegetation".

All excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections indicated on the Drawings. Suitable excavated materials shall be utilized, insofar as practical, in constructing required embankments. The construction of all embankments shall conform to Specification Item No. 132S, "Embankment". No material shall be stockpiled within the banks of a waterway.

Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor. Unsuitable material encountered below the subgrade elevation in roadway cuts, when declared "Waste" by the Engineer or designated representative, shall be replaced with material from the roadway excavation or with other suitable material as approved by the Engineer. It shall become the Contractor's responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

All blasting shall conform to the Provisions of the Standard Contract Document Section 01550, "Public Safety and Convenience". In all cases, a Blasting Permit must be obtained in advance from the City of Austin, Public Works Department.

Adequate dewatering and drainage of excavation shall be maintained throughout the time required to complete the excavation work.

111S.5 - Measurement

All accepted excavation will be measured by either Method A or B as follows:

(1) Method A

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) by the average end area methods. Cross-sectional areas shall be computed from the existing ground surface to the established line of the subgrade, as shown on typical sections in the Drawings, over the limits of the right of way or other work limits, including parkway slopes and sidewalk areas.

(2) Method B

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) based upon the average end area method taken from pre-construction cross sections and planned grades. The planned quantities for excavation will be used as the measurement for payment for this item.

111S.6 - Payment

This item will be paid for at the contract unit bid price for "Excavation", as provided under measurement Method A or B as included in the bid. The bid price shall include full compensation for all work herein specified including dewatering, drainage, subgrade preparation, unless otherwise indicated, and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 111S-A:	Excavation	Per Cubic Yard.
Pay Item No. 111S-B:	Excavation, Plan Quantity	Per Cubic Yard.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 111S, "EXCAVATION"	
City of Austin Standard Contract Documents	
Designation	Description
00700	General Conditions

01550	Public Safety and Convenience
City of Austin Utilities Criteria Manual	
Designation	Description
Section 5.2.0	Permit for Excavation in the Public Right-of-Way
City of Austin Technical Specifications	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 236S	Proof Rolling
Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS
Specification Item 111S, "EXCAVATION"
City of Austin Standard Contract Documents

Designation	Description
01500	Temporary Facilities

City of Austin Standard Specifications

Designation	Description
Item No. 120S	Channel Excavation
Item No. 203	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence

City of Austin Standard Details

Designation	Description
No. 610S-1	Tree Protection Fence Locations
No. 610S-2	Tree Protection Fence, Type B Chainlink

No. 610S-3	Tree Protection Fence, Type B Wood
No. 610S-4	Tree Protection Fence, Modified Type A
No. 610S-5	Tree Protection Fence, Modified Type B
No. 621S-1	Diversion
No. 622S-1	Diversion Dike
No. 624S-1	Earth Outlet Sediment Trap
No. 625S-1	Grade Stabilization Structure
No. 627S-1	Grass Lined Swale
No. 627S-2	Grass Lined Swale With Stone Center
No. 628S	Triangular Sediment Filter Dike
No. 628S-1	Hay Bale Dike
No. 629S-1	Brush Berm
No. 630S-1	Interceptor Dike
No. 631S-1	Interceptor Swale
No. 632S-1	Storm Inlet Sediment Trap
No. 633S-1	Landgrading
No. 634S-1	Level Spreader
No. 635S-1	Perimeter Dike
No. 636S-1	Perimeter Swale
No. 637S-1	Pipe Slope Drain (Flexible)

No. 637S-2	Pipe Slope Drain (Flexible)
No. 638S-1	Pipe Outlet Sediment Trap
No. 639S-1	Rock Berm
No. 641S-1	Stabilized Construction Entrance
No. 642S-1	Silt Fence
No. 643S-1	Stone Outlet Structure
No. 644S-1	Stone Outlet Sediment Trap

The Code of the City of Austin, Code of Ordinances, Volume 1

Designation	Description
Article 15-12-166	Permit Required
Article 15-12-173	Conditions for Permit Issuance
Article 15-12-174	Permit Term

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening

Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 260	Lime Treatment for Materials Used as Subgrade (Road Mixed)
Item No. 265	Lime-Fly Ash (LFA) Treatment for Materials Used as Subgrade

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

End

ITEM NO. 130S - BORROW 9-26-12

130S.1 - Description

This item shall govern required excavation, removal and proper utilization of materials secured from sources, selected by the Contractor and approved by the Engineer or designated representative. The compaction of embankments constructed from borrow as provided herein shall conform to the appropriate sections of Specification Item Nos. 132S, "Embankment" and 236S, "Proof Rolling".

Borrow will be used only when indicated on the Drawings or directed by the Engineer or designated representative and shall only be acquired from approved sources.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

130S.2 - Submittals

The submittal requirements of this specification item may include:

A. Identification of Class, source and characteristics (P.I., linear shrinkage, etc.) of proposed borrow material, and

B. A plan for managing and maintaining borrow sites.

130S.3 - Materials

All authorized borrow shall conform to one of the following classes:

Class A (Select Borrow)

Class A Borrow material shall consist of suitable granular material, free from vegetation or other objectionable matter and reasonably free from lumps of earth. When tested by standard TxDOT laboratory methods Tex-105-E, Tex-106-E and Tex-107-E, the Class A Select Borrow, shall meet the following requirements:

The Liquid Limit shall not exceed	45
The Plasticity Index shall not exceed	15
The bar linear shrinkage shall not be less than	2

Class B (Borrow)

Class B Borrow material shall consist of suitable non swelling [i.e. soils with a plasticity index (P.I.) less than 20] earth material such as loam, clay or other such materials that will form a stable embankment.

Class C (Topsoil) See Standard Specification Item No. 601S.3(A)

Class C Borrow material shall consist of approved soils, which shall be clean, friable and capable of supporting plant life. This material shall also be free of stones and all other debris.

130S.4 - Construction Methods

Prior to commencing this work, all required erosion control and environmental measures shall be in place. All suitable materials removed from excavations shall be used, insofar as practicable in the formation of embankments conforming to Specification Item No. 132S, "Embankment", as otherwise indicated on the Drawings or as directed by the Engineer or designated representative. The completed work shall conform to the established alignment, grades and cross section as shown on the Drawings. The additional material necessary to complete the work described above shall be "Borrow" of the class specified.

The Contractor shall arrange for borrow from one of the following sources:

1. Existing borrow pit,
2. New borrow pit, or
3. Surplus excavated material from a site, with a site development permit.

The Contractor shall notify the Engineer 3 weeks prior to opening a pit or any other borrow source to allow necessary testing for approval of materials. All borrow sites shall comply with the requirements of the site development permit.

During construction, borrow sources shall be kept drained to permit final cross sections to be measured, when required.

Borrow sites shall be managed and maintained to minimize the impact of the appearance of the natural topographic features and at no time create a potential hazard to the public.

130S.5 - Measurement

Borrow will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.196 cubic yards) in its final position based upon the average end areas, calculated from pre-construction cross sections and plan grades. The plan quantities for Borrow or Topsoil will be used as the measurement for payment for this item.

130S.6 - Payment

All work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering on the road; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work.

Payment will be made under one of the following:

Pay Item No. 130S-A:	Class A (Select Borrow), Plan Quantity	Per Cubic Yard.
Pay Item No. 130S-B:	Class B (Borrow), Plan Quantity	Per Cubic Yard.
Pay Item No. 130S-T:	Class C (Topsoil), Plan Quantity	Per Cubic Yard.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 130S, "BORROW"	
City of Austin Standard Specifications	
Designation	Description
Item No. 132S	Embankment
Item No. 236S	Rolling (Proof)
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-107-E	Determination of Bar Linear Shrinkage of Soils

RELATED CROSS REFERENCE MATERIALS	
Specification 130S, "BORROW"	
City of Austin Standard Contract Documents	
Designation	Description
00700	General Conditions

City of Austin Standard Specifications	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence

City of Austin Standard Details	
Designation	Description
No. 610S-1	Tree Protection Fence Locations
No. 610S-2	Tree Protection Fence, Type B Chainlink

No. 610S-3	Tree Protection Fence, Type B Wood
No. 610S-4	Tree Protection Fence, Modified Type A
No. 610S-5	Tree Protection Fence, Modified Type B
No. 621-1	Diversion
No. 622-1	Diversion Dike
No. 624-1	Earth Outlet Sediment Trap
No. 625-1	Grade Stabilization Structure
No. 626-1	Grass Lined Swale
No. 627-1	Grass Lined Swale With Stone Center
No. 628S	Triangular Sediment Filter Dike
No. 628S-1	Hay Bale Dike
No. 629S-1	Brush Berm
No. 630S-1	Interceptor Dike
No. 631S-1	Interceptor Swale
No. 632S-1	Storm Inlet Sediment Trap
No. 633S-1	Landgrading
No. 634S-1	Level Spreader
No. 635S-1	Perimeter Dike
No. 636S-1	Perimeter Swale
No. 637S-1	Pipe Slope Drain (Flexible)

No. 637S-2	Pipe Slope Drain (Flexible)
No. 638S-1	Pipe Outlet Sediment Trap
No. 639S-1	Rock Berm
No. 641S-1	Stabilized Construction Entrance
No. 642S-1	Silt Fence
No. 643S-1	Stone Outlet Structure
No. 644S-1	Stone Outlet Sediment Trap

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)

Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

End

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ITEM NO. 201S - SUBGRADE PREPARATION 8-20-07

201S.1 - Description

This item shall govern scarifying; blading and rolling the subgrade to obtain a uniform texture and provide as nearly as practicable a uniform density for the top 6 inches (150 mm) of the subgrade.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

201S.2 - Submittals

The submittal requirements of this specification item may include:

A. A plan identifying classification and characteristics (P.I., optimum moisture-density, etc.) of insitu subgrade soils, as well as the source, classification and characteristics of any proposed borrow material,

B. Type and size of equipment proposed to produce the required compaction, and

C. Compaction (moisture-density, etc) test results for in-situ subgrade soils and/or borrow materials.

201S.3 - Construction Methods

Prior to initiation of subgrade preparation activities, all operations involving Standard Specification Item No. 101S," Preparing Right of Way" and/or Standard Specification Item No. 102S, "Clearing and Grubbing" shall be completed. The surface of the subgrade shall be scarified and shaped in conformity with the typical sections and the lines and grades indicated on the Drawings; by the removal of existing material or addition of approved material as established by the Engineer or designated representative. Any deviation in the subgrade cross section which exceeds ½ inch in a length of 10 feet (12 mm in a length of 3 meters), measured longitudinally, shall be corrected by loosening, adding or removing material, and then reshaping and compacting by sprinkling and rolling.

All unsuitable material shall be removed and replaced with approved material. All foundations, walls or other objectionable material shall be removed in accordance with Standard Specification Item No. 104S, "Removing Portland Cement Concrete" to a minimum depth of 18 inches (450 mm) under all structures and 12 inches (300 mm) under areas to be vegetated. All holes, ruts and depressions shall be filled with approved material and compacted by approved methods.

The subgrade shall be prepared sufficiently in advance to insure satisfactory prosecution of the Work. The Contractor will be required to set blue tops for the subgrade on the centerline, at the quarter points and along the curb lines or edge of pavement at maximum intervals of 50 feet (15 meters). The subgrade shall be tested by proof rolling in conformity with Standard Specification Item No. 236S, "Proof Rolling" prior to placement of the first course of base material. Any unstable or spongy subgrade areas identified by proof rolling shall be corrected either by additional re-working, drying and compaction, or by removal and replacement of unsuitable materials. When specifically directed by the Engineer or designated representative, the Contractor shall re-work the subgrade* as follows:

A. Remove the unstable subgrade to the full depth of the unstable insitu material or to a minimum depth of 6 inches (150 mm), whichever is greater;

B. Spread the material over a sufficient area to allow reworking of the excavated material;

C. Disc, scarify or otherwise breakup the excavated material and allow to dry (Note: If approved by the Engineer or designated representative, the addition of lime or other additive may be used to aid in the drying process or to stabilize the unstable material);

D. Fill the excavated area with the re-worked material and compact to specified densities; and

E. Proof roll the re-worked area.

* The Rework process will not be allowed for unstable organic subgrade soils. These type soils will be permanently removed and replaced with materials approved by the Engineer or designated representative.

All suitable material removed in accordance with Standard Specification Item No, 111S, "Excavation", may be utilized in the subgrade with the approval of the Engineer or designated representative. All other material required for completion of the Subgrade, including those defined in accordance with Specification Item No. 130S, "Borrow", shall also be subject to approval by the Engineer or designated representative.

It is the intent of this specification to provide the required density and moisture control for the subgrade based on the plasticity characteristics of the approved materials. The subgrade materials shall be sprinkled as required and compacted to the extent necessary to provide the density specified below, unless otherwise indicated on the Drawings. The Plasticity Index (P.I.) will be established in accordance with TxDOT Test Methods Tex-104-E, Tex-105-E and Tex-106-E. The density determination will be made in accordance with TxDOT Test Method Tex-114-E and field density measurements will be made in accordance with TxDOT Test Method Tex-115-E.

Description	Density, Percent	Moisture
Non-swelling Soils (P.I. less than 20)	Not less than 95	
Swelling Soils (P.I. between 20 and 35)	Not less than 95 nor more than 102	Not less than optimum
Swelling Soils (P.I. greater than 35)	Not less than 95 nor more than 100	Not less than optimum

Subgrade materials on which planting or turf will be established shall be compacted to a minimum of 85 percent of the density as determined in accordance with TxDOT Test Method Tex-114-E. Field tests for density in accordance with TxDOT Test Method Tex-115-E will be made as soon as possible after compaction operations are completed. If the material fails to meet the density specified, it shall be reworked as necessary to obtain the density required.

Prior to placement of any base materials, the in-place density and moisture content of the top 6 inches (150 mm) of compacted subgrade shall be checked. If the tests indicate that the relative density and moisture do not meet the limits specified in the table above, the subgrade shall be reworked as necessary to obtain the specified compaction and moisture content. All initial testing will be paid for by the City of Austin. All retesting shall be paid for by the Contractor.

201S.4 - Measurement

All acceptable subgrade preparation when included in the contract as a separate pay item, will be measured by the square yard (square meter: 1 square meter equals 1.196 Square yards). The measured area includes the entire width of the roadway for the entire length as indicated on the Drawings.

SPECIFIC CROSS REFERENCE MATERIALS

Specification Item 201S, "SUBGRADE PREPARATION"

City of Austin Standard Specification Items

Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 236S	Proof Rolling

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils

Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials

RELATED CROSS REFERENCE MATERIALS	
Specification Item 201S, "SUBGRADE PREPARATION"	
City of Austin Standard Specifications	
Designation	Description
Item No.132S	Embankment
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling

Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials

End

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ITEM NO. 210S - FLEXIBLE BASE 2-24-10

210S.1 - Description

This item governs furnishing and placing a crushed stone base course for surfacing, pavement, or other base courses. "Flexible Base" shall be constructed on an approved, prepared surface in one or more courses conforming to the typical sections and to the lines and grades, indicated on the Drawings or established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

210S.2 - Submittals

The submittal requirements of this specification item may include:

A. Source, gradation and test results for the crushed limestone material,

B. Notification that the crushed limestone stockpile is completed and ready for testing, and

C. Field density test results for in-place compacted flexible base,

210S.3 - Material

A. Mineral Aggregate

The material shall be crushed argillaceous limestone meeting the requirements specified herein. The material shall be from sources approved by the City and shall consist of durable crushed stone that has been screened to the required gradation.

Flexible base materials shall be tested according to the following TxDoT standard test methods:

a) Preparation for Soil Constants and Sieve Analysis	Tex-101-E
b) Liquid Limit	Tex-104-E
c) Plastic Limit	Tex-105-E
d) Plasticity Index	Tex-106-E
e) Sieve Analysis	Tex-110-E
f) Wet Ball Mill	Tex-116-E
g) Triaxial Test	Tex-117-E, Part II

1. Plasticity Index shall be determined in accordance with Tex-107-E (Linear Shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
2. When a soundness value is required on the drawings, the material shall be tested in accordance with Tex-411-A.

Base material shall be stockpiled after crushing, then tested by the City's designated laboratory and approved by the Engineer or designated representative prior to being hauled to the Project.

The material shall be well graded and shall meet the following requirements:

Sieve Designation		Other Requirements	% Retained	
US	SI			
1¾″	45 mm		0	
7/8 ″	22.4 mm		10—35	
3/8 ′	9.5 mm		30—50	
#4	4.75 mm		45—65	
#40	425 µm		70—85	
		Maximum Plasticity Index		10
		Maximum Wet Ball Mill		42
Maximum Increase in passing #40 (425 µm) sieve from Wet Ball Mill Test			20	

Minimum compressive strength when subjected to the triaxial test shall be 35 psi at 0 psi lateral pressure [240 kiloPascal (kPa) at 0 kPa lateral pressure] and 175 psi at 15 psi lateral pressure [1200 kiloPascal (kPa) at 100 kPa lateral pressure].

B. Asphaltic Material

Prime Coat. Prime Coat shall conform to the requirements of Standard Specification Item 306S, "Prime Coat", except for measurement and payment.

210S.4 - Stockpiling, Storage and Management

A. Managing Material:

The stockpile shall be constructed on a relatively smooth area that has been cleared of debris, weeds, brush, trees and grass. Stockpiles shall contain between 25,000 and 50,000 cubic yards (19,100 to 38,200 cubic meters). The stockpile shall be constructed using scrapers, bottom dumps or

other similar equipment that allows dumping and spreading without rehandling. The stockpile shall be constructed to allow dumping and spreading in one direction only. The height of the stockpile shall not exceed the capabilities of available equipment to make a full cut (bottom to top) on any of the four sides.

A stockpile shall be completed before being tested by the City. The Contractor's supplier shall notify the City when a stockpile has been completed and is ready to be tested. The stockpile shall not be added to after it has been tested.

The Contractor shall provide material only from stockpiles that have been inspected, tested and accepted by the City. A ticket showing the date, source, stockpile number, and net weight (mass) shall be provided to the Inspector with each load of material delivered to the Project.

Material shall be loaded from the stockpile by making successive vertical cuts through its entire depth.

B. Test Sampling:

The Contractor's supplier may choose the method of sample gathering for testing by the City's laboratory as follows:

1. The supplier shall make a full-height cut a sufficient distance into each side of the stockpile to obtain a uniform sample. The four samples (one from each side of the stockpile) shall then be combined and mixed into a single "test" specimen from which the City's laboratory can obtain a sample.
2. As the stockpile is constructed, a perpendicular cut will be made across the spreading direction at every two feet to four feet (0.6 to 1.2 meters) of height and the sample used to start a "mini" stockpile. The process shall be repeated in two feet to four feet (0.6 to 1.2 meter) increments of height, until the stockpile and the "mini" stockpile are completed. Samples shall be obtained from the "mini" stockpile in the same manner described in (1) above.

C. Testing and Acceptance:

When initial tests indicate that the material is unacceptable, the City may, if requested by the Contractor's supplier, sample and test the material one more time. The additional sampling and testing shall be paid for by the supplier.

210S.5 - Construction Methods

A. Preparation of Subgrade:

Flexible base shall not be placed until the Contractor has verified by proof rolling that the subgrade has been prepared and compacted in conformity with Standard Specification Item 201S, "Subgrade Preparation," to the typical sections, lines and grades indicated on the Drawings. Any deviation shall be corrected and proof rolled prior to placement of the flexible base material.

The Contractor shall not place flexible base until the subgrade has cured to the satisfaction of the Engineer or designated representative, regardless of whether or not the subgrade has been successfully proof rolled. As a minimum, this will be after the surface displays no damp spots and there is no evidence of "sponginess" in the subgrade.

B. First Lift:

Immediately before placing the flexible base material, the subgrade shall be checked for conformity with grade and section. The thickness of each lift of flexible base shall be equal increments of the total base depth. No single lift shall be more than six inches (150 mm) or less than three inches (75 mm) compacted thickness.

The material shall be delivered in approved vehicles. It shall be the responsibility of the Contractor to deliver the required amount of material. If it becomes evident that insufficient material was placed, additional material as necessary shall be delivered and the entire course scarified, mixed and compacted.

Material deposited upon the subgrade shall be spread and shaped the same day unless otherwise approved by the Engineer or designated representative. In the event inclement weather or other unforeseen circumstances render spreading of the material impractical, the material shall be spread as soon as conditions allow.

Additionally, if the material cannot be spread and worked the same day it is deposited, the Contractor shall "close up" the dump piles before leaving the job site. "Closed up" shall be defined as the use of a motor grader to blade all dump piles together, leaving no open space between piles.

The material shall be spread, sprinkled, if required, then thoroughly mixed; bladed, dragged and shaped to conform to the typical sections indicated on the Drawings.

All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well-graded material.

Each lift shall be sprinkled as required to bring the material to optimum moisture content, then compacted to the extent necessary to provide not less than the percent density specified in Section 210S.5.D, "Density." In addition to the requirements specified for density, the full depth of flexible base material shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section of flexible base material is completed, tests, as necessary, will be made by the Engineer or designated representative. As a minimum, three in-place density tests per section per day will be taken. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. All initial testing will be paid for by the City. All retesting shall be paid for by the Contractor.

Throughout the entire operation, the surface of the material shall be maintained by blading and, upon completion, shall be smooth and shall conform to the typical section indicated on the Drawings and to the established lines and grades.

In that area on which pavement is to be placed, any deviation in excess of 1/4 inch (6.5 mm) in cross section or 1/4 inch in a length of 16 feet (6.5 mm in a length of 5 meters) measured longitudinally shall be corrected by loosening, adding or removing material, and by reshaping and recompacting. All irregularities, depressions or weak spots shall be corrected immediately by scarifying the areas affected, adding suitable material as required, and by reshaping and recompacting. Should the lift, due to any reason or cause, lose the required stability, density and/or finish before the surfacing is complete, it shall be recompacted and refinished at the Contractor's expense.

C. Succeeding Lifts:

Construction methods for succeeding lifts shall be the same as prescribed for the first lift. For that lift of the flexible base upon which the curb and gutter will be constructed, as well as the last flexible base lift (i.e. top of the flexible base), the Contractor shall check the surface of the lift for conformity to the lines and grades by setting "blue tops" at intervals not exceeding 50 feet (15 meters) on the centerline, at quarterpoints, at curb lines or edge of pavement, and at other points that may be indicated on the Drawings.

When the thickness of a particular lift of the flexible base is in question, the Contractor shall check the surface of the lift for conformity to the lines and grades by setting "blue tops" at intervals not exceeding 50 feet (15 meters) on the centerline, at quarter points, at curb lines or edge of pavement, and at other points that may be indicated on the Drawings

D. Density:

The flexible base shall be compacted to not less than 100 percent density as determined by TxDoT Test Method Tex-113-E.

Field density determination shall be made in accordance with TxDoT Test Method Tex-115-E unless otherwise approved by the Engineer or designated representative. Each lift of the flexible base shall also be tested by proof rolling in conformity with Standard Specification Item 236S "Proof Rolling."

E. Priming:

After the flexible base material has been compacted to not less than 100 percent density, and tested by proof rolling, a prime coat will be applied in accordance with Standard Specification Item 306S, "Prime Coat."

F. Curing:

Pavement materials, such as a tack coat or surface course, shall not be placed on the primed surface until the prime coat has been absorbed into the base course. At least 24 hours, or longer if designated by the Engineer or designated representative, shall be allowed when cutback asphalt is used as the prime coat.

210S.6 - Measurement

"Flexible Base" will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.196 cubic yards), complete in place, as indicated in the Contract Documents.

210S.7 - Payment

This item will be paid for at the contract unit bid price for "Flexible Base". The unit bid price shall include full compensation for all work specified herein, including the furnishing, hauling, placing and compacting of all materials; for rolling, proof rolling, recompacting and refinishing; for all water required; for retesting as necessary; for priming; and for all equipment, tools, labor and incidentals necessary to complete the Work.

Prime coat will not be measured nor paid for directly but shall be inculded in the unit price bid for Standard Specification Item 210S, "Flexible Base."

Payment will be made under one of the following:

Pay Item No. 210S-A:	Flexible Base	Per Cubic Yard.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 210S, "Flexible Base"	
City of Austin Standard Specifications	
Designation	Description

Item No. 201S	Subgrade Preparation
Item No. 236S	Proof Rolling
Item No. 306S	Prime Coat

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Tex-101-E	Preparation of Soil and Flexible Base Materials for Testing
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-107-A	Determination of Bar Linear Shrinkage of Soils
Tex-110-E	Determination of Particle Size Analysis of Soils
Tex-113-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials and Cohesionless Sands
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials
Tex-116-E	Ball Mill Method for Determination of the Disintegration of Flexible Base Material
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-411-A	Soundness of Aggregate By Use of Sodium Sulfate or Magnesium Sulfate

RELATED CROSS REFERENCE MATERIALS

Specification 210S, "Flexible Base"

City of Austin Standard Details

Designation	Description
No. 1000S-2	Flexible Base with Asphalt Surface Trench Repair-Existing Pavement
No. 510S-3	Typical Trench with Paved Surface
No. 1000S	Bus Stop Paving
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections-(4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections

City of Austin Utility Criteria Manual

Designation	Description
Section 5.8.2	Flexible Base
Section 5.7.3	Flexible Base with Asphalt Surface
Section 5.9.1	Excavation in Alley

City of Austin Transportation Criteria Manual	
Designation	Description
Section 3.2.0	General Criteria
Section 3.4.3.D	Layer Data-Minimum Thickness
Table 3-1	Minimum Layer Thickness
Section 3.4.3.F	Layer Data- Minimum Thickness
Table 3-2	Layer Thickness Increment
Section 3.4.3.J	Layer Data-Stiffness Coefficient
Table 3-3	Stiffness Coefficient
Table 3-9	Recommended Salvage values
Table 3-10	AASHTO Layer Coefficients

End

ITEM NO. 220S - SPRINKLING FOR DUST CONTROL 2-24-10

220S.1 - Description

This item shall govern the authorized application of water for dust control on specified streets, detours, haul routes or construction sites, as shown on the Drawings or directed by the Engineer or designated representative, for the purpose of maintaining these areas relatively free of dust.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, inch-pound units are given preference with SI units shown within parentheses.

220S.2 - Submittals

The submittal requirements of this specification item include

A. The manufacturer, model and description of the proposed dust control equipment,

B. The sprinkling plan including application rate, pattern of sprinkling and scheduled times of application.

220S.3 - Materials

Water shall be furnished by the Contractor and shall be clean and free from industrial wastes and other objectionable matter.

220S.4 - Construction Methods

Dust control shall only be conducted when directed by the Engineer or designated representative. The Contractor shall furnish and operate an approved sprinkler, equipped with positive and rapidly working cut-off valves and approved spray bars to insure the distribution of water in a uniform and controllable rate of application over the entire width sprinkled. The Contractor shall apply the water in the quantity specified on the Drawings or as directed by the Engineer or designated representative.

It shall be the Contractor's continuous responsibility at all times, including nights, holidays and weekends until acceptance of the project by the City, to maintain the specified areas relatively free of dust in a manner that will cause the least inconvenience to the public.

220S.5 - Measurement

Sprinkling for dust control will be included in the unit price bid for other items of the contract unless included as a separate pay item in the contract. When included for payment in the contract as a separate contract pay item, it will be measured in units of 1,000 gallons (3.785 kiloliters) actually placed as authorized by the Engineer or designated representative.

220S.6 - Payment

When this item is specified on the Drawings as a separate pay item, the water furnished and the work performed as prescribed by this item and measured as provided under Section 220S.5, "Measurement" will be paid for in accordance with the contract unit bid price for 'Sprinkling for Dust Control'. The unit bid price shall include total compensation for all labor, materials, tools, machinery, equipment and incidentals necessary to complete the work as indicated on the Drawings.

Payment, when specified in the contract, will be made under the following:

Pay Item No. 220S-A:	Sprinkling for Dust Control (Water) -	Per 1000 gallon Unit.

RELATED CROSS REFERENCE MATERIALS	
Specification 220S, "Sprinkling For Dust Control"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation

Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling

End

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ITEM NO. 230S - ROLLING (FLAT WHEEL) 8-20-07

230S.1 - Description

This item shall govern compaction of subgrade, embankment, flexible base, surface treatments and asphalt surfaces by the operation of approved power rollers as herein specified and as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

230S.2 - Submittals

The submittal requirements of this specification item may include:

A. A plan describing the condition of each roller proposed for the work, as well as the type, size, weight, configuration (three wheel, tandem, etc) for each individual roller, and

B. The operating speed proposed for each individual roller.

230S.3 - Equipment

A. Embankments and Flexible Bases

Power rollers shall be of the 3-wheel, self-propelled type, weighing not less than 10 tons (9 megagrams) and shall provide compression on the rear wheels of not less than 325 pounds per linear inch (5.80 kilograms per linear millimeter) of wheel width. All wheels shall be flat. The rear wheels shall have a diameter of not less than 48 inches (1.2 meters) and each shall have a wheel width of not less than 20 inches (510 millimeters).

B. Surface Treatments and Pavements

Power rollers shall be the 3-wheel or tandem, self-propelled type, weighing not less than 3 tons (2.7 megagrams) nor more than 6 tons (5.4 megagrams). All wheels shall be flat. Rollers shall be equipped with an adequate scraping or cleaning device on each wheel. Rollers used to compact asphalt mixture shall be equipped with a water system, which will keep all tires uniformly wet.

In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment, as determined by the Engineer or designated representative, its use shall be discontinued and the Contractor will be required to furnish the specified equipment.

Rollers shall be maintained in good repair and operating condition and shall be approved by the Engineer or designated representative.

230S.4 - Construction Methods

This work shall only be conducted at the direction of the Engineer or designated representative. A sufficient number of rollers shall be provided to compact the material in a satisfactory manner. When operations are isolated and a single roller unit cannot produce the required compaction satisfactorily, additional roller units shall be provided.

A. Subgrades, Embankments and Flexible Base

The subgrade, embankment layer or base course shall be sprinkled, if required by Standard Specification Item Nos. 201S, "Subgrade Preparation" and 210S, "Flexible Base". Rolling with a power roller shall start longitudinally at the sides of the designated area and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the rear wheel of the power roller. On superelevated curves, rolling shall begin at the low sides and progress toward the high sides. Alternate trips of the roller shall be slightly different in length. Rolling shall be conducted in accordance with Standard Specification Item Nos. 201S, "Subgrade Preparation" and 210S, "Flexible Base". The rollers, unless otherwise directed by the Engineer or designated representative, shall be operated at a speed between 2 and 3 miles (3 and 5 kilometers) per hour.

B. Surface Treatments and Pavements

Rolling shall be done as called for in the surface treatment (Items 310S and 320S) and asphalt pavement (Item 340S) Standard Specification Items. The sequence of work shall be as specified above for embankment layer or base course. The operating speed shall be determined by the Contractor and approved by the Engineer or designated representative.

230S.5 - Measurement and Payment

Compensation will not be allowed for materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 230S, "ROLLING (FLATWHEEL)"	
City of Austin Standard Specifications	
Designation	Description
Item No. 201S	Subgrade Preparation
Item No. 210S	Flexible Base
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement

RELATED CROSS REFERENCE MATERIALS

Specification 230S, "ROLLING (FLATWHEEL)"	
City of Austin Standard Specifications	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 236S	Proof Rolling
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures

City of Austin Standard Details	
Designation	Description
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment

Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 264	Lime and Lime Slurry
Item No. 300	Asphalts, Oils and Emulsions

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 301	Asphalt Anti-stripping Agents
Item No. 310	Prime Coat (Cutback Asphaltic Materials)
Item No. 314	Emulsified Asphalt Treatment
Item No. 316	Surface Treatments
Item No. 345	Asphalt Stabilized Base (Plant Mixed)

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-101-E	Surveying and Sampling Soils for Highways

Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures by Extraction
Tex-222-F	Method of Sampling Bituminous Mixtures
Tex-228-F	Determination of Asphalt Content of Bituminous Mixtures By The Nuclear Method
Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

End

ITEM NO. 232S - ROLLING (PNEUMATIC TIRE) 8-20-07

232S.1 - Description

This item shall govern compaction of embankment, flexible base, surface treatments or pavements by the operation of approved pneumatic tire rollers as herein specified and as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

232S.2 - Submittals

The submittal requirements of this specification item may include:

A. A plan describing the condition of each roller proposed for the work, as well as the type of traction (self propelled or drawn), Type, size, weight, tire pressure and configuration for each individual roller, and

B. The operating speed proposed for each individual roller.

232S.3 - Equipment

A. General Requirements

When used on seal coats, asphaltic surface treatments and bituminous mixture pavements, the roller shall be self propelled and equipped with smooth tread tires whether "Rolling (Light Pneumatic Tire)" or "Rolling (Medium Pneumatic Tire)" is specified on the Drawings. The roller shall be so constructed as to be capable of being operated in both a forward and a reverse direction. When used on bituminous mixture pavements, the roller shall have suitable provisions for moistening the surface of the tires while operating.

When turning is impractical or detrimental to the work and when specifically directed by the Engineer or designated representative, the roller shall be capable of being operated in a forward or backward motion.

In lieu of the rolling equipment specified, the Contractor may, upon written permission of the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment, as determined by the Engineer or designated representative, its use shall be discontinued and the Contractor will be required to furnish the specified equipment.

Rollers shall be maintained in good repair and operating condition and shall be approved by the Engineer or designated representative.

Tire pressure is critical to successful operation of the roller. The Contractor shall have equipment on the construction site to inflate tires as required.

B. Light Pneumatic Tire Roller

The light pneumatic tire roller shall consist of not less than 9 pneumatic tired wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of

the forward group and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The pneumatic tire roller, under working conditions, shall have an effective rolling width of approximately 60 inches (1.5 meters) and shall be so designed that by ballast loading, the total load may be varied uniformly from 9,000 pounds (4 megagrams) or less to 18,000 pounds (8 megagrams) or more. The roller shall be equipped with tires that will afford ground contact pressures to 45 pounds per square inch (310 kiloPascals) or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the particular tires furnished. The roller under working conditions shall provide a uniform compression under all wheels. Individual tire inflation pressures shall be within + 5 psi (+ 34 kiloPascals) of each other. The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type. The roller, when drawn or propelled by either type of equipment, shall be considered a light pneumatic tire roller unit.

C. Medium Pneumatic Tire Roller (Type A)

The medium pneumatic tire roller (Type A) shall consist of not less than 7 pneumatic tired wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The pneumatic tire roller, under working conditions, shall have an effective rolling width of approximately 84 inches (2.1 meters) and shall be so designed that, by ballast loading, the total load may be varied uniformly from 23,500 pounds (10.5 megagrams) or less to 50,000 pounds (22.5 megagrams) or more. The roller shall be equipped with tires that will afford ground contact pressures of 80 pounds per square inch (550 kiloPascals) or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart. The roller under working conditions shall provide a uniform compression under all wheels. Individual tire inflation pressures shall be within + 5 psi (+ 34 kiloPascals) of each other.

The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type. The roller, when drawn or propelled by any type of equipment, shall be considered a medium pneumatic tire roller unit. The power unit shall have adequate tractive effort to properly move the operating roller at variable uniform speeds up to approximately 5 miles per hour (8 kilometers per hour).

D. Medium Pneumatic Tire Roller (Type B)

The medium pneumatic tire roller (Type B) shall conform to the requirements for Medium Pneumatic Tire Roller (Type A) as specified above, except that the roller shall be equipped with tires that will afford ground contact pressures to 90 psi (620 kiloPascals) or more.

232S.4 - Construction Methods

The embankment layer or the base course shall be sprinkled in accordance with Standard Specification Item Nos. 201S, "Subgrade Preparation" and 210S, "Flexible Base". Rolling with a pneumatic tire roller shall start longitudinally at the sides of the designated area and shall proceed towards the center, overlapping on successive trips by at least 1/2 of the width of the pneumatic tire roller. On superelevated curves, rolling shall begin at the low sides and progress toward the high sides. Alternate trips of the roller shall be slightly different in length.

The light pneumatic tire roller shall be operated at speeds, which shall be between 3 and 11 miles per hour (between 6 and 19 kilometers per hour) for asphalt surfacing work and between 2 and 6 miles per hour (between 3 and 10 kilometers per hour) for all other work.

The medium pneumatic tire roller shall be operated at speeds as directed by the Engineer or designated representative, which produce a satisfactory product.

Sufficient rollers shall be provided to compact the material in a satisfactory manner. When operations are so isolated from one another that 1 roller unit cannot produce the required compaction satisfactorily, additional roller units shall be provided.

232S.5 - Measurement and Payment

Compensation will not be allowed for materials, equipment or labor required by this item. These items shall be included in the unit price bid for the item of construction in which this item is used.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 232S, "Rolling (Pneumatic Tire)"	
City of Austin Standard Specifications	
Designation	Description
Item No. 201S	Subgrade Preparation
Item No. 210S	Flexible Base

RELATED CROSS REFERENCE MATERIALS	
Specification 232S, "Rolling (Pneumatic Tire)"	
City of Austin Contract Documents	
Designation	Description
Section 00700	General Conditions
City of Austin Standard Specifications	
Designation	Description

Item No. 101S	Preparing Right-of-Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 236S	Proof Rolling
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures
City of Austin Standard Details	

Designation	Description
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
tem No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading

Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 264	Lime and Lime Slurry
Item No. 300	Asphalts, Oils and Emulsions
Item No. 301	Asphalt Anti-stripping Agents
Item No. 310	Prime Coat (Cutback Asphaltic Materials)
Item No. 314	Emulsified Asphalt Treatment
Item No. 316	Surface Treatments
Item No. 345	Asphalt Stabilized Base (Plant Mixed)

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-101-E	Surveying and Sampling Soils for Highways
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils

Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soil & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures by Extraction
Tex-228-F	Determination of Asphalt Content of Bituminous Mixtures By The Nuclear Method
Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

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ITEM NO. 234S - ROLLING (TAMPING) 8-20-07

234S.1 - Description

This item shall govern compaction of embankment, lime-treated subgrade or other courses by the operation of approved tamping rollers as herein specified and as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

234S.2 - Submittals

The submittal requirements of this specification item may include:

A. A plan describing the condition of each roller proposed for the work, as well as the type of traction (self propelled or drawn), Type of roller, size, weight, and configuration of each individual tamping roller, and

B. The operating speed proposed for each individual tamping roller.

234S.3 - Equipment

The tamping rollers shall consist of 2 metal rollers, drums or shells of 40 inches (1 meter) minimum diameter; each not less than 42 inches (1.067 meters) in length. The drums shall be unit mounted in a rigid frame in such a manner that each roller may oscillate independently of the other.

Each roller, drum or shell shall be surmounted by metal studs with tamping feet projecting not less than 7 inches (180 millimeters) from the surface and spaced not less than 6 inches (150 millimeters) nor more than 10 inches (254 millimeters), measured diagonally center to center and the cross-sectional area of each tamping foot, measured perpendicularly to the axis of the stud, shall not be less than 5 nor more than 8 square inches (less than 3200 nor more than 5200 square millimeters). The roller shall be supplemented with cleaning teeth to provide self-cleaning.

The roller shall be so designed that, by ballast loading, the load on each tamping foot may be varied uniformly from 125 to 550 psi (860 to 3800 kiloPascals) of cross sectional area. The load per tamping foot will be determined by dividing the total weight (mass) of the roller by the number of tamping feet in 1 row parallel to or approximately parallel to the axis of the roller. The compression to be provided at any time shall be as directed by the Engineer or designated representative.

The tamping roller shall be drawn by suitable power equipment of adequate tractive effort. Two tamping rollers, consisting of 4 cylinders, conforming to the above prescribed requirements, drawn by approved power equipment, shall be considered a roller unit.

Where turning is impractical or detrimental to the work and when specifically directed by the Engineer or designated representative, the roller shall be capable of being operated in a forward and backward direction. When operations are confined to narrow widths and when specifically directed in writing by the Engineer or designated representative, 1 tamping roller consisting of 2 cylinders, fastened to the front end of approved power equipment shall be considered a roller unit.

In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction

equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment, as determined by the Engineer or designated representative, its use shall be discontinued and the Contractor will be required to furnish the specified equipment.

Rollers shall be maintained in good repair and operating condition and shall be approved by the Engineer or designated representative.

234S.4 - Construction Methods

The embankment layer, subbase or the base course shall be sprinkled in accordance with Standard Specification Item Nos. 201S, "Subgrade Preparation" and 203, "Lime Treatment for Materials In Place". Rolling with a tamping roller unit shall start longitudinally at the sides of the designated area and proceed toward the center, overlapping on successive trips by at least 1/2 of the width of the tamping roller unit. On superelevated curves, rolling shall begin at the low sides and progress toward the high sides. Alternate trips of the unit shall be slightly different in length. The tamping roller unit, unless otherwise directed by the Engineer or designated representative, shall be operated at a speed between 2 and 3 miles per hour (3 and 5 kilometers per hour).

Sufficient rollers shall be provided to compact the material in a satisfactory manner. When operations are so isolated from one another that one roller cannot perform the required compaction satisfactorily, additional rollers shall be provided and operated as directed by the Engineer.

234S.5 - Measurement and Payment

No additional payment will be made for the materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 234S, "Rolling (Tamping)"	
City of Austin Standard Specifications	
Designation	Description
Item No. 201S	Subgrade Preparation
Item No. 203S	Lime Treatment for Materials in Place

RELATED CROSS REFERENCE MATERIALS
Specification 234S, "Rolling (Tamping)"

City of Austin Contract Documents	
Designation	Description
Section 00700	General Conditions

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 132	Embankment
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)

City of Austin Standard Specifications	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment

Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 210S	Flexible Base
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 236S	Proof Rolling
Item No. 301	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures

City of Austin Standard Details

Designation	Description
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-	Primary Collector Street Sections

12(1)	
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 264	Lime and Lime Slurry
Item No. 300	Asphalts, Oils and Emulsions
Item No. 301	Asphalt Anti-stripping Agents
Item No. 310	Prime Coat (Cutback Asphaltic Materials)

Item No. 314	Emulsified Asphalt Treatment
Item No. 316	Surface Treatments
Item No. 345	Asphalt Stabilized Base (Plant Mixed)

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-101-E	Surveying and Sampling Soils for Highways
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures

Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

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ITEM NO. 236S - PROOF ROLLING 8-20-07

236S.1 - Description

This item shall govern furnishing and operating heavy pneumatic tired compaction equipment for locating unstable areas of embankment, subgrade and flexible base courses.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

236S.2 - Submittals

The submittal requirements of this specification item may include:

A. A plan describing the condition of each roller proposed for the work, as well as the type of traction (self propelled or drawn), Type of roller, size, weight, tire pressure (if appropriate) and configuration of each individual roller, and

B. The operating speed proposed for each individual roller.

236S.3 - Equipment

A. Standard Proof Roller:

The proof rolling equipment shall have a loading platform or body suitable for ballast loading that is supported on a minimum of two (2) axles with not more than two (2) pneumatic tired wheels per axle. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces. Pneumatic proof rolling equipment with multiple pivotal axles and more than two tires along the front or rear axle axis shall have articulating axle supports to equally distribute the load to all tires over uneven surfaces.

The proof roller unit, under working conditions, shall have a minimum contact width of 7½ feet (2.3 meters) and shall be so designed that the gross roller weight may be varied uniformly from 25 tons to 50 tons (23 megagrams to 45 megagrams) by ballast loading. The tires shall be capable of operating under various loads with variable air pressures up to 145 psi (up to 1000 kiloPascals). The tires shall be smooth tread and shall impart a minimum ground contact pressure of 75 pounds per square inch (520 kiloPascals). Tires shall be practically full of liquid (i.e. when liquid will flow from the valve stem of a fully inflated tire with the stem in the uppermost position). The operating load and tire pressure shall be within the range of the manufacturer's chart as directed by the Engineer or designated representative.

The proof roller shall be drawn by a power train of adequate tractive effort or may be of a self-propelled type. The proof rolling equipment shall be equipped with a reverse mode transmission or be capable of turning 180 degrees in the street width. When a separate power train is used to draw the proof roller, the power train weight shall not be considered in the weight of the proof roller. The power train shall be rubber-tired when rolling subgrade and base materials. A cleated or track-type power train may be used on earth and rock embankments.

B. Alternate Equipment:

With the written approval of the Engineer or designated representative, the Contractor may utilize alternate equipment on embankment courses, subgrade and base courses subject to the requirements of the standard proof roller except with respect to minimum contact width, axle/tire arrangement and tire tread.

Alternate equipment for stability testing of embankments shall be restricted to equipment that can be shown to impart a stress distribution on the embankment structure equivalent to or greater than the stress induced by the concentrated weight of a standard proof roller.

C. Equipment Submittals:

All standard proof rollers and proposed alternate equipment must be approved by the Engineer or designated representative prior to their use. The Contractor shall furnish the Engineer or designated representative with charts or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the particular tires furnished.

Alternate equipment submittals for proof rolling of embankments shall be signed and sealed by a registered Professional Engineer licensed in the State of Texas.

236S.4 - Construction Methods

A. General:

Within the ranges set forth in Section 236S.3, the load and tire inflation pressures shall be adjusted as directed by the Engineer or designated representative. It is proposed to use a contact pressure corresponding as nearly as practical to the maximum supporting value of the earthwork or base. The entirety of prepared surfaces to be tested by this method shall be proof rolled by a minimum of two passes of the proof roller tires. Each succeeding trip of the proof roller shall be offset by not greater than one tire width.

When alternate equipment is proposed and only one axle meets minimum requirements, only the qualifying axle shall be used to proof roll. If the operation of the proof roller shows an area to be unstable, the substandard area shall be brought to satisfactory stability and uniformity by additional curing, compaction, or by removal and replacement of unsuitable materials. The re-worked area shall then be proof rolled.

Proof rollers shall be operated at speeds between 2 and 6 miles per hour (3 and 10 kilometers per hour) or as directed by the Engineer or designated representative.

Acceptable limits of elastic and plastic deformation of prepared subgrade courses shall be established by proof rolling Test Sections of representative soil conditions, previously tested and approved for density and moisture requirements of the governing subgrade and earth embankment items. Proof rolling of first course base over a plastic subgrade may be waived by the Engineer or designated representative if it is determined that the prepared first course base will be damaged by the proof roller.

B. Roadway Construction:

The subgrade and all lifts of base material shall be proof rolled in new roadway construction and in the reconstruction of existing streets. Proof rolling of the curb course base shall be substituted for proof rolling of final course base at the direction of the Engineer or designated representative. Proof rolling may be waived by the Engineer or designated representative where construction is limited to turn lanes, street widening less than 7½ feet (2.3 meters) in width, or where the site is otherwise congested.

C. Trenches:

Trenches shall be proof rolled where no limitations to the operation of the proof roller exist as may be determined by the Engineer subject to the provisions hereunder.

All trenches shall be proof rolled in new roadways or in existing roadways under reconstruction. Trenches shall be proof rolled at the street subgrade elevation by longitudinal and perpendicular passes of the roller as may be dictated by the width of the trench.

Proof rolling of trenches in existing paved streets shall be limited to pavement cross-sections capable of sustaining the weight of the proof rolling equipment without imparting damage to the remaining pavement structure as determined by the Engineer. Trenches less than 4 feet (1.2 meters)

in width shall be exempted of all proof rolling requirements. Only the final course base shall be proof rolled in trenches 4 feet (1.2 meters) or wider but narrower than the proof roller contact width. The subgrade, the first course and the final course base shall be proof rolled in trenches 7½ feet (2.3 meters) or wider.

D. Embankment Construction:

All embankment courses shall be proof rolled, unless otherwise directed by the Engineer or designated representative.

If required by the Engineer or designated representative, stability testing of embankments constructed to the finished cross-section and elevation or to interim elevations shall either be conducted with a standard proof roller or alternate equipment, which can be proven to impart a horizontal and vertical pressure distributions equivalent to or greater than those induced by a standard proof roller.

236S.5 - Measurement and Payment

No direct payment will be made for the materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

RELATED CROSS REFERENCE MATERIALS	
Specification Item 236S, "Proof Rolling"	
City of Austin Contract Documents	
Designation	Description
Section 00700	General Conditions
City of Austin Standard Specifications	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow

Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 204S	Portland Cement Treatment For Materials in Place
Item No. 206S	Asphalt Stabilized Base (Plant Mix)
Item No. 210S	Flexible Base
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
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Item No. 403S	Concrete for Structures
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Item No. 150	Blading

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Item No. 204	Sprinkling
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Texas Department of Transportation: Manual of Testing Procedures

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Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils

Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soil and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures
Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

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ITEM NO. 301S - ASPHALTS, OILS, AND EMULSIONS 8-20-07

301S.1 - Description

This item includes the requirements for cutback asphalts, emulsified asphalts, polymer modified asphalt cements, performance graded asphalt binders and other miscellaneous asphaltic materials and latex additives.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

301S.2 - Submittals

Submittals shall include test results for each the materials described herein when specifically identified on the drawings and/or referenced in associated standard specification items and standard details.

Submittals may include samples of the base asphalt cement and polymer additives.

301S.3 - Materials

When tested in accordance with designated TxDOT, AASHTO and/or ASTM test methods, the various materials shall meet the applicable requirements of this specification.

A. Acronyms

The acronyms used in this specification are defined in the following table.

Table 1: Acronyms

Acronym	Definition	Acronym	Definition
Test Method Prefix		Polymer Modifier	
Tex	TxDOT	SBR or L	Styrene-Butadiene Rubber (Latex)
T	AASHTO	SBS	Styrene-Butadiene-Styrene Block Copolymer
D	ASTM	TR	Tire Rubber, from ambient temperature grinding of truck and passenger tires
		P	Polymer Modified
AC	Asphalt Cement	SS	Slow Setting
RC	Rapid Curing	H-suffix	Harder Residue (Lower Penetration)
MC	Medium Curing	AE	Asphalt Emulsion

SCM	Special Cutback Material	S-suffix	Stockpile Usage
HF	High Float	AE-P	Asphalt Emulsion Prime
C	Cationic	EAP&T	Emulsified Asphalt Prime and Tack
RS	Rapid Setting	PCE	Prime, Cure, and Erosion Control
MS	Medium Setting	PG	Performance Grade

B. Asphalt Cement

The material shall be homogeneous, free from water, shall not foam when heated to 350°F (177°C) and shall meet the requirements in Table 2.

Table 2: Asphalt Cement Requirements

Viscosity Grade		AC-10		AC-20		AC-30	
Property	Test Method	Min	Max	Min	Max	Min	Max
Viscosity: 140°F, poises (60°C, pascals)	T 202	800 (80)	1200 (120)	1600 (160)	2400 (240)	2400 (240)	3600 (360)
Viscosity: 275°F, stokes (135°C, pascals)	T 202	1.9 (.19)	-	2.5 (.25)	-	3.0 (.30)	-
Penetration: 77°F (25°C), 100g, 5s	T 49	85	-	55	-	45	-
Flash Point, C.O.C. °F (°C)	T 48	450 (232)	-	450 (232)	-	450 (232)	-
% Solubility trichloroethylene	T44	99.0	-	99.0	-	99.0	-
Spot test	Tex 509-C						
Viscosity: 140°F stokes	T 202	-	3000	-	6000	-	9000

(60°C pascals)			(300)		(600)		(900)
Ductility 77°F (25°C), 5 cm/min, cm	T 202	100	-	70	-	50	-

C. Polymer Modified Asphalt Cement

Polymer modified asphalt cement must be smooth, homogeneous, and shall comply with the requirements listed in Table 3.

Table 3: Polymer Modified Asphalt Cement Requirements

Polymer Modified Viscosity Grade		AC-5		AC-10		AC-15P		AC-45P*	
Polymer Type		SBR		SBR		SBS		SBS	
Property	Test Method	Min	Max	Min	Max	Min	Max	Min	Max
Polymer in % (solids basis)	Tex-533-C	2.0	-	2.0	-	3.0	-	3.0	-
Viscosity									
140°F, poise (60°C, pascals)	T 202	700 (70)	- -	1300 (130)	- -	1500 (150)	- -	4500 (450)	- -
275°F, poise (135°C, pascals)	T 202	- -	7.0 (0.7)	- -	8.0 (0.8)	- -	8.0 (0.8)	14.0 (1.4)	
Penetration, 77°F (25°C), 100 g, 5 s.	T 49	120	-	80	-	100	150	50	74
Ductility, 5cm/min., 39.2°F, cm	T 51	70	-	60	-	-	-	15	-
Elastic Recovery, 50°F (10°C), %	Tex-539-C	-	-	-	-	55	-		-
Polymer Separation, 48 hrs**.	Tex-540-C	None		None		None		None	
Flash Point, C.O.C., °F (°C),	T 48	425	-	425	-	425	-	425	-
		(218)	-	(218)	-	(218)	-	(218)	-

Tests on Residue from Thin Film Oven Test: (T179)									
Retained Penetration Ratio, 77°F (25°C), % original	T 49	-	-	-	-	0.60	1.00	0.60	0.90

* The SBS block copolymer may be pre-blended with a polymer processing oil (up to a 1:1 ratio of polymer to oil) to aid the solution of the polymer in the asphalt.

** A 350-gram (0.77 pound) sample of the asphalt-SBS blend is stored for 48 hours at 325°F (163°C). Upon completion of the storage time, the sample is visually examined for separation of the SBS from the asphalt (smoothness and homogeneity). If a question still exists about the separation of the SBS, samples shall be taken from the top and bottom of the sample for Infrared Spectroscopy analysis. A difference of 0.4% or more in the concentration of the SBS between the top and bottom samples shall constitute separation.

D. Cutback Asphalt

Cutback asphalt shall meet the requirements presented in Tables 4 and 5 for the specified type and grade.

Table 4: Rapid Curing Type Cutback Asphalt Requirements

Type-Grade		RC-250		RC-800		RC-3000	
Properties	Test Method	Min	Max	Min	Max	Min	Max
Water, percent	T55	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., °F (°C)	T79	80 (27)	-	80 (27)	-	80 (27)	-
Kinematic viscosity @ 140°F, cst (60°C, mm ^{2}/s)	T201	250	400	800	1600	3000	6000
Distillation Test:	T78						
Distillate, % by volume of total distillate to 680°F (360°C):							
to 437°F (225°C):		40	75	35	70	20	55
to 500°F (260°C):		65	90	55	85	45	75

to 600°F (316°C):		85	-	80	-	70	-
Residue from Distillation, Volume %		70	-	75	-	82	-
Tests of Distillation Residue:							
Penetration, 100g, 5 sec., 77°F (25°C), cm	T49	80	120	80	120	80	120
Ductility, 5 cm/min., 77°F, 5 cm/min., cm	T51	100	-	100	-	100	-
(25°C, 50 mm/min., mm)		1000	-	1000	-	1000	-
Solubility in trichloroethylene, %	T44	99.0	-	99.0	-	99.0	-
Spot Test	Tex 509-C	ALL NEGATIVE					

Table 5: Medium Curing Type Cutback Asphalt Requirements

Type		MC-30		MC-70		MC-250		MC-800		MC-3000	
Properties	Test Method	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Water, %	T55	-	0.2	-	0.2	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., °F (°C)	T79	100 (38)	-	100 (38)	-	150 (65)	-	150 (65)	-	150 (65)	-
Kinematic viscosity. @ 140°F. cst (60°C, mm ^{2}/s)	T201	30	60	70	140	250	500	800	1600	3000	6000
Distillation Test:	T78										
Distillate, as % by volume to total distillate to 680°F(360°C):, shall be as follows:											
to 437°F (225°C):		-	25	-	20	-	10	-	-	-	-

to 500°F (260°C):		40	70	20	60	15	55	-	35	-	15
to 600°F (316°C):		75	93	65	90	60	87	45	80	15	≥75
Residue from 80°F (225°C) distillation											
Volume Percent		50	-	55	-	67	-	75	-	80	-
Tests on Distillation Residue:											
Penetration @77°F (25°C), 100g, s, 01 mm:	T49	120	250	120	250	120	250	120	250	120	250
Ductility	T51										
@ 77°F, 5 cm/min, cms		100*	-	100*	-	100*	-	100*	-	100*	-
(25°C, 50 mm/min., mm)		1000*	-	1000*	-	1000*	-	1000*	-	1000*	-
% Solubility in trichloroethylene	T44	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Spot Test	Tex 509-C	ALL NEGATIVE									

* If penetration of residue is more than 200 and the ductility at 77°F (25°C) is less than 100 cm (1000 mm), the material will be acceptable if its ductility at 60°F (16°C) is more than 100cm (1000 mm).

E. Emulsified Asphalt

The material shall be homogenous. It shall show no separation of asphalt after thorough mixing and shall meet the requirements for the specified type and grade presented in Tables 6, 7 and 8.

Table 6: Anionic Emulsion Requirements

	Type	Medium Setting	Slow Setting

	Grade	MS-2		SS-1		SS-1h	
Property	Test Method	Min	Max	Min	Max	Min	Max
Furol Viscosity @ 77°F (25°C), sec.	T72	-	-	20	100	30	100
@ 122°F(50°C), sec		100	300	-	-	-	-
Sieve Test, %.	T59	-	0.1	-	0.1	-	0.1
Miscibility (Standard Test)	T59	-	-	Passing		Passing	
Cement Mixing, %	T59	-	-	-	2.0	-	2.0
% Demulsibility: 35 cc 0.02N $CaCl_2$	T59	-	30	-	-	-	-
Storage Stability 1 day, %	T59	-	1	-	1	-	1
Freezing Test, 3 Cycles*	T59	Passing		Passing	Passing		
Distillation Test	T59						
Distillation Residue, %		65	-	60	-	60	-
Distillate Oil Portion, %		-	½	-	½	-	½
Tests of Residue from Distillation:							
Penetration @ 77°F (25°C), 100g, 5s	T49	120	160	120	160	70	100
Solubility in Trichloroethylene, %	T44	97.5	-	97.5	-	97.5	-
Ductility @ 77F, 5 cm/min., cm	T51	100	-	100	-	80	-
(@ 25°C, 50 mm/min., mm)		1000	-	1000	-	800	-

* Applies only when Engineer or designated representative specifies the material for winter use.

Table 7: High Float anionic Emulsion Requirements

	Type	Rapid Setting		Medium Setting	
	Grade	HFRS-2		AES-300	
Property	Test Method	Min	Max	Min	Max
Viscosity, Saybolt Furol	T72				
@ 77°F (25°C), sec.		-	-	75	400
@ 122°F (50°C), sec.		150	400	-	-
Oil Portion of Distillate, %	T59	-	2	-	7
Sieve Test, %	T59	-	0.1	-	0.1
Particle Charge	T59	positive		positive	
Coating Ability and Water Resistance:	T59				
Coating, dry aggregate		-	-	good	
Coating, after spraying		-	-	fair	
Coating, wet aggregate				fair	
Coating, after spraying				fair	
% Demulsibility: 35 ml 0.02 N $CaCl_2$	T59	50	-	-	-
Storage Stability Test, 1 day, %	T59	-	1	-	1
Distillation Test	T59				
Residue by Distillation, % by weight		65	-	65	-
Oil Distillate, by volume of emulsion, %		-	1/2	-	5

Tests on Residue from Distillation:					
Penetration at 77°F (25°C), 100g, 5s	T49	100	140	300	-
Solubility in Trichloroethylene, %	T44	97.5	-	97.5	-
Ductility @ 77°F., 5 cm/min, cms	T51	100	-	-	-
(25°C., 50 mm/min, mm)		(1000)			
Float Test at 140°F (60°C), sec.	Tex 509-C	1200	-	1200	-

Table 8: Cationic Emulsion Requirements

	Type	Rapid Setting				Medium Setting				Slow Setting			
	Grade	CRS-2		CRS-2h		CMS-2		CMS-2s		CSS-1		CSS-1h	
Property	Test Method	Min	Max	Min	Max	Min.	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T72												
@ 77°F (25°C), sec.		-	-	-	-	-	-	-	-	20	100	20	100
@ 122°F (50°C), sec.		150	400	150	400	100	300	100	300	-	-	-	-
Storage stability test, 1 day %	T59	-	1	-	1	-	1	-	1	-	1	-	1
% Demulsibility: *, **	T59	40	-	40	-	-	-	-	-	-	-	-	-
Coating, ability & water resistance	T59												
Coating, dry aggregate		-	-	-	-	good		good		-	-	-	-

Coating, after spraying		-	-	-	-	fair		fair		-	-	-	-
Coating, wet aggregate		-	-	-	-	fair		fair		-	-	-	-
Coating, after spraying		-	-	-	-	fair		fair		-	-	-	-
Particle charge test	T59	Positive		Positive		Positive		Positive		Positive		Positive	
Sieve test, %	T59	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10
Cement Mixing test, %	T59	-	-	-	-	-	-	-	-	-	2.0	-	2.0
Distillation Test:	T59												
% Oil distillate, vol. of emulsion		-	1/2	-	1/2	-	7	-	5	-	1/2	-	1/2
Residue by Distillation,% by wt.		65	-	65	-	65	-	65	-	60	-	60	-
Tests on Residue from Distillation:													
Penetration, 77°F	T49	120	160	80	110	120	200	300	-	120	160	80	110
(25°C), 100g, 5s.													
Ductility,	T51												
77°F, 5 cm/min, cm		100	-	80	-	100	-	-	-	100	-	80	-
(25°C, 50 mm/min, mm)		1000	-	800	-	1000	-	-	-	1000	-	800	-
% Solubility in trichloroethylene	T44	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-

* At a level of 35 ml 0.8% sodium dioctyl sulfosuccinate.

** The demulsibility test shall be made within 30 days from date of shipment.

F. Polymer Modified Emulsions

The material shall be homogenous. It shall show no separation of asphalt after thorough mixing and shall meet the requirements for the specified type and grade presented in Tables 9 and 10.

G. Specialty Emulsions

Specialty emulsions may be either asphaltic-based or resin-based and must meet the requirements included in Table 11.

H. Recycling Agent

Recycling agent and emulsified recycling agent must meet the requirements of Table 12. Additionally, recycling agent and residue from emulsified recycling agent, when added in the specified proportions to the recycled asphalt, must meet the properties specified on the drawings.

Table 9: Polymer Modified Emulsified Asphalt Requirements

Type-Grade		Rapid Setting				Medium Setting						Slow Setting	
		RS-1P		HFRS-2P		AES-150P		AES-300P		AES-300S		SS-1P	
Property	Test Method	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72												
77°F, sec.		-	-	-	-	75	400	75	400	75	400	30	100
122°F, sec.		50	200	150	400	-	-	-	-	-	-	-	-
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Miscibility	T 59	-		-		-		-		-		pass	
Coating Ability and Water Resistance:	T 59												
dry aggregate/after spray		-		-		good/fair		good/fair		good/fair		-	
wet aggregate/after spray		-		-		fair/fair		fair/fair		fair/fair		-	
Demulsibility, 35 ml of 0.02 N $CaCl_2$, %	T 59	60	-	50	-	-	-	-	-	-	-	-	-

Storage Stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1	-	1
Breaking Index, g	Tex-542-C	-	80	-	-	-	-	-	-	-	-	-	-
Distillation Test: [1]	T 59												
Residue by Distillation, % by wt.		65	-	65	-	65	-	65	-	65	-	60	-
Oil Distillate, % by vol of emulsion		-	3	-	0.5	-	3	-	5	-	7	-	0.5
Tests: Residue from Distillation:													
Polymer Content, wt. % (solids basis)	Tex-533-C	-	-	3.0	-	-	-	-	-	-	-	3.0	-
Penetration, 77°F, (25°C) 100 g, 5 sec.	T 49	225	300	90	140	150	300	300	-	300	-	100	140
Solubility in Trichloroethylene, %	T 44	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-
Viscosity, 140&degF, poise 60°C, Pa-s	T 202	-	-	1500	-	-	-	-	-	-	-	1300	-
Float Test, 140°F, sec.	T 50	-	-	1200	-	1200	-	1200	-	1200	-	-	-
Ductility [2],													
39.2°F, 5 cm/min., cm	T 51	-	-	50	-	-	-	-	-	-	-	50	-
(4°C, 5 cm/min., mm)		-	-	500	-	-	-	-	-	-	-	500	-
Elastic Recovery [2], 50°F,(10°C), %	Tex-539-C	55	-	55	-	-	-	-	-	-	-	-	-

Tests on RTFO Curing of Distillation Residue:	Tex-541-C												
Elastic Recovery, 50°F,(10&degF) %	Tex-539-C	-	-	-	-	50	-	50	-	30	-	-	-

[1] Exception to AASHTO T 59: Bring the temperature on the lower thermometer slowly to 350°F +/- 10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 +/- 5 min. from the first application of heat.

[2] HFRS-2P must meet one of either the Ductility or Elastic Recovery.

Table 10: Polymer Modified Cationic Emulsified Asphalt Requirements

Type-Grade		Rapid Setting				Slow Setting	
		CRS-1P		CRS-2P		CSS-1P	
Property	Test Method	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72	-	-	-	-	20	100
77°F (25°C), sec.		50	150	150	400	-	-
122°F (50°C), sec.		-	0.1	-	0.1	-	0.1
Sieve Test, %	T 59	60	-	70	-	-	-
Demulsibility, 35 ml of 0.8% sodium dioctyl sulfosuccinate, %	T 59	-	1				
Storage Stability, 1 day, %	T 59	-	1	-	1	-	1
Breaking Index, g	Tex-542-C		80	-	-	-	-
Particle Charge	T 59	positive		positive		positive	

Distillation Test: [1]	T 59	65	-	65	-	62	-
Residue by Distillation, % by wt.							
Oil Distillate, % by volume of emulsion		-	3	-	0.5	-	0.5
Tests on Residue from Distillation:							
Polymer Content, wt. % (solids basis)	Tex-533-C	-	-	3.0	-	3.0	-
Penetration, 77°F (25°C), 100 g, 5 sec.	T 49	225	300	90	150	55	90
Viscosity, 140°F, poise (60°C, Pa-s)	T 202	-	-	1300	-	-	-
Solubility in Trichloroethylene, %	T 44	97.0	-	97.0	-	97.0	-
Softening Point, °F	T 53	-	-	-	-	135	-
Ductility, 77°F, 5 cm/min., cm (25°C, 5 cm/min., mm)	T 51	-	-	-	-	70 700	-
Ductility [2], 39.2°F, 5 cm/min., cm (4°C, 5 cm/min., mm)	T 51	-	-	50	-	-	-
Elastic Recovery [2], 50°F (10°C), %	Tex-539-C	45	-	55	-	-	-

[1] Exception to AASHTO T 59: Bring the temperature on the lower thermometer slowly to 350°F +/- 10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 +/- 5 min. from the first application of heat.

[2] CRS-2P must meet one of either the Ductility or Elastic Recovery.

Table 11: Specialty Emulsion Requirements

Type-Grade		Medium Setting		Slow Setting
		AE-P	EAP&T	PCE [1]

Property	Test Method	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72						
77°F (25°C), sec.		-	-	-	-	10	100
122°F (50°C), sec.		15	150	-	-	-	-
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1
Miscibility [2]	T 59	-		pass		pass	
Demulsibility, 35 ml of 0.10 N CaCl2, %	T 59	-	70	-	-	-	-
Storage Stability, 1 day, %	T 59	-	1	-	1	-	-
Particle Size [3], % by volume ≤ 2.5 m	Tex-238-F	-	-	90	-	-	-
Asphalt Emulsion Distillation to 500°F (260°C) followed by Cutback Asphalt Distillation of Residue to 680°F (360°C):	T 59 & T 78						
Residue after both Distillations, % by wt.		40	-	-	-	-	-
Total Oil Distillate from both distillations, % by volume of emulsion		25	40	-	-	-	-
Distillation:	T 59						
Residue by Distillation, % by wt.		-	-	60	-	-	-
Evaporation:4	T 59						
Residue by Evaporation, % by wt.		-	-	-	-	60	-
Tests on Residue after all Distillation(s):							
Viscosity, 140°F, poise (60°C, Pa-s)	T 202	-	-	800	-	-	-

Kinematic Viscosity, 140°F, cSt (60°C, mm ^{2}/s)	T 201	-	-	-	-	100	350
Flash Point, C.O.C., °F (°C)	T 48	-	-	-	-	400 204	-
Solubility in Trichloroethylene, %	T 44	97.5	-	-	-	-	-
Float Test, 122°F (50°C), sec	T 50	50	200	-	-	-	-

[1] Supply with each shipment of PCE:

a) a copy of a lab report from an approved analytical lab, signed by a lab official, indicating the PCE formulation does not meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste;

b) a certification from the producer that the formulation supplied does not differ from the one tested and that no listed RCRA hazardous wastes or PCB's have been mixed with the product; and

c) a Materials Safety Data Sheet.

[2] Exception to AASHTO T 59: In dilution, use 350 ml of distilled or deionized water and a 1000-ml beaker.

[3] Tex-238-F, beginning at "Particle Size Analysis by Laser Diffraction," "Procedure" (using - medium: distilled or deionized water and dispersant: none), or other approved method.

[4] Exception to AASHTO T 59: Leave sample in the oven until foaming ceases, then cool and weigh.

Table 12: Recycling Agent and Emulsified Recycling Agent Requirements

Property	Test Method	Recycling Agent		Emulsified Recycling Agent	
		Min	Max	Min	Max
Viscosity, Saybolt Furol, 77°F, sec.	T 72	-	-	15	100
Sieve Test, %	T 59	-	-	-	0.1

Miscibility [1]	T 59	-		No Coagulation	
Evaporation Test: [2]	T 59				
Residue by Evaporation, % by wt.		-	-	60	-
Tests on Recycling Agent or Residue from Evaporation:					
Flash Point, C.O.C., °F	T 48	400	-	400	-
Kinematic Viscosity,	T 201				
140°F, cSt		75	200	75	200
275°F, cSt		-	10.0	-	10.0

[1] Exception to AASHTO T 59: Use 0.02 N CaCl2 solution in place of water.

[2] Exception to AASHTO T 59: Maintain sample at 300°F until foaming ceases, then cool and weigh.

I. Crack Sealer

This section sets forth the requirements for a polymer modified emulsion suitable for sealing fine cracks, and a rubber asphalt compound suitable for sealing cracks of 1/8 inch (3 mm) or greater width.

1. Polymer Modified Asphalt Emulsion Crack Sealer

For cracks on the order of 1/8 inch (3 mm) width, HFRS-2P polymer modified emulsion as described in the table included in Section F, Polymer Modified Emulsions of this item may be used. Requirements for the polymer modified emulsion and rubber-asphalt crack-sealing compound are presented in Table 13.

Table 13: Polymer Modified Asphalt Emulsion Crack Sealer Requirements

Property	Test Methods	Min	Max
Rotational Viscosity, 77°F, cP	ASTM D 2196, Method A	10,000	25,000
Sieve Test, %	T 59	-	0.1

Storage Stability, 1 day, %	T 59	-	1
Evaporation	Tex-543-C		
Residue by Evaporation, % by wt.		65	-
Tests on Residue from Evaporation:			
Penetration, 77°F, 100 g, 5 sec.	T 49	35	75
Softening Point, °F	T 53	140	-
Ductility, 39.2°F, 5 cm/min., cm	T 51	100	-

2. Rubber-Asphalt Crack Sealing Compound

This specification item may be a proprietary product. The compound shall be capable of being melted and applied at a temperature of 400°F (200°C) or less by a suitable oil jacketed kettle equipped with a pressure pump, a hose and a nozzle. It shall contain no water or highly-volatile matter. It shall not be tracked by vehicular traffic once it cools to road pavement temperature.

The rubber-asphalt crack sealing compound shall meet requirements in Table 14.

Table 14: Rubber-Asphalt Crack Sealer Requirements

Property	Test Methods	Class A		Class B	
		Min	Max	Min	Max
CRM Content, Grade A or B, % by wt.	Tex-544-C	22	26	-	-
CRM Content, Grade B, % by wt.	Tex-544-C	-	-	13	17
Virgin Rubber Content [1], % by wt.		-	-	2	-
Flash Point [2], COC, °F	T 48	400	-	400	-
Penetration [3], 77°F, 150g, 5 sec.	T 49	30	50	30	50
Penetration [3], 32°F, 200g, 60 sec.	T 49	12	-	12	-

Softening Point, °F	T 53	-	-	170	-
Bond [4], 3 cycles, 20°F	Tex-525-C	-	Pass		

[1] Provide certification that the min. % virgin-rubber was added.

[2] Before passing the test flame over the cup, agitate the sealing compound with a 3/8 to ½ in. (9.5 to 12.7 mm) wide, square-end metal spatula in a manner so as to bring the material on the bottom of the cup to the surface, i.e., turn the material over. Start at one side of the thermometer, move around to the other, and then return to the starting point using 8 to 10 rapid circular strokes. Accomplish agitation in 3 to 4 sec. Pass the test flame over the cup immediately after stirring is completed.

[3] Exception to AASHTO T 49: Substitute the cone specified in ASTM D 217 for the penetration needle.

[4] No crack in the crack sealing materials or break in the bond between the sealer and the mortar blocks over ¼ in. deep for any specimen after completion of the test.

a. Properties of Rubber Used in Sealer. The rubber shall be one of the following types;

1) Type I - Ground tire rubber.

2) Type II - A mixture of ground tire rubber and high natural reclaimed scrap rubber. The natural rubber content, determined by ASTM D 297, shall be a minimum of 25 percent.

b. Ground Rubber. The ground rubber shall comply with the following gradation requirements when tested by TxDOT Test Method Tex-200-F, Part I.

Table 15: Ground Rubber Gradation Requirements

Sieve Size		Percent Retained	
U.S.	SI	Type I	Type II
No. 8	2.36 mm	0	-
No. 10	2.00 mm	0-5	0
No. 30	600mm	90-100	50-70
No. 50	300mm	95-100	70-95

No. 100	150mm	-	95-100

The ground rubber shall be free from fabric, wire, cord or other contaminating materials.

c. Packaging. The rubber-asphalt crack sealing compound shall be packaged in boxes, which contain two 30-35 pound (14-16 kilogram) blocks that are individually packaged in a liner made of polyethylene, or other packaging approved by the Engineer or designated representative.

J. Performance Graded Binders

Performance graded binders must be smooth, homogeneous, show no separation when tested in accordance with Test Method Tex-540-C, and must meet the requirements in the following table.

Separation testing is not required if:

• a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer, or

• the binder is blended on site in continuously agitated tanks, or

• binder acceptance is based on field samples taken from an in-line sampling port at the hot mix plant after the addition of modifiers.

Table 16: Performance Graded Binder Requirements (Printer-friendly version in PDF)

Performance Grade	PG 58			PG 64				PG 70				PG 76				PG 82		
	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28	-34	-16	-22	-28
Average 7-day Max Pavement Design Temperature, °C [1]	58			64				70				76				82		
Min Pavement Design Temperature, °C [1]	≥-22	≥-28	≥-34	≥-16	≥-22	≥-28	≥-34	≥-16	≥-22	≥-28	≥-34	≥-16	≥-22	≥-28	≥-34	≥-16	≥-22	≥-28
ORIGINAL BINDER																		
Flash Point, AASHTO T 48: Min,	230°C																	

Viscosity, AASHTO TP 48: [2, 3] Max, 3.0 Pas, Test Temperature,	135°C																		
Dynamic Shear, AASHTO TP 5: [4] G*/sin (δ), Min, 1.00 kPa Test Temperature @ 10 ead/sec.,	58°C			64°C				70°C				76°C				82°C			
Elastic Recovery, ASTM D 6084, 50°F, % Min	-	-	30	-	-	30	50	-	30	50	60	30	50	60	70	50	60	70	
ROLLING THIN FILM OVEN (Tex-541-C)																			
Mass Loss, Max, %	1.0																		
Dynamic Shear, AASHTO TP 5: G*/sin (δ) in, 2.20 kPa Test Temperature @10 red/sec.,	58°C			64°C				70°C				76°C				82°C			
PRESSURE AGING VESSEL (PAV) RESIDUE (AASHTO PP 1)																			
PAV Aging Temperature	100°C																		
Dynamic Shear, AASHTO TP 5: G*/sin (δ) Max, 5000 kPa Test Temperature10 rad/sec., °C	25	22	19	28	25	22	19	28	25	22	19	28	25	22	19	28	25	22	
Creep Stiffness, AASHTO TP 1: [5, 6] S, Max, 300 mPa, M - value, Min, 0.300 Test Temperature @ 60 sec., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	
Direct Tension, AASHTO TP 3: [6] Failure Strain, Min, 1.0% Test Temperature @1.0 mm/min., °C	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	-24	-6	-12	-18	

[1] Pavement temperatures are estimated from air temperatures using an algorithm contained in the PGEXCEL3.xls software program, may be provided by the Department or by following the procedures as outlined in AASHTO MP 2 and PP 28.

[2] This requirement may be waived at the Department's discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (AASTHO T 201 or T 202) or rotational viscometry (AASHTO TP 48).

[3] Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.

[4] For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of G*/sin (δ) at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (AASHTO T 201 or T 202) or rotational viscometry (AASHTO TP 48).

[5] Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.

[6] If creep stiffness is below 300 mPa, direct tension test is not required. If creep stiffness is between 300 and 600 mPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

301S.4 - Equipment.

All equipment necessary to transport, store, sample, heat, apply, and incorporate asphalts, oils and emulsions shall be provided.

301S.5 - Construction

Typical materials used for specific applications are identified in Table 17. These are typical uses only and circumstances may require use of other material.

Table 17: Typical Material Use

Material Application	Typically Used Materials
Hot-Mixed, Hot-Laid Asphalt Mixtures	PG Binders, Modified PG Binders

Surface Treatment	AC-5, AC-10, AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-15-5TR, HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P,Surface Treatment
(Cool Weather)	RS-1P, CRS-1P, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, MC-2400L
Precoating	AC-5, AC-10, PG 64-22, SS-1, SS-1H, CSS-1, CSS-1H
Tack Coat	RC-250, SS-1, SS-1H, CSS-1, CSS-1H, EAP&T
Fog Seal	SS-1, SS-1H, CSS-1, CSS-1H
Hot-Mixed, Cold-Laid Asphalt Mixtures	AC-0.6, AC-1.5, AC-3, AES-300, AES-300P, CMS-2, CMS-2S
Patching Mix	MC-800, SCM I, SCM II, AES-300S
Recycling	AC-3, AES-150P, AES-300P, Recycling Agent, Emulsified Recycling Agent
Crack Sealing	SS-1P, Polymer Mod AE Crack Sealant, Rubber Asphalt Crack Sealers (Class A, Class B)
Prime	MC-30, AE-P, EAP&T, PCE
Curing Membrane	SS-1, SS-1H, CSS-1, CSS-1H, PCE
Erosion Control	SS-1, SS-1H, CSS-1, CSS-1H, PCE

301S.6 - Storage, Heating and Application Temperatures

Asphaltic materials should be applied at the temperature, which provides proper and uniform distribution. Within practical limits higher temperatures than necessary to produce the desired results shall be avoided. Satisfactory application usually should be obtained within the recommended ranges shown below.

No material shall be heated above the following maximum temperatures:

Table:18 Recommended Temperature Ranges

	Recommended	Maximum

	Range; °F (°C)	Temperature; °F (°C) for	
Type-Grade	Application/Mixing	Allowable Application	Storage
AC-5, 10,20,30	275—350 (135—177)	375 (191)	400 (204)
AC-5 or AC-10 + 2% SBR	300—375 (142—191)	390* (199)	375 (191)
AC-10 + 3% SBR, AC-45P	300—350 (142—191)	350 (177)	360 (182)
RC-250	125—180 (52—82)	200 (93)	200 (93)
RC-800	170—230 (77—110)	260 (127)	260 (127)
RC-3000	215—275 (102—135)	285 (141)	285 (141)
MC-30, AEP	70—150 (21—66)	175 (79)	175 (79)
MC-70	125—175 (52—79)	200 (93)	200 (93)
MC-250	125—210 (52—99)	240 (116)	240 (116)
MC-800, SCM I, SCM II	175—260 (79—127)	275 (135)	275 (135)
MC-3000 & MC-2400 Latex	225—275 (107—135)	290 (143)	290 (143)
HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P,	120—160	180	180

CMS-2, CMS-2S, AES-300, AES-300S, AES-150P, AES-300P			
SS-1, SS-1h, SS-1P, CSS-1, CSS-1h, PCE, EAP & T, SS-1P, RS-1P, CRS-1P, CSS-1P, recycling agent, emulsified recycling agent, polymer modified AE crack sealant.	50—130 (10—54)	140 (60)	140 (60)
RS-2, RS-2h, MS-2, CRS-2, CRS-2h, CRS-2p, CMS-2, CMS-2S, HFRS-2, HFRS-2p, AES-300	110—160 (43—71)	170 (77)	170 (77)
Special Precoat Material	125—250 (52—121)	275 (135)	275 (135)
PG Binders, Modified PG Binders	275—350	350	350
Rubber Asphalt Crack Sealers (Class A, Class B)	350—375	400	-
Rubber-Asphalt Crack Sealer	350—375 (177—191)	400 (204)	-

* AC-5 + 2% SBR and AC-10 + 2% SBR, which is designated for surface treatment work, may be heated to a maximum temperature of 390°F (200°C) by the supplier loading through an in-line heater, or with the permission of the Engineer or designated representative, these materials may be heated to maximum of 390°F (200°C) by the Contractor just prior to application. When any of the SBR-modified asphalt cements are used in asphaltic concrete, the storage temperature at the mix plant should not exceed 350°F (177°C).

Attention is called to the fact that asphaltic materials (except emulsions) are very flammable and constitute fire hazards. Proper precautions should be used in all cases, especially with RC cutbacks.

Utmost care shall be taken to prevent open flames from coming in contact with the asphaltic material or the gases of it. The Contractor shall be responsible for any fires or accidents, which may result from heating the asphaltic materials.

SPECIFIC CROSS REFERENCE MATERIALS
Specification Item 301S "Asphalts, Oils and Emulsions"

American Association of State Highway and Transportation Officials (AASHTO)	
Designation	Description
AASHTO T-44	Solubility of Bituminous Materials in Organic Solvents
AASHTO T-48	Flash and Fire Points by Cleveland Open Cup
AASHTO T-49	Penetration of Bituminous Materials
AASHTO T-50	Float Test for Bituminous Materials
AASHTO T-51	Ductility of Bituminous Materials
AASHTO T-53	Distillation of Road Tar
AASHTO T-55	Water in Petroleum Products and Bituminous Materials by Distillation
AASHTO T-59	Testing Emulsified Asphalt
AASHTO T-72	Saybolt Viscosity
AASHTO T-78	Distillation of Cut-Back Asphaltic (Bituminous) Products
AASHTO T-79	Flash Point with Tag Open-Cup Apparatus
AASHTO T-201	Kinematic Viscosity of Asphalts
AASHTO T-202	Viscosity of Asphalts by Vacuum Capillary Viscometer
AASHTO TP-1	Creep Stiffness
AASHTO TP-3	Direct Tension
AASHTO TP-5	Dynamic Shear
AASHTO TP-48	Rotational Viscometry
Texas Department of Transportation: Manual of Testing Procedures	

Designation	Description
Tex-200-F	Sieve Analysis of Fine and Coarse Aggregates
Tex-238-F	Laser Diffraction Particle Size Distribution Analyzer
Tex-509-C	Spot Test of Asphaltic Materials
Tex-525-C	Tests for Asphalt and Concrete Joint Sealers
Tex-533-C	Determination of Polymer Additive Percentages in Polymer Modified Asphalt Cements
Tex-539-C	
Tex-540-C	
Tex-541-C	
Tex-542-C	
Tex-543-C	
Tex-544-C	

American Society for Testing and Materials (ASTM)

Designation	Description
D 217	Test Methods for Cone Penetration of Lubricating Grease
D 297	Test Methods for Rubber Products-Chemical Analysis
D 2186 Method A	Test Methods for Deposit-Forming Impurities in Steam
D 6084	Test Method for Elastic Recovery of Bituminous Materials by Ductilolmeter

RELATED CROSS REFERENCE MATERIALS	
Specification Item 301S "Asphalts, Oils and Emulsions"	
City of Austin Standard Specifications	
Designation	Description
Item No. 206S	Asphalt Stabilized Base
Item No. 210S	Flexible Base
Item No. 302S	Aggregates for Surface Treatments
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
City of Austin Standard Specifications	
Designation	Description
Item No. 312S	Seal Coat
Item No. 313S	Rubber Asphalt Joint and Crack Sealant
Item No. 315S	Milling Asphaltic Concrete Paving
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement

Item No. 341S	Paving Fabric
Item No. 350S	Heating, Scarifying and Repaving
Item No. 351S	Recycling Agent

City of Austin Standard Details

Designation	Description
1000S-10	Local Street Sections
1000S-11(1)	Residential and Neighborhood collector Street Sections
1000S-11(2)	Industrial and Collector Street Sections
1000S-12(1)	Primary Collector Street Sections
1000S-12(2)	Primary Arterial Street Sections
1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
1000S-13(2)	Minor Arterial Street Sections (4 Lanes divided)
1000S-14	Major Arterial Street

Texas Department of Transportation: Standard Specifications for Construction And Maintenance of Highways, Streets, and Bridges

Designation	Description
Item 300	Asphalts, Oils and Emulsions
Item 301	Asphalt Antistripping Agents

Item 310	Prime Coat (Cutback Asphaltic Materials)
Item 314	Emulsified Asphalt Treatment
Item 316	Surface Treatments
Item 345	Asphalt Stabilized Base (Plant Mixed)
Item 354	Planing and/or Texturing Pavement
Item 520	Weighing and Measuring Equipment

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-211-F	Recovery of Asphalt from Bituminous Mixtures by Abson
Tex-215-	Determination of Asphalt Content of Rock Asphalt Process by Hot Solvent Method
Tex-217-F	Determination of Deleterious Material and Decantation Test for Coarse Aggregates
Tex-224-F	Determination of Flakiness
Tex-400-A	Method of Sampling Stone, Gravel, Sand and Mineral Aggregates
Tex-410-A	Abrasion of Coarse Aggregate Using the Los Angeles Machine
Tex-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
Tex-438-A	Accelerated Polish Test for Aggregate
Tex-460-A	Determination of Crushed Face Particle

Tex-501-C	Test for Water in Petroleum Products and Other Bituminous Materials
Tex-502-C	Test for Penetration of Bituminous Material
Tex-503-C	Test for Ductility of Bituminous Materials
Tex-504-C	Test for Flash and Fire Points of Petroleum Materials by Cleveland Open Cup

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-505-C	Test for Softening Point of Bituminous Materials by Ring-and-Ball Method
Tex-506-C	Test for Loss on Heating of Oils and Asphaltic Compounds
Tex-507-C	Proportion of Bitumen Soluble in Trichloroethylene
Tex-510-C	Determining the Effect of Heat and Air on Asphaltic Materials when Exposed in Thin Films
Tex-512-C	Test for Flash Points of Volative Flammable Materials by Tag Open-Cup Apparatus
Tex-513-C	Test for Saybolt Viscosity
Tex-515-C	Distillation of Cut-Back Asphalt Products
Tex-519-C	Float Test for Bituminous Materials
Tex-520-C	Test for Residue of Specified Penetration
Tex-521-C	Testing Emulsified Asphalts
Tex-528-C	Test for Absolute Viscosity of Asphalt Cements
Tex-529-C	Test for Kinematic Viscosity of Asphalts

End

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ITEM NO. 306S - PRIME COAT 2-24-10

306S.1 - Description

This item shall govern the application of asphaltic material on the completed base course and/or other approved areas in accordance with the Drawings, these specifications or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

306S.2 - Submittals

The submittal requirements of this specification item include:

A. List of recommended materials (i.e. prime material, dispersal agent, etc.).

B. Temperature Viscosity data and proposed temperature of application.

C. Characteristics (i.e. manufacturer, rate of application, speed, etc.) of the proposed pressure distributor including calibration documentation.

D. List of facilities and equipment proposed for temperature measurements.

E. List of facilities and equipment proposed for storage and handling of asphaltic materials.

306S.3 - Materials

A. Asphalt Materials

The asphalt material for Prime Coat shall meet the requirements of Cutback Asphalt, MC-30, Emulsion, SS-1, Emulsion CSS-1 or AE-P, Standard Specification Item No. 301S, "Asphalts, Oils and Emulsions".

B. Water

Water shall be furnished by the Contractor and shall be clean and free from industrial wastes and other objectionable matter.

C. Dispersal Agent

Agent shall be added to water and sprayed on surfaces to be primed in accordance with asphalt manufacturer's recommendations.

306S.3 - Construction Methods

When, in the opinion of the Engineer or designated representative, the base course or other surface is satisfactory to receive the prime coat, the surface shall be prepared by sweeping or other approved methods as directed by the Engineer or designated representative. The surface shall be lightly sprinkled with water just prior to application of the asphaltic material unless this requirement is waived by the Engineer or designated representative. The Contractor shall submit a list of prime material(s) recommended for application on the work to the Engineer or designated representative for approval. When emulsions are approved, a dispersal agent shall be added to the water before sprinkling.

The asphaltic material shall be applied on the clean surface by an approved type of self-propelled pressure distributor operated so as to distribute the prime coat at a rate ranging from 0.1 to 0.3 gallons per square yard (0.45 to 1.36 liters per square meter) of surface area. The material shall be evenly and smoothly distributed under pressure sufficient to assure proper distribution. During the application of

prime coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutters or structures. The Contractor shall be responsible for cleaning all splattered areas.

Prime Coat may be applied when the temperature of the surface on which the prime coat is to be placed is 60°F (16°C) or above and the air temperature is above 50°F (10°C) and rising; the air temperature being taken in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the Engineer or designated representative, are not suitable.

The Contractor shall provide all necessary facilities and equipment for determining the temperature of the asphaltic material in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two (2) distributor loads.

The distributor shall have been calibrated within three (3) years from the date it is first used on this project. The Engineer or designated representative shall be furnished an accurate and satisfactory record of such calibration. After beginning the work, if the yield on the asphaltic material applied appears in error, the distributor shall be calibrated in a manner satisfactory to the Engineer or designated representative before proceeding with the work.

The Contractor shall be responsible for the maintenance of the surface until the work is accepted by the Engineer or designated representative. No traffic, hauling or placement of any subsequent courses shall be permitted over the freshly applied prime coat for a minimum of 48 hours or until the prime coat is accepted as dry and cured completely by the Engineer or designated representative.

All storage tanks, piping, retorts, booster tanks and distributors used in storing or handling asphaltic material shall be kept clean and in good operating condition at all times and they shall be operated in such a manner that there will be no contamination of the asphaltic material with foreign material. It shall be the responsibility of the Contractor to provide and maintain in good working order a recording thermometer at the storage heating unit at all times.

The Engineer or designated representative will approve the temperature of application based on the temperature-viscosity relationship that will permit application of the asphalt within the limits recommended in Standard Specification Item No. 301S, "Asphalts, Oils and Emulsions". The Contractor shall apply the asphalt at a temperature within 150F (80C) of the temperature specified in Standard Specification Item No. 301S, "Asphalt, Oils and Emulsions".

306S.5 - Measurement

The prime coat will be included in the unit price bid for Standard Specification Item No. 340S, "Hot Mix Asphaltic Concrete Pavement" unless included as a separate pay item in the contract. When included for payment, it shall be measured at point of delivery on the project in gallons (liters: 1 liter equals 0.264 gallons) at the applied temperature. The quantity to be paid for shall be the number of gallons used in the accepted prime coat.

306S.6 - Payment

The work performed and materials furnished as prescribed by this item, when included as a contract pay item, will be paid for at the unit bid price per gallon for "Prime Coat". The price shall include full compensation for cleaning the base course or other surface, for furnishing, heating, hauling and distributing the prime coat specified; for all freight involved and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 306S:	Prime Coat	Per Gallon.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 306S "Prime Coat"	
City of Austin Standard Specifications	
Designation	Description
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 340S	Hot Mix Asphaltic Concrete Pavement

RELATED CROSS REFERENCE MATERIALS	
Specification Item 306S "Prime Coat"	
City of Austin Standard Specifications	
Designation	Description
Item No. 206S	Asphalt Stabilized Base
Item No. 210S	Flexible Base
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 320S	Two Course Surface Treatment

City of Austin Standard Details	
Designation	Description
1000S-10	Local Street Sections
1000S-11 (1)	Residential and Neighborhood collector Street Sections
1000S-11 (2)	Industrial and Collector Street Sections
1000S-12 (1)	Primary Collector Street Sections
1000S-12 (2)	Primary Arterial Street Sections
1000S-13 (1)	Minor Arterial Street Sections (4 Lanes)
1000S-13 (2)	Minor Arterial Street Sections- (4 Lanes divided)
1000S-14	Major Arterial Street

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 300	Asphalts, Oils and Emulsions
Item 301	Asphalt Antistripping Agents
Item 310	Prime Coat (Cutback Asphaltic Materials)
Item 314	Emulsified Asphalt Treatment
Item 345	Asphalt Stabilized Base (Plant Mixed)
Item 520	Weighing and Measuring Equipment

End

ITEM NO. 307S - TACK COAT 2-24-10

307S.1 - Description

This item shall govern the application of asphaltic material on completed base courses, existing pavement, bituminous surface, bridge deck, slab or prepared surface as indicated on the Drawings and as directed by the Engineer or designated representative. The application of asphaltic material on completed base courses shall only be applied after the prime coat has completely cured in accordance with Standard Specification Item No. 306S, "Prime Coat"

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

307S.2 - Submittals

The submittal requirements of this specification item include:

A. List of recommended materials (i.e. tack coat material, sand type, etc.).

B. Temperature Viscosity data and proposed temperature of application.

C. Characteristics (i.e. manufacturer, rate of application, speed, etc.) of the proposed pressure distributor including calibration documentation.

D. List of facilities and equipment proposed for temperature measurements.

E. List of facilities and equipment proposed for storage and handling of asphaltic materials.

307S.3 - Materials

A. Asphalt Materials

The asphalt material for "Tack Coat" shall meet the requirements for Cutback Asphalt or Emulsified Asphalt, Standard Specification Item No. 301S, "Asphalts, Oils and Emulsions" as listed below. Cutback asphalt shall be made by combining 50 to 70 percent by volume of the asphaltic material as specified for the type of paving mixture with 30 to 50 percent by volume of gasoline and/or kerosene. The type of material shall be selected from the following table:

Temperature of Surface, °F (°C)	40—70°F (5 to 21°C)	Over 70°F (Over 21°C)
	RS-2	SS-1
	RS-2H	
	RC-250	MC-70
	CRS-2	CSS-1
	CRS-2H	CSS-1h

B. Water

Water shall be furnished by the Contractor and shall be clean and free from industrial wastes and other objectionable matter.

C. Sand

Sand may be Grade 1 conforming to Standard Specification Item No. 403S, "Concrete Structures" or washed sand, largely siliceous, with the following gradation:

Sieve Designation	Percent Retained by Weight (Mass) Natural Sand	
US		SI
No. 8	2.36 mm	0
No. 16	1.18 mm	0—40
No. 30	600mm	25—65
No. 50	300mm	65—85
No. 100	150mm	85—98
No. 200	75mm	98—100

There shall not be more than 50 percent of the aggregate retained between any 2 sieves listed above and not more than 25 percent of the aggregate retained between the No. 50 (300 µm) and the No. 100 (150 µm) sieves.

307S.4 - Construction Methods

Tack coat shall be applied when the surface on which the tack coat is to be placed is 600 F (160C) or above and the air temperature is above 500F (100C) and rising, where the air temperature is measured in the shade and away from any artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the Engineer or designated representative, are not suitable.

Before the tack coat is applied, the surface shall be cleaned thoroughly to the satisfaction of the Engineer or designated representative. The asphaltic material shall be applied on the clean surface by an approved type of self-propelled pressure distributor, so operated as to distribute the tack coat at a rate not to exceed 0.10 gallon per square yard (0.45 liters per square meter) of surface, evenly and smoothly with sufficient pressure to provide proper distribution.

In those instances where the pavement mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated by the Engineer or designated representative. All contact surfaces of curbs and structures and all joints shall be cleaned thoroughly and painted with a thin uniform coat of the asphaltic material used for tack coat. The tack coat shall be rolled with a pneumatic tire roller to distribute the asphaltic material uniformly over the tacked area. During the application of tack coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutters or structures. The Contractor shall clean splattered areas.

The distributor shall have been calibrated within three (3) years from the date it is first used on this project. The Engineer or designated representative shall be furnished an accurate and satisfactory record of such calibration. After beginning of the work, if the yield on the asphaltic material applied appears in error, the distributor shall be calibrated in a manner satisfactory to the Engineer or designated representative before proceeding with the work.

The Contractor shall provide all necessary facilities and equipment for determining the temperature of the asphaltic material in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two (2) distributor loads.

The Contractor shall be responsible for the maintenance of the surface until the HMAC is placed over the tack coat or the work is accepted by the Engineer or designated representative. No traffic, hauling or placement of any subsequent courses shall be permitted over the freshly applied tack coat unless it is blotted by the application of sand as directed by the Engineer or designated representative.

All storage tanks, piping, retorts, booster tanks and distributors used in storing or handling asphaltic material shall be kept clean and in good operating condition at all times and they shall be operated in such a manner that there will be no contamination of the asphaltic material with foreign material. It shall be the responsibility of the Contractor to provide and maintain in good working order a recording thermometer at the storage heating unit at all times.

The Contractor shall apply the asphalt at a temperature that will permit application of the asphalt within the limits recommended in Standard Specification Item No 301S, "Asphalts, Oils and Emulsions". The application temperature shall be within 150 F (80C) of 1600 F (710C).

307S.5 - Measurement

The asphaltic material for "Tack Coat" will be included in the unit price bid for Standard Specification Item 340S, "Hot Mix Asphaltic Concrete Pavement" unless included as a separate pay item in the contract. When included for payment, "Tack Coat" shall be measured at point of delivery on the project in gallons (liters: 1 liter equals 0.264 gallons) at the applied temperature. The quantity to be paid for shall be the number of gallons used.

307S.6 - Payment

The work performed and materials furnished as prescribed by this item, when included as a contract pay item, will be paid for at the unit bid price per gallon for "Tack Coat". The price shall include full compensation for cleaning the area to receive the "Tack Coat"; for furnishing, heating, hauling and distributing the tack coat specified; for all freight involved and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 307S:	Tack Coat	Per Gallon.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 307S "Tack Coat"	
City of Austin Standard Specifications	
Designation	Description
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 340S	Hot Mix Asphaltic Concrete Pavement

RELATED CROSS REFERENCE MATERIALS	
Specification Item 307S "Tack Coat"	
City of Austin Standard Specifications	
Designation	Description
Item No. 206S	Asphalt Stabilized Base
Item No. 210S	Flexible Base
Item No. 306S	Prime Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 320S	Two Course Surface Treatment

City of Austin Standard Details	
Designation	Description
1000S-10	Local Street Sections
1000S-11(1)	Residential and Neighborhood collector Street Sections
1000S-11(2)	Industrial and Collector Street Sections
1000S-12(1)	Primary Collector Street Sections
1000S-12(2)	Primary Arterial Street Sections
1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
1000S-14	Major Arterial Street
Texas Department of Transportation: Standard Specifications for Construction And Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 300	Asphalts, Oils and Emulsions
Item 301	Asphalt Antistripping Agents
Item 310	Prime Coat (Cutback Asphaltic Materials)
Item 314	Emulsified Asphalt Treatment
Item 345	Asphalt Stabilized Base (Plant Mixed)

Item 520	Weighing and Measuring Equipment

End

ITEM NO. 310S - EMULSIFIED ASPHALT TREATMENT 9-17-01

310S.1 - Description

This item shall govern one or more applications of a mixture of emulsified asphalt and water to be used as a base or subgrade treatment, earthwork seal for erosion control, prime coat or dust palliative, which is constructed in accordance with the Drawings and these specifications. This mixture may be applied to the base course, subgrade, shoulders or detours at the locations and to the extent indicated on the Drawings or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

310S.2 - Submittals

The submittal requirements of this specification item include:

A. List of recommended materials (i.e. emulsified asphalt, dispersal agent, etc.).

B. Recommended use, rate of application and percent emulsified asphalt in the mixture.

C. Characteristics (i.e. manufacturer, rate of application, speed, etc.) of the proposed sprinkler including calibration documentation.

310S.3 - Materials

The emulsified asphalt used shall meet the requirements of Standard Specification Item No. 301, "Asphalts, Oils and Emulsions". The water used shall be clean and free from industrial wastes and other objectionable matter.

310S.4 - Construction Methods

The emulsified asphalt mixture shall be applied by a self-propelled sprinkler that is equipped with positive and rapidly working cut-off valves and approved spray bars. The sprinkler shall be capable of maintaining the distribution of the mixture in a uniform and controllable rate of application and shall be operated, so as to uniformly distribute the mixture in the quantity required for the use.

The emulsion may be mixed in the sprinkler tank. The Contractor shall make suitable provisions for agitating the materials sufficiently to produce a uniform blend. The sprinkler tank shall have been calibrated within three (3) years from the date it is first used on this project. The Engineer shall be furnished an accurate and satisfactory record of such calibration. After beginning the work, if the yield of the emulsion applied appears to be in error, the distributor shall be calibrated in a manner satisfactory to the Engineer or designated representative before proceeding with the work.

An approved dispersal agent shall be added to water and sprayed on severely weathered asphalt surfaces to be treated in accordance with asphalt manufacturer's recommendations.

Where indicated on the Drawings, the "Emulsified Asphalt Treatment" shall be mixed with the base or subbase material. The emulsified asphalt and water mixture shall be applied and incorporated in the top portion of subbase or base course layers to the depth and width indicated on the Drawings or as directed by the Engineer or designated representative. Successive applications of a mixture of emulsified asphalt and water shall be completed for the area to be treated, with either a pressure distributor or an approved sprinkler, and the procedure shall be continued until all of the specified amount of emulsified asphalt has been incorporated in the material.

The percentage of emulsified asphalt in the mixture shall be regulated to insure that the specified amount of emulsified asphalt is incorporated in the material while maintaining the proper moisture content.

The treated material shall be mixed by blading, then shaped and compacted, as required by the pertinent specifications for the particular course, to the lines, grades and typical sections indicated on the Drawings. The surface shall be maintained with light applications of emulsified asphalt and water mixture or raw water, as directed by the Engineer or designated representative, during curing of the course.

Temporary pavement markings will be in accordance with Item No. 864S, "Abbreviated Pavement Markings".

310S.5 - Rates of Application

	Rate of Application	
Use	Gallons/Square Yard	Liters/Square Meter
Dust Palliative	0.05 to 0.1	0.25 to 0.45
Base Course	0.35 to 0.5	1.60 to 2.25
Earthwork Seal	0.1 to 0.35	0.45 to 1.60
Prime Coat	See Specification Item No. 306S	
Pavement Seal	0.1 to 0.35	0.45 to 1.60

310S.6 - Measurement

Emulsified asphalt will be measured by the gallon (liters: 1 liter equals 0.264 gallons) of emulsified asphalt used in the emulsified asphalt and water mixture.

310S.7 - Payment

The work performed and the emulsified asphalt furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid price for "Emulsified Asphalt" of the type specified. The price shall include full compensation for furnishing all required materials, mixing water for application, Dispersal Agent and for all freight involved; for all hauling, mixing and distributing the mixture, as specified; and for all manipulation, labor, tools, equipment, temporary pavement markings and incidentals necessary to complete the work

Payment will be made under:

Pay Item No. 310S:	Emulsified Asphalt	Per Gallon.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 310S "Emulsified Asphalt Treatment"	
City of Austin Standard Specifications	
Designation	Description
Item No. 301	Asphalts, Oils and Emulsions
Item No. 864S	Abbreviated Pavement Markings

RELATED CROSS REFERENCE MATERIALS	
Specification Item 310S "Emulsified Asphalt Treatment"	
City of Austin Standard Specifications	
Designation	Description
Item No. 206S	Asphalt Stabilized Base
Item No. 210S	Flexible Base
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 320S	Two Course Surface Treatment

Item No. 340	Hot Mix Asphaltic Concrete Pavement
Item No. 403	Concrete Structures

City of Austin Standard Details

Designation	Description
1000S-10	Local Street Sections
1000S-11(1)	Residential and Neighborhood collector Street Sections
1000S-11(2)	Industrial and Collector Street Sections
1000S-12(1)	Primary Collector Street Sections
1000S-12(2)	Primary Arterial Street Sections
1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
1000S-14	Major Arterial Street

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item 300	Asphalts, Oils and Emulsions
Item 301	Asphalt Antistripping Agents
Item 310	Prime Coat (Cutback Asphaltic Materials)
Item 314	Emulsified Asphalt Treatment

Item 345	Asphalt Stabilized Base (Plant Mixed)
Item 520	Weighing and Measuring Equipment

End

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ITEM NO. 340S - HOT MIX ASPHALTIC CONCRETE PAVEMENT 9-26-12

340S.1 - Description

This item shall govern base, level up, and pavement surface courses composed of a compacted mixture of aggregate and asphaltic cement mixed hot in a mixing plant. The hot mix asphaltic (HMA) concrete pavement shall be constructed on a previously completed and approved subgrade, subbase material, base material, concrete slab or existing pavement.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

340S.2 - Submittals

The submittal requirements of this specification item may include:

A. A mix design submittal including the plant corrected Job Mix Formula (JMF) for the hot mix asphaltic concrete.

B. Certification that the aggregate materials meet appropriate quality requirements.

C. Particle-size gradation and specific gravity tests on all aggregate materials.

D. Certification that the asphalt cement for paving materials meet appropriate quality requirements.

340S.3 - Materials

The Contractor shall furnish materials to meet the requirements specified herein and shall be solely responsible for the quality and consistency of the product delivered to the Project.

A. Aggregate: The aggregate shall be composed of coarse aggregate, a fine aggregate and, if required or allowed, mineral filler and reclaimed asphalt pavement (RAP). RAP use will be allowed in all base course mixtures except as specifically excluded herein, in the Contract Documents or on the Drawings, provided no more than 20% RAP is used.

   RAP use will not be permitted in pavement surface courses.

   Aggregates shall meet the quality requirements of Table 1 and other requirements as specified herein. The aggregate contained in RAP will not be required to meet Table 1 requirements unless indicated otherwise on the Drawings.

   1. Coarse Aggregate: Coarse aggregate is defined as that part of the aggregate retained on the No. 10 (2.00 mm) sieve and shall consist of clean, tough, durable fragments of crushed stone or crushed gravel of uniform quality throughout.

      Gravel from each source shall be crushed to the extent that it has a minimum of 85% of the particles retained on the No. 4 (4.75 mm) sieve with two or more mechanically induced crushed faces as determined by TxDOT Test Method TEX-460-A (Part I). The material passing the No. 4 (4.75 mm) sieve and retained on the No. 10 (2.00 mm) sieve must be the produced from crushing aggregate that was originally retained on the No. 4 (4.75 mm) sieve.

   2. Reclaimed Asphalt Pavement (RAP): RAP is defined as a salvaged, milled, pulverized, broken or crushed asphaltic pavement. The RAP to be used in the mix shall be crushed or broken to the extent that 100 percent will pass the 2-inch (50 mm) sieve.

The RAP shall be stockpiled in such a manner that assures that it will not become contaminated by dirt or other objectionable materials. Unless indicated otherwise on the Drawings, stockpiled, crushed RAP must not exhibit a decantation more than 5 percent or a plasticity index more than 8, when tested in accordance with TxDOT Test Method Tex-406-A, Part I, or Test Method Tex-106-E, respectively.

3. Fine Aggregate: Fine aggregate is defined as that part of the aggregate passing the No. 10 (2.00 mm) sieve and shall be of uniform quality throughout. A maximum of 15 percent of the total aggregate may be field sand or other uncrushed fine aggregate.

   Screenings shall be supplied from sources whose coarse aggregate meets the abrasion and magnesium sulfate soundness loss requirements shown in Table 1.

   a. Unless indicated otherwise on the Drawings, stone screenings, which are the product of a rock crushing operation, are required and shall meet the following gradation requirements when tested in accordance with TxDOT Test Method Tex-200-F, Part I.

Material	Percent by Weight (Mass)
Passing 3/8 inch (9.50 mm) sieve	100
Passing No. 10 (2.00 mm) sieve	70—100
Passing No. 200 (75 µm) sieve	0—15

   b. Crushed gravel screenings may be used with, or in lieu of, stone screenings only when indicated on the Drawings. Crushed gravel screenings must be the product of crushing aggregate that was originally retained on the No. 4 (4.75 mm) sieve and must meet the gradation for stone screenings shown above.

4. Mineral Filler: Mineral filler shall consist of thoroughly dried stone dust, Portland cement, fly ash, lime or other mineral dust approved by the Engineer or designated representative. The mineral filler shall be free from foreign matter.

   Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

   Fly ash obtained from a source using a process fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

   The addition of baghouse fines or other collected fines will be permitted if the mixture quality is not adversely affected in the opinion of the Engineer or designated representative. In no case

shall the amount of material passing the No. 200 (75 µm) sieve exceed the tolerances of the job-mix formula or the master gradation limits.

When tested by TEX-200-F (Part I or Part III, as applicable), the mineral filler shall meet the following gradation requirements. Baghouse fines are not required to meet the gradation requirements.

Material	Percent by Weight (mass)
Passing No. 30 (600 µm) Sieve	95—100
Passing No. 80 (187.5 µm) Sieve, not less than	75
Passing No. 200 (75 µm) Sieve, not less than	55

TABLE 1: AGGREGATE QUALITY REQUIREMENTS *

Requirement	Test Method	Amount
COARSE AGGREGATE		
Deleterious Material, percent, maximum	Tex-217-F, I	1.5
Decantation, percent, maximum	Tex-217-F, II	1.5
Los Angeles Abrasion, percent, maximum	Tex-410-A	40
Magnesium Sulfate Soundness Loss 5 cycle, percent, maximum	Tex-410-A	30
FINE AGGREGATE		
Linear Shrinkage, maximum	Tex-107-E,	3

	II	
COMBINED AGGREGATES		
Sand Equivalent Value, minimum	Tex-203-F	45

* - Aggregates, without added mineral filler or additives, combined as used in the job-mix formula (Plant Corrected).

B. Asphaltic Material:

1. Paving Mixture: Asphalt cement for the paving mixture shall conform to the requirements of Standardl Specification Item No. 301S, "Asphalts, Oils and Emulsions", for AC-20 or PG64-22, Styrene (SBS) Modified Asphalt Cement, AC-SBS Blend AC-45P or PG76-22S, unless otherwise indicated in the Project Documents.

2. Tack Coat: Tack Coat shall conform to Standard Specification Item No. 307S, "Tack Coat".

C. Additives: Additives to facilitate mixing and/or improve the quality of the asphaltic mixture or tack coat may be used with the authorization of the Engineer or designated representative. The Contractor may choose to use either lime or a liquid anti-stripping agent to reduce moisture susceptibility of the aggregate.

340S.4 - Paving Mixtures

An asphalt mixture design is developed by a laboratory process, which includes the determination of the quality and quantity of the asphalt cement and the individual aggregates, and the testing of the combined mixture (Laboratory Design). The Laboratory Design is subsequently revised to produce an appropriate job mix formula.

The job mix formula (JMF) lists the quantity of each component to be used in the mix after the laboratory design has been adjusted by running it through a particular plant (i.e. the mix design is Plant Corrected). The JMF will be the standard to which the Acceptance Plan will be applied. The JMF of one drum or batching unit shall not be used for another unit.

The Contractor shall submit to the Engineer on forms provided by the Engineer or designated representative, an asphalt mixture design reviewed, signed and sealed by a Registered Professional Engineer licensed in the State of Texas or certified by a TxDOT Level II Certified Asphalt Technician. An asphalt mixture design shall be submitted for a comprehensive review every two (2) years. Mix designs older than one year will not be accepted without a review of current test data of the proposed materials and current mix design to ensure that the materials meet specification requirements.

The JMF (Plant Corrected) shall be submitted to the Engineer or designated representative on a form provided by the Engineer through the Construction Inspector or Project Manager of the Project for review, for each individual Project, a minimum of three (3) working days before the mixture is to be placed. Under no circumstances will a mixture be placed before its use is reviewed and approved by the Engineer or designated representative.

Performance of the mix design shall remain the responsibility of the Contractor.

A. Mixture Design: The mix shall be designed in accordance with TxDOT Construction Bulletin C-14 and Test Method Tex-204-F to conform with the requirements herein. The master grading limits of

the appropriate type and the JMF will be plotted on a graduated chart with sieve sizes raised to the 0.45 power and will be submitted to the Engineer or designated representative with the asphalt mixture design.

The Bulk Specific Gravity of aggregates in RAP will be determined on extracted aggregates.

B. Types: The blend of coarse aggregate, fine aggregate, and mineral filler, if allowed, that is established by TxDOT Test Method Tex-200-F, Dry Sieve Analysis, shall conform to the master gradation shown in Table 2 for the type of specified mixture. The voids in the mineral aggregate (VMA) will be determined as a mixture design requirement only, in accordance with TxDOT Test Method Tex-207-F, and shall not be less than the value indicated in Table 2.

TABLE 2: Master Grading - Percent Passing by Weight (Mass) or Volume

Sieve Size US (SI)	Type A Coarse Base	Type B Fine Base	Type C Coarse Surface	Type D Fine Surface	Type F Fine Mixture
1½″ (37.5 mm)	100				
1¼″ (31 mm)	95—100				
1″ (25 mm)		100			
7/8 ″ (22 mm)	70—90	95—100	100		
5/8 ″ (15.5 mm)		75—95	95—100		
½″ (12.5 mm)	50—70			100	
3/8 ″ (9.5 mm)		60—80	70—85	85—100	100
¼″ (6.25 mm)					95—100
No. 4 (4.75 mm)	30—50	40—60	43—63	50—70	
No. 10 (2.00 mm)	20—34	27—40	30—40	32—42	32—42
No. 40 (425 µm)	5—20	10—25	10—25	11—26	9—24
No. 80 (187.5	2—12	3—13	3—13	4—14	3—13

µm)					
No. 200 (75 µm)	1—6*	1—6*	1—6*	1—6*	1—6*
VMA % minimum	11	12	13	14	15
Rec. Min. Lift	3″ (75 mm)	2″ (50 mm)	1¾″ (70 mm)	1″ (50 mm)	¾″ (20 mm)

C. Tolerances: Fluctuations in the aggregate gradation and asphalt content of the Job Mix Formula (JMF) shall not vary by more than the following criteria but the aggregate gradation shall be limited to the range of the master gradation as established by TEX-210-F.

SIEVES	**Percent By Weight (Mass)**
2″ "(50 mm) Sieve through No. 10" (2.00 mm) Sieve	±5.0
No. 40 (425 µm) through No. 200 (75 µm) Sieve	±3.0
Asphalt Content	±0.5

D. Stability and Density: The mixture shall be designed at or near optimum density, as indicated on the Drawings, to conform to the following percent of Maximum Theoretical Density as measured by TxDOT Test Method TEX-227-F and Stability conforming to TxDOT Test Method TEX-208-F. The laboratory mixture shall be molded in accordance with TxDOT Test Method TEX-206-F and the Bulk Specific Gravity determined in accordance with TxDOT Test Method TEX-207-F.

	Optimum Laboratory Density (%)		**Laboratory Density (%)**		**Stability**
			Min.	**Max.**	
Local Streets Surface Courses	96	94.5	97.5	35 Min.	
Collectors & Arterials Surface Courses	96	94.5	97.5	40—60	

All Base Courses	96	94.5	97.5	35 Min.	

E. Job Mix Formula Field Adjustments: The Contractor shall produce a mixture of uniform composition closely conforming to the reviewed JMF, that falls within the limits of the tolerances given above and the Acceptance Plan.

If it is determined by the City of Austin that adjustments to the JMF are necessary to achieve the specified requirements, the Engineer or designated representative may allow adjustments of the JMF within the following limits without a laboratory redesign of the mixture. The adjusted JMF shall not exceed the master grading criteria for the type of mixture specified. The proposed JMF adjustments shall not exceed 5 percent on any one sieve, ½-inch (12.5 mm) size and larger, or 3 percent on the sieve size below the ½-inch (12.5 mm) sieve of the JMF (Plant Corrected) reviewed for the Project.

When the proposed adjustments exceed either the 5 or 3 percent limits, and the Engineer or designated representative determines that the impact of these changes may adversely affect pavement performance, a new laboratory mixture design will be required.

The asphalt content may be adjusted with the concurrence of the Engineer or designated representative to maintain desirable laboratory density near the optimum value while achieving other mix requirements. However, increasing the asphalt content of the mixture in order to reduce pavement air voids will not be allowed. Also, if the percent air voids is determined to be less than 4 percent, adjustments shall be made to the plant production by the Contractor, within the tolerances as outlined above, so that an adequate air void level is attained.

340S.5 - Equipment

The trucks that deliver the hot mix asphalt concrete material to the project shall be of sufficient number to insure a continuous paving operation. All equipment used for the production, placement and compaction of the mixture shall be maintained in good repair and operating conditions to the satisfaction of the Engineer or designated representative. All equipment shall be made available for inspection. If the Engineer or designated representative expresses concern about the condition of any equipment, it shall not be used until it is repaired to the satisfaction of the Engineer or designated representative.

A. Mixing Plants: Plants may be of the weigh-batch type, the modified weigh-batch type or drum-mix type equipped with suitable material conveyers, power units, mixing equipment, aggregate proportioning devices, dryers, bins, dust collectors and sensing and recording devices as appropriate for the mixing plant type. The mixing plants shall meet the requirements specified in Section 340.4, 'Equipment' of TxDOT Specification Item No. 340, "Hot Mix Asphaltic Concrete Pavement".

B. Spreading and Finishing Paving Machine: The paving machine shall be self-propelled and equipped with a heated compacting screed capable of producing a finish surface meeting the requirements of the street cross-section indicated on the Drawings and all surface criteria. Extensions to the screed shall have the same heating and compacting capabilities as the primary unit, except for use on variable depth tapered areas and/or as approved by the Engineer or designated representative.

The paving machine shall be equipped with an approved automatic dual longitudinal screed control system and an automatic transverse screed control system. The longitudinal controls shall be capable of operating from any longitudinal grade reference including a string line, ski, mobile string line or matching shoe. Unless indicated otherwise on the Drawings, the Contractor may use any one of these grade references. The selected grade reference equipment shall be maintained in good operating condition by personnel trained in the use of the specific type of equipment.

The Contractor shall furnish all labor and equipment required for establishing and maintaining appropriate grade reference.

C. Rollers: The Contractor shall select rollers conforming to Item 230S, "Rolling (Flat Wheel)" and Item 232S, "Rolling (Pneumatic Tire)". Rollers that do not conform to these requirements shall be immediately removed from the Project.

D. Motor Grader: A self-propelled power motor grader may only be used when its use is approved by the Engineer or designated representative. It shall have a blade of not less than 12 feet (3.66 meters) and a wheelbase of not less than 16 feet (4.88 meters). Smaller graders may be used for small irregular areas when approved by the Engineer or designated representative.

E. Material Transfer Equipment: Equipment for transferring the HMA mixture from the hauling units or the roadbed to the spreading and finishing machine will be allowed unless indicated otherwise on the Drawings.

Windrow pick-up equipment, if permitted by the Engineer or designated representative, shall be constructed in such a manner that substantially all of the HMA mixture deposited on the roadbed is picked up and loaded into the spreading and finishing machine. The HMA mixture shall not be contaminated with foreign material. The loading equipment shall be designed so that it does not interfere with the spreading and finishing machine in obtaining the required line, grade and surface without resorting to hand finishing.

F. Straightedges and Templates: The Contractor shall provide a ten-foot (3.05 meter) straightedge acceptable to the Engineer or designated representative for surface testing. Satisfactory templates shall be provided as required by the Engineer or designated representative.

340S.6 - Stockpiling Aggregates

Aggregates shall be stockpiled to facilitate blending. When the aggregate is not stockpiled on a hard, non-contaminant base, the bottom six-inch (150 mm) depth of the stockpiles shall not be used in asphaltic mixtures. Where space is limited at the plant site, the aggregate stockpiles shall be separated by walls or other appropriate barriers.

Aggregates shall be stockpiled and handled in a manner that will insure minimization of segregation and contamination. Aggregate and RAP stockpiles shall only contain material from a single source.

340S.7 - Mixture Temperature

The Contractor shall select a target temperature for discharge of the HMA mixture from the mixer between 250°F (120°C) and 350°F (176°C) that is suitable to weather and Project conditions. The target temperature shall be reported to the Engineer or designated representative daily and recorded in the Daily Progress Report. The HMA mixture temperature shall not vary by more than 25°F (14°C) from the target temperature for discharge from the mixer. HMA mixtures that are discharged from the mixer at a temperature exceeding 360°F (182°C) or a temperature more than 50°F (28°C) below the target temperature shall not be accepted and shall not be placed on the Project.

340S.8 - Mixture Storage

A surge-storage system may be used to minimize production interruptions during a normal day of operation. When approved by the Engineer or designated representative, overnight storage of HMA mixture in insulated storage bins may be used provided that material temperature and physical properties of the HMA mixture are not adversely affected. HMA mixtures that include hardened lumps shall not be used. Stored HMA mixtures shall not be exempt from any requirements provided in this specification.

When a surge-storage system is used, it shall be equipped with a device such as a gob hopper or other device approved by the Engineer or designated representative to prevent segregation in the surge-storage bin.

340S.9 - Mixture Moisture Content

Hot mix asphalt (HMA) mixtures produced from any plant shall not have a moisture content in excess of 1 percent by weight (mass) when discharged from the mixer. The moisture content shall be determined in accordance with TxDOT Test Method Tex-212-F, Part II, except that the sample shall be left in the oven a total of not less than four (4) hours.

340S.10 - Construction Methods

A. General: The Contractor shall be responsible for the production, transportation, placement and compaction of the specified HMA paving mixture to the requirements of this specification. The Contractor shall also be responsible for providing a safe environment for inspection personnel to inspect the equipment and to acquire samples.

All hot mix asphalt concrete pavement surface courses shall be placed with a spreading and finishing (lay-down) machine only. All hot mix asphalt concrete pavement base layers with the possible exception of the first lift of the base layer shall also be placed with a spreading and finishing (lay-down) machine. Longitudinal pavement joints shall be located under the proposed lane lines. Density tests shall be taken prior to opening to traffic.

The first lift of a base layer may be placed with a motor grader if approved in advance by the Engineer or designated representative. The loose measure thickness of this first lift shall not exceed 6 inches (150 mm). If placed with a motor grader, the first lift shall achieve a minimum in-place relative density of 89% as determined by TxDOT test procedures TEX-207-F and TEX-227-F. All subsequent lifts should be placed with a spreading and finishing (lay-down) machine and shall be subject to the requirements of Section 340S.12, "Acceptance Plan". Density tests will be taken randomly to confirm compliance with the specification requirements.

For hot mix asphalt overlays, an automatic screed shall be used with outriggers.

Any material delivered to the Project that by visual inspection can reasonably be expected not to meet specification requirements (i.e. segregated or burned material, deficient or excess asphalt, low mixing temperature, visible contaminants, etc.), as determined by the Engineer or designated representative, shall not be used or left in place.

Equipment shall be inspected prior to use and, if found to be defective or in an operating condition that could potentially affect the quality of the finished pavement, as determined by the Engineer or designated representative, its use shall not be allowed. Leakage of fuels, oils, grease, hydraulic or brake fluids or other contaminants onto the prepared surface or newly-laid HMA layer will not be allowed and may require replacement of the affected pavement area.

The HMA paving mixture, when placed with a spreading and finishing machine, shall not be placed when the air temperature is below 50°F (10°C) and is falling, but it may be placed when the air temperature is above 40°F (4°C) and is rising.

The paving mixture, when used as a level-up course or when spread with a motor grader, shall not be placed when the air temperature is below 60°F (15°C) and is falling, but it may be placed when the air temperature is 50°F (10°C) and is rising. An HMA layer with a thickness of 1½ inches (37.5 mm) and less shall not be placed when the temperature of the surface on which the layer is to be placed is below 50°F (10°C). The temperature shall be taken in a shaded area away from artificial heat.

Additional surface temperature requirements may be included in the Contract Documents or indicated on the Drawings.

Surfaces to be paved shall be finished, primed, cured, broomed and tacked, as appropriate, to the satisfaction of the Engineer or designated representative. If the surface on which the first course of

the paving mixture is to be placed is a flexible base course, and a cut-back asphalt is to be used as a prime coat, the flexible base shall have been primed and cured a minimum of 24 hours before the paving mixture may be placed. The 24-hour restriction will not apply to a flexible base that has been primed with material other than a cutback. However, the surface on which the tack coat and/or paving mixture are to be placed shall be in a dry condition.

Pavement shall be opened to traffic as soon as possible after temporary pavement markings or permanent markings are in place as indicated on the Drawings) or as directed by the Engineer or designated representative. Construction traffic allowed on pavements open to the public will be subject to all laws governing traffic on streets and highways.

B. Tack Coat: The surface upon which the tack is to be placed shall be cleaned thoroughly to the satisfaction of the Engineer or designated representative. The surface shall be given a uniform application of tack coat as governed by Standard Specification Item No. 307S, "Tack Coat". The tack coat shall be applied, as directed by the Engineer or designated representative, with an approved sprayer at a rate not to exceed 0.05 gallons per square yard. (0.225 liters per square meter) of surface area. Where the paving mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated when approved by the Engineer or designated representative. All contact surfaces of curbs, castings and all structures and all joints shall be painted with a thin uniform application of tack coat.

During the application of tack coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutter and structures. Before the Work can be accepted, all splatter shall be removed by the Contractor at the Contractor's expense.

C. Transporting Hot Mix Asphaltic (HMA) Concrete: The HMA mixture shall be hauled to the Work site in tight vehicles that were previously cleaned of all foreign material. Dispatching of the vehicles shall normally be arranged so that all material delivered is placed and all rolling completed during daylight hours. Nighttime paving may be allowed, when approved in advance by the Engineer or designated representative.

In cool weather or for long hauls, truck bodies containing the HMA mixture shall be covered.

If necessary, to prevent the HMA mixture from adhering to the truck body, the inside of the truck may be given a light coating of a release agent satisfactory to the Engineer or designated representative.

D. HMA Placement: The HMA mixture shall be dumped and spread on the approved prepared surface with the spreading and finishing machine. When properly compacted, the finished pavement shall be smooth, of uniform texture and density and shall meet the requirements of the typical cross sections and the surface tests. In addition the placement of the HMA mixture shall be done without tearing, shoving, gouging or segregating the mixture and without producing streaks in the HMA layer.

Discharge of the HMA mixture into the finishing machine shall be controlled so that the spreading and finishing machine is not bounced or jarred and the required lines and grades shall be obtained without resorting to hand finishing except as permitted below in this Section.

Unless indicated otherwise on the Drawings, dumping of the HMA material in a windrow and then placing the HMA mixture in the finishing machine with windrow pick-up equipment will be permitted provided the temperature of the HMA mixture does not drop more than 50°F (28°C) below the target temperature before being placed by the finishing machine.

Under no circumstances will the HMA material be permitted to be dumped on or near the job site and then reloaded for hauling to the site of placement. Exceptions may be allowed if approved by the Engineer or designated representative.

The windrow pick-up equipment shall be operated in such a manner that substantially all the mixture deposited on the roadbed or prepared surface is picked up and loaded into the finishing machine without contamination by foreign material. The windrow pick-up equipment will also be so operated

that the finishing machine will obtain the required line, grade and surface without resorting to hand finishing. Any operation of the windrow pick-up equipment resulting in accumulation and subsequent shedding of accumulated material into the HMA mixture will not be permitted.

When approved by the Engineer or designated representative, level-up courses may be spread with a motor grader that meets the requirements of this specification item.

The spreading and finishing machine shall be operated at a uniform forward speed consistent with the plant production rate, hauling capability and roller train capacity to result in a continuous operation. Stopping of the spreading and finishing machine between trucks is to be held to a minimum. If, in the opinion of the Engineer or designated representative, delivery of material is adversely affecting the condition of the HMA layer (excessive stopping of the spreading and finishing machine, loss of mixture temperature, etc.), the Engineer or designated representative may require paving operations to cease until acceptable methods are provided to minimize starting and stopping of the spreading and finishing machine.

The hopper gates of the spreading and finishing machine shall be adjusted to provide an adequate and consistent flow of material. This shall result in enough material being delivered to the augers so that they are operating approximately 85 percent of the time or more. The augers shall provide means to supply adequate flow of material to the center of the paver. Augers shall supply an adequate flow of material for the full width of the mat being placed, as approved by the Engineer or designated representative. Augers should be kept approximately one-half to three-quarters full of HMA mixture at all times during the paving operation.

When the HMA mixture is placed in a narrow strip along the edge of an existing pavement, or is used to level up small areas of an existing pavement or is placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated when permitted by the Engineer or designated representative.

The paving material adjacent to castings and flush curb and gutter and structures shall be finished uniformly high so that when compacted, it will be slightly above but not more than 1/8 inch (3 mm) above the edge of the casting or gutter lip.

Construction joints of successive courses of HMA material shall be offset at least 6 inches (150 mm). Longitudinal joints in the layer shall be placed to coincide with lane lines as directed the Engineer or designated representative. Transverse joints shall be offset a minimum of 5 feet (1.5 meters).

E. Compaction: The pavement layers/lifts shall be compacted thoroughly and uniformly to obtain the compaction and cross section meeting the requirements indicated on the Drawings and this specification item.

Regardless of the method used for compaction, all rolling to achieve specified density shall cease before the temperature of the HMA mixture drops below 175°F (80°C).

Rolling with a pneumatic tire roller shall be used to seal the surface. Rolling with a tandem or other steel-wheel roller shall be provided if required to iron out any roller marks. Surface sealing and removal of roller marks may be accomplished at HMA temperatures below 175°F (80°C).

Vibratory rollers shall not be allowed in the vibrating mode on layers with a plan thickness less than 1½ inches (37.5 mm).

The motion of the rollers shall be slow enough to avoid other than usual initial displacement. If any displacement occurs, it shall be corrected to the satisfaction of the Engineer or designated representative.

The roller shall not be allowed to stand on pavement, which has not been compacted to minimum density requirements. In order to prevent adhesion of the surface mixture to the steel-wheel rollers, the wheels shall be thoroughly moistened with water; however an excess of water will not be

allowed. Necessary precautions shall be taken to prevent the dropping of diesel, gasoline, oil, grease or other foreign matter on the pavement, either when the rollers are in operation or when standing.

The edges of the pavement along curbs, headers and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction with the rollers, shall be thoroughly compacted with lightly oiled tamps.

Rolling with a trench roller will be required on widened areas, in trenches and other limited areas where satisfactory density cannot be obtained with the approved rollers.

340S.11 - Sampling and Testing

The HMA mixture shall be tested daily at the Project site for conformance to specification requirements. The Engineer or designated representative shall utilize a random selection method to determine sample locations based on the Contractor's anticipated production. Each day's anticipated production shall be divided into three (3) essentially equal single-pass, sub-area lots. Each day's sample locations shall be equally distributed over the three (3) sub-areas. If, due to the weather or plant malfunctions, the Contractor's daily-anticipated production is not attained, the random locations will not be recalculated. Also, no more than one location of the three (3) sub-areas shall be located in an irregular shaped area such as a cul-de-sac.

Unless directed otherwise by the Engineer or designated representative, a minimum of three bag samples and three correlating 6-inch (150-mm) cores will be obtained from each day's production.

Bag samples shall be taken during lay-down operations. The primary sampling point for the bag samples shall be from the windrow if a windrow elevator is used. If a windrow elevator is not used, the sample shall be taken from the middle of the paving machine hopper. This sampling location will require a stoppage in the paving operation in order for the Inspector to safely secure a sample from the hopper.One core shall be taken for every 2,000 single-pass square yards (1,675 single-pass square meters) with a minimum of three (3) cores for all projects. One core shall be taken at the same station and pass sampled for each of the bag samples. Cores shall be taken by the City's laboratory within 48 hours of pavement laydown unless otherwise directed by the Engineer or designated representative.

For total areas of less than 500 square yards (420 square meters), a total of only two bag samples and two correlating cores will be obtained. If the Contractor desires additional testing, it shall be at its own entire expense.

The Engineer or designated representative may alter, increase or waive the testing schedule to ensure that the Work performed and the material used meet specification requirements. Acceptability of the completed pavement shall be based on the average of test results for the Project as defined in Section 340S.12, "Acceptance Plan" of this item.

Gradation, asphalt content and stability value of the HMA mixture shall be reported for each of the bag samples. The stability value reported for each of the bag samples shall be the average of three (3) tests per bag.

Pavement thickness and density shall be determined from 6-inch (150 mm) field cores. For each day's placement, density of cores for which no corresponding bag samples were taken shall be determined by using the average Maximum Theoretical Density of the day's three (3) bag samples or as may otherwise be determined by the Engineer or designated representative.

When, in the opinion of the Engineer or designated representative, test results appear unrepresentative, additional testing may be authorized. The retesting will be at the expense of the Contractor and the results of the retesting shall be averaged with the results of the original testing. If the results of retesting indicate that the original test results were erroneous, the original test results will be discarded. In the instance of erroneous original test results the subsequent first set of retests will be at the expense of the City of Austin.

Pavements with low-density results may be recored; but the pavement shall not receive any additional compactive effort.

Pavements that will not or cannot be cored within 48 hours shall be closed to both public and construction traffic.

340S.12 - Acceptance Plan

For the purpose of the Acceptance Plan only, the "Paving Project" of each of the specified mixture types shall be defined by the Engineer or designated representative before the paving operation begins

Considerations for defining the Paving Project shall include paving operations staged due to traffic considerations, pavement structural section (i.e. with varying layer thicknesses), time required for paving, changes to the Job Mix Formula, phasing of large projects, or other factors affecting the consistency in the production, lay-down/compaction, use of completed portions, and/or aging of in-place material.

Acceptability of the completed pavement structure for a Paving Project shall be based on all daily averages of three test results and when approved by the Engineer or designated representative the overall average of all test results for each of the mixture/layer types specified on the Drawings.

Pay adjustments for two or more acceptance factors shall be accumulative. Pay adjustments of 100% unit price reduction shall require removal and replacement of the Work. Replacement materials shall be subject to all requirements of this specification. Alternatively, the Engineer or designated representative may allow the Work to remain in place without payment provided that the Work is warranted for an extended period under conditions as determined by the Engineer or designated representative. The decision of the Engineer or designated representative related to the removal and replacement of the Work shall be the final authority.

A. Non-Pay-Adjustment Acceptance Factors:

1. Surface Characteristics: Unless otherwise directed by the Engineer or designated representative, all pavements shall be tested for smoothness. Surfaces shall be tested with a 10-foot (3.05 meter) straightedge parallel to the roadway centerline and perpendicular to the centerline on flat, cross-slope sections. Maximum allowable deviation in 10 feet shall be 1/8 inch (1-mm per meter) parallel to the centerline and 1/4 inch (2-mm per meter) perpendicular to the centerline. Sections exceeding these maximums shall be corrected to the satisfaction of the Engineer or designated representative. The completed surface must meet the approval of the Engineer or designated representative for surface smoothness, finish and appearance.

   If the surface ravels, ruts or deteriorates in any manner prior to the end of the warranty period, it will be the Contractor's responsibility to correct this condition at its own entire expense to the satisfaction of the Engineer or designated representative in conformance with the requirements of this specification.

   For HMAC rehabilitation and overlay projects, if cracks develop in the pavement surface within the one-year warranty period, the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)".

   For new HMAC roadways constructed in accordance with the Drawings and specifications, if cracks less than 1/4 inch (6 mm) in width develop in the pavement surface within the one year warranty period the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)".

   If cracks equal to or greater than 1/4 inch (6 mm) in width develop in the pavement surface within the one-year warranty period, the cracking shall be reviewed and evaluated by the Engineer or designated representative before corrective action is taken.

2. Stability: Stability test results shall be used as indicators of potential problems. Where stability test results fall below the range specified in this specification, additional tests shall be taken as directed by the Engineer or designated representative for further evaluation and monitoring of the paving mixture. This additional stability testing will be at the expense of the Contractor. When, in the opinion of the Engineer or designated representative, the stability is deemed unacceptable for the intended use of the pavement, the paving mixture shall be removed and replaced to the limits indicated by test results or may be left in place on conditions acceptable to the Engineer or designated representative. When the paving mixture is removed and replaced, it shall be at the sole expense of the Contractor.

3. Laboratory Density: Laboratory density results as determined by TxDOT Test Method Tex-207-F shall be used as indicators of potential problems. Where laboratory density test results are less than 94.5% or more than 97.5% of mix design maximum density, additional tests shall be taken as directed by the Engineer or designated representative for further evaluation and monitoring of the paving mixture. This additional laboratory density testing will be at the expense of the Contractor. When, in the opinion of the Engineer or designated representative, the laboratory density is deemed unacceptable for the intended use of the pavement, the paving mixture shall be removed and replaced to the limits indicated by test results.

   The removal and replacement of the paving mixture shall be at the sole expense of the Contractor.

4. Limited Areas: Irrespective of an acceptable overall Paving Project average for any or all of the Pay-Adjustment Acceptance Factors, limited substandard portions of the Work, as determined by the Engineer or designated representative, shall be remedied or removed and replaced to the satisfaction of the Engineer or designated representative at the sole expense of the Contractor.

B. Pay-Adjustment Acceptance Factors: Contract unit prices shall be adjusted for paving mixtures that fail to meet acceptance criteria for gradation, asphalt content, density and mat thickness in accordance with the following:

Gradation Acceptance Schedule (TEX-210-F)

Sieve	Deviation From Job Mix Formula		Percent Contract Unit Price Reduction
	Daily Average	Overall Average	
Total retained on No. 10 (2.00 mm)	±6.5 6.6±	±5.0 5.1±	0 10
Passing No. 200 (75 µm)	±3.9 4.0±	±3.0 3.1±	0 5

Asphalt Content Acceptance Schedule (TEX-210-F, Part II)

Deviation from the Job Mix Formula	Percent Contract Unit Price Reduction

Daily Average	Overall Average	Local Streets*	All Others
±0.5	±0.4	0	0
±0.51 to ±0.60	±0.41 to ±0.50	15	25
+0.61 to +0.70	+0.51 to +0.60	25**	100; Remove and Replace
-0.61 to -0.70	-0.51 to -0.60	100: Remove and Replace	100; Remove and Replace
Over ±0.70	Over ±0.60	100: Remove and Replace	100; Remove and Replace
*A local or residential street that serves as access to residence or other abutting property.			
**If the street has an ADT of 500, or less, with 1%, or less, of truck traffic, plus a 2 year warranty; otherwise, Remove and Replace			

Density Acceptance Schedule (TEX-207-F/TEX-227-F)

*Percent Density		Percent Contract Unit Price Reduction	
Daily Average	**Overall Average**	**1½" (38 mm) Thickness or Greater**	**Less than 1½" (38 mm) Thickness**
Above 96.5	Above 96	100; Remove and Replace	100; Remove and Replace
90.5 to 96.5	91 to 96	0	0
90.5 to 87.6	90.9 to 88.1	0.625 per 0.10% deficiency in density	0.50 per 0.10% deficiency in density
Less than 87.6	Less than 88.1	100: Remove and Replace	100; Remove and Replace
*Core bulk density divided by max. theoretical density			

Thickness Acceptance Schedule

Variance Percent of Thickness		Percent Contract Unit Price Reduction
Daily Average	**Overall Average**	
0—15.0	0—10	0
15.1—20.0	10.1—16	20
20.1—30.0	16.1—25	50

Over 30.0	Over 25	100; Remove and Replace or mill/overlay 1" (25 mm) minimum

The Density Acceptance Schedule For Irregularly Shaped Areas; Hike And Bike Trails And Utility Trenches (see following table) will apply to utility trenches of widths less than 4 feet (1.2 meter) and to irregular shaped areas and hike and bike trails in which an appropriate rolling pattern cannot be established making it difficult to achieve compaction.

Density Acceptance Schedule For Irregularly Shaped Areas; Hike And Bike Trails and Utility Trenches (TEX-207-F/TEX-227-F)

***Percent Density**	**Percent Contract Unit Price Reduction**	
Daily Average	1½" (38 mm) Thickness or Greater	Less than 1½" (38 mm) Thickness
Above 96.5	100; Remove and Replace	100; Remove and Replace
96.5 to 89.0	0	0
89.0 to 86.1	0.625 per 0.10% deficiency in density	0.50 per 0.10% deficiency in density
Less than 86.1	100: Remove and Replace	100; Remove and Replace
*Core bulk density divided by maximum theoretical density		

The Density Acceptance Schedule will apply to utility trenches 4 feet (1.2 meter) or wider.

Core thicknesses greater than Drawing requirements shall be factored into the average thickness calculation as the Drawing required thickness. If total thickness of lift(s) proves to be less than required, the Contractor may remove and replace the overlay deficient areas as agreed to by the Engineer or designated representative. Overlays to correct thickness deficiencies shall be not less than one (1) inch (25-mm) thick. Overlays shall require milling of the asphalt in order to prevent a "featheredge" of the overlaying pavement.

The extent of the area to be overlaid or removed and replaced shall be determined by additional cores with thicknesses greater than or equal to the required thickness. All additional coring that is necessary to determine the area shall be paid for by the Contractor.

340S.13 - Measurement

Work performed and material placed shall be measured under one of the following methods. When Drawing quantity measurement is specified, adjustment of quantity may be made as follows. If the quantity measured as outlined vary from those shown on the Drawings by more than 5%, either party to the Contract may request in writing and adjustment of the quantity by each separate bid item. The party to the Contract which requests the adjustment shall present to the other party one copy of measurements and calculations showing the revised quantity in question. This revised quantity, when approved by the Engineer or designated representative, shall constitute the final quantity for which payment will be made. However, no adjustment will be made for any quantity, which exceeds the Drawing required thickness.

A. Method A: Asphaltic concrete pavement shall be measured by the ton (2,000 pounds) of the type actually used in completed and accepted Work in accordance with the Drawings and specifications.

The measurement shall be made on approved truck scales that meet the requirements of the National Institute of Standards and Technology Handbooks 44 and 112 except that the required accuracy shall be 0.4 percent of the load being weighed. The Contractor shall furnish a report of calibration from a scale mechanic licensed by the Texas Department of Agriculture certifying that the scales meet this requirement.

B. Method B: Asphaltic concrete pavement shall be measured by the square yard of specified total thickness of the type of paving mixture actually used in completed and accepted Work in accordance with Drawings and specifications. Multiple lifts of the same type shall be considered as one for square yard measurement purposes.

C. Method C: Asphaltic concrete pavement shall be measured by the lineal foot of specified total thickness of the type of paving mixture actually used in completed and accepted Work in accordance with Drawings and specifications. Multiple lifts of the same type shall be considered as one for linear foot measurement purposes.

340S.14 - Payment

Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid prices or pay adjusted unit price for Hot Mix Asphaltic Concrete Pavement, of the types and thicknesses specified. The unit bid prices shall include full compensation for furnishing all labor, equipment, time, materials and incidentals necessary to complete the Work.

Removal of existing hot mix asphalt concrete transition areas prior to overlay, tack coat, saw cutting and temporary pavement markings will not be measured or paid for directly but shall be included in the unit price bid for Standard Specification Item No. 340S, "Hot Mix Asphaltic Concrete Pavement."

Payment for Work meeting these specifications will be made under one of the following:

Pay Item No. 340S-A:	Hot Mix Asphaltic Concrete Pavement, Type ___,	Per Ton
Pay Item No. 340S-B:	Hot Mix Asphaltic Concrete Pavement, ___ inches, Type ___.	Per Square Yard.
Pay Item No. 340S-C:	Hot Mix Asphaltic Concrete Pavement, ___ Inches, Type ___.	Per Lineal Foot.
Pay Item No. 340S-PQ:	Hot Mix Asphaltic Concrete Pavement, ___ Inches, Type ___, Plan Quantity	Per Ton.
Pay Item No. 340S-L:	Hot Mix Asphaltic Concrete Pavement, ___ in., Type ___, Level-up Course.	Lump Sum
Pay Item No. 340S-M:	Crack Sealing Mobilization,	Lump Sum

Pay Item No. 340S-S:	Crack Sealing,	per Lineal Foot

SPECIFIC CROSS REFERENCE MATERIALS	
Special Specification Item 340S, "Hot Mix Asphaltic Concrete Pavement"	
City of Austin Standard Specifications	
Designation	Description
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 307S	Tack Coat
Item No. 313S	Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-106E	Method of Calculating the Plasticity Index of Soils
Tex-107E	Determination of Bar Linear Shrinkage of Soils
Tex-200-F	Sieve Analysis of Fine and Coarse Aggregates
Tex-203-F	Sand Equivalent Test

Tex-204-F	Design of Bituminous Mixtures
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-208-F	Test for Stabilometer Value of Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures by Extraction
Tex-212-F, Part II	Determination of Moisture Content of Bituminous Mixtures (by oven drying)
Tex-217-F	Determination of Deleterious Material and Decantation Test For Coarse Aggregates
Tex-227-F	Theoretical Maximum Specific Gravity of Bituminous Mixtures
Tex-410-A	Abrasion of Coarse Aggregate Using the Los Angeles Machine
Tex-460-A	Determination of Crushed Face Particle

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item 340	Hot Mix Asphalt Concrete Pavement

RELATED CROSS REFERENCE MATERIALS

Special Specification Item 340S, "Hot Mix Asphaltic Concrete Pavement"

City of Austin Standard Specifications

Designation	Description
Item No. 206S	Asphalt Stabilized Base

Item No. 210S	Flexible Base
Item No. 306S	Prime Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 320S	Two Course Surface Treatment

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-215-F	Determination of Asphalt Content of Rock Asphalt By Hot Solvent Method
Tex-224-F	Determination of Flakiness
Tex-400-A	Method of Sampling Stone, Gravel, Sand and Mineral Aggregates
Tex-411-A	Soundness of Aggregate by Use of Sodium Sulfate or magnesium Sulfate
Tex-438-A	Accelerated Polish Test for Aggregate

End

ITEM NO. 360S - CONCRETE PAVEMENT 9-26-12

360S.1 - Description

This item shall consist of a pavement and/or base of Portland Cement concrete, with or without reinforcement as indicated on the Drawings, with or without monolithic curbs, constructed as herein specified, on prepared subgrade or base course in conformity with the thickness and typical cross sections indicated on the Drawings. Concrete to be considered of satisfactory quality provided it is made (a) of materials accepted for job, (b) in the proportions established by the Contractor and (c) mixed, placed, finished and cured in accordance with the requirements of this specification.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

P360S.2 - Submittals

The submittal requirements of this specification item may include:

A. Mix design option(s) of the class of concrete required on the project,

B. The supplier of the concrete mix design(s) and type of mixing equipment, and

C. Type of admixtures to be used with the concrete mixes.

360S.3 - Materials

A. Cementitious Materials

Portland cement shall conform to ASTM C 150, Type I (General Purpose) and Type III (High Early Strength). Type III cement shall be used when high early strength concrete is indicated on the Drawings. If the use of high early cement is not specified and the Contractor desires to use it, the Contractor shall obtain written permission from the Engineer or designated representative prior to its use and shall assume all additional costs incurred by the use of such cement. All cement shall be of the same type and from the same source for a project unless written permission if first received from the Engineer or designated representative.

Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Commission on Environmental Quality (TCEQ) and the United States Environmental Protection Agency (USEPA). Supplier shall provide current TCEQ and EPA authorizations to operate the facility.

Bulk or sacked cement may be used and a bag shall contain 94 pounds (42.6 KG) net. All bags shall be in good condition at the time of inspection. Bulk cement shall be weighed on approved scales as herein prescribed.

All cement shall be stored in a suitable weather tight building or bin, which will protect the cement from dampness. The cement shall be so stored as to provide easy access for proper inspection. Any cement, which has become partially set or which contains hard lumps or cakes or cement salvaged from discarded or used bags, shall not be used.

Fly ash (denoted by Texas DOT designations Type A and Type B) may replace 20 to 35 percent of a mix design's Portland cement content by absolute volume. Fly ash shall not be used in mix designs with less that 5 sacks of Portland cement per cubic yard [six and a half (6.5) sacks of Portland cement per cubic meter] unless specifically permitted by the Contract plans of project manual. Fly ash shall conform to the requirements of Item No. 405S, "Concrete Admixtures."

B. Admixtures

Concrete admixtures conforming to Item No. 405S, "Concrete Admixtures" may be used when approved by the Engineer or designated representative to minimize segregation, improve workability, reduce the amount of mixing water and to provide normal hot weather concreting provisions. The use of admixtures shall not alter the approved mix designs, except for water content.

C. Coarse Aggregate

Coarse aggregate shall consist of durable particles of gravel, crushed blast furnace slag and/or crushed stone of reasonably uniform quality throughout, free from injurious amounts of salt, alkali, vegetable matter or other objectionable material, either free or as an adherent coating on the aggregate. It shall not contain more than 0.25 percent by weight of clay lumps nor more than 1.0 percent by weight of shale nor more than 5.0 percent by weight of laminated and/or friable particles when tested in accordance with TxDOT Test Method Tex-413-A.

Coarse aggregate shall have a wear of not more than 45 percent when tested according to TxDOT Test Method Tex-410-A and when tested by standard laboratory methods shall meet the following grading requirements:

Retained on 1¾ inch (43.75 mm) sieve	0%
Retained on 1½ inch (37.5 mm) sieve	0 to 5%
Retained on ¾ inch (19.0 mm) sieve	30 to 65%
Retained on 3/8 inch (9.5 mm) sieve	70 to 90%
Retained on No. 4 (4.75 mm) sieve	95 to 100%

Loss by Decantation TxDOT Test Method *Tex-406-A. 1.0% Maximum

* In the case of aggregate made primarily from crushing of stone. If the material finer than the 200 sieve is definitely established to be the dust of fracture essentially free from clay or shale as established by Part III of TxDOT Test Method Tex-406-A, the percent may be increased to 1.5.

When the plans do not require a monolithic pour of curb or curb and gutter, the Contractor may elect to use the following gradation of coarse aggregate for curb or curb and gutter:

Retained on 1½ inch (37.5 mm) sieve	0%
Retained on 3/8 inch (9.5 mm) sieve	5 to 30%
Retained on No. 4 (4.75 mm) sieve	75 to 100%

Where the coarse aggregate is delivered on the job in 2 or more sizes or types, each type and/or size shall be batched and weighed separately.

All aggregates shall be handled and stored in such a manner as to prevent size segregation and contamination by foreign substances and maintain as nearly as possible in a uniform condition of moisture. When segregation is apparent, the aggregate shall be remixed with suitable equipment as required. At time of its use, the aggregate shall be free from frozen material and aggregate containing foreign materials will be rejected. Coarse aggregate that contains more than 0.5 percent free moisture by weight shall be stockpiled for at least 24 hours prior to use.

Adequate storage facilities shall be provided for approved materials. The intermixing of non-approved materials with approved materials either in stockpiles or in bins will not be permitted. Aggregates from different sources shall be stored in different stockpiles unless otherwise approved by the Engineer or designated representative.

D. Fine Aggregate

Fine aggregate shall be free from injurious materials of salt, alkali or vegetable matter. It shall not contain more than 0.5 percent by weight of clay lumps. When subjected to the color test for organic impurities, TxDOT Test Method Tex-408-A, the fine aggregate shall not show a color darker than standard.

Unless shown otherwise on the drawings, fine aggregate shall have an acid insoluble residue of at least 60% by weight when tested in accordance with Tex 612-J.

Unless specified otherwise, fine aggregate shall meet the following grading requirements:

Retained on 3/8 inch (9.5 mm) sieve	0%
Retained on No. 4 (4.75 mm) sieve	0 to 5%
Retained on No. 8 (2.36 mm) sieve	0 to 20%
Retained on No. 16 (1.185 mm) sieve	15 to 30%
Retained on No. 30 (600 µm) sieve	35 to 75%
Retained on No. 50 (300 µm) sieve	70 to 90%
Retained on No. 100 (150 µm) sieve	90 to 100%
Retained on No. 200 (75 µm) sieve	97 to 100%

Fine aggregate will be subjected to the Sand Equivalent Test, TxDOT Test Method Tex-203-F. The sand equivalent value shall not be less than 80.

E. Mineral Filler

Mineral filler shall consist of clean stone dust, crushed sand, crushed shell or other approved inert material. It shall meet the following requirements when tested in accordance with TxDOT Test Method Tex-401-A:

Retained on No. 30 (600 µm) sieve	0%
Retained on No. 200 (75 µm) sieve	0 to 35%

Where fine aggregate is delivered to the job in 2 or more sizes or types, each type and/or size of material shall be batched and weighed separately. Where mineral filler is used, it shall be batched and weighed separately. At the time of its use the fine aggregate shall be free from frozen material and aggregate containing foreign material will be rejected.

All fine aggregate shall be stockpiled for at least 24 hours prior to use.

F. Mixing Water

Water for use in concrete and for curing shall be free from oils, acids, organic matter or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl nor more than 1,000 parts per million of sulfates as SO4.

Water from municipal supplies approved by the State Health Department will not require testing. Contractor shall sample and test water from other sources and submit test results to the Engineer or designated representative for approval 10 days prior to proposed use.

Tests shall be made in accordance with "Standard Method of Test for Quality of Water to be used in Concrete," AASHTO Method T-26.

G. Transit-mixed Concrete

The use of transit-mixed (ready-mixed) concrete will be permitted by the Engineer or designated representative provided the batching plant and mixer trucks meet requirements of quality specified herein.

When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the drum of the mixer or agitator truck. Delivery of concrete to the site of the work and its discharge from the truck mixer, agitator or non-agitating equipment shall be in accordance with the requirements of Item No. 410S, "Concrete Structures."

Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

1. A ticket system will be used that includes a copy for the construction inspector. The ticket will have machine stamped time/date of the concrete batch, weight of cement, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on the ticket may be cause for rejection of the concrete.
2. Sufficient trucks will be available to support continuous slab placements. The Contractor will satisfy the Engineer or designated representative that adequate standby trucks are available to support monolithic placement requirements.
3. A portion of the mixing water, required by the batch design to produce the specified slump, may be withheld and added at the job site but only with the permission of the Engineer or designated

representative and under the Inspector's observation. When water is added under these conditions, it will be thoroughly mixed before any slump or strength samples are taken.

H. Joint Sealer

Unless otherwise shown on the plans, joint sealant for concrete pavement used on airport runways and/or taxiways shall be TxDOT Class 5. All other joint sealant shall be TxDOT Class 2.

As a minimum, the joint sealant shall comply with the following. The manufacturer of the joint sealant shall furnish certification that the product to be supplied meets or exceeds the specification.

1. Class 2 (Hot Poured Rubber-Asphalt). This sealer shall conform to Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)". The sealer must be compatible with asphaltic concrete.
2. Class 5 (Low Modulus Silicone Sealant for Concrete Pavement). This material shall conform to Item 413S, "Cleaning and/or Sealing Joints and Cracks (PCC)" and shall be furnished in a one-part silicone formulation, which does not require a primer for bond to concrete. A backer rod shall be required which will be compatible with the sealant. No bond or reaction shall occur between the rod and sealant. The sealant shall adhere to the sides of the concrete joint. It shall not crack or break when exposed to temperatures below 32°F (0°C).

   The sealant material shall have the following properties:

Color	Gray
Flow, MIL-2-8802D, Sec 4.8.4, max	0.2
Working time, minutes	10
Tack-free time at 77°F ±2°F (25°C ±1.1°C), MIL-2-8802D	
Sec 4.8.7, minutes	60
Cure time at 77°F (25°C), days	7—14
Full Adhesion, days	14—21

As Cured - after 7 days at 77°F (25°C) and 40% Relative Humidity

Elongation, minimum percent	1200
Durometer Hardness, Shore A, ASTM D 2240, min	15
Joint movement capability, percent	+100/-50

Tensile Strength, maximum elongation, percent	100
Peal strength, psi	25 (172 kPa)

I. Backer Rod

Backer Rod shall be expanded closed cell polyethylene foam compatible with sealant. No bond or reaction shall occur between rod and sealant. Backer Rod shall be of sufficient width to be in compression after placement.

J. Joint Filler

Boards for expansion joint filler and for contraction and longitudinal joints shall be of the size, shape and type indicated.

Board shall be obtained from Redwood, Cypress, Gum, Southern Yellow Pine or Douglas Fir timber. They shall be solid heartwood and shall be free from sapwood, knots, clustered birdseye, checks and splits. Occasional sound or hollow birdseye, when not in clusters, will be permitted provided the board is free from any other defects that will impair its usefulness as a joint filler. With the exception of Redwood and Cypress, all boards shall have a creosote or pentachlorophenol treatment of 6 pounds per cubic foot (96 kg/m3). When oven dried at 230°F (110°C) to a constant weight, the weight of the board per cubic foot (minus treatment), shall not be less than 20 pounds nor more than 35 pounds (not less than 320 nor more than 561 kgs per cubic meter).

K. Asphalt Board

Asphalt board when used as indicated shall be of required size, full depth of concrete placement and uniform thickness. When used in transverse joints, it shall conform approximately to shape of the pavement crown as indicated. Asphalt board shall consist of 2 liners of 0.016-inch (0.4 mm) asphalt impregnated paper filled with a mastic mixture of asphalt and vegetable fiber and/or mineral filler. Boards shall be smooth, flat and straight throughout and shall be sufficiently rigid to permit easy installation. Boards that crack or shatter during installing and finishing operations will not be acceptable. Board shall be furnished in lengths equal to ½ the pavement width or in lengths equal to the width between longitudinal joints and may be furnished in strips or scored sheets of the required shape. When tested in accordance with TxDOT Test Method Tex-524-C the asphalt boards shall not deflect from the horizontal more than ¾ inch in 3½ inches (19.3 cm in 90 cm). The asphalt board shall be placed such that they will not interfere with the bonding of the joint sealer.

L. Load Transmission Devices for Expansion and Contraction Joints

Approved load transmission devices, when indicated, shall meet the requirements specified herein:

Smooth steel bar dowels, used when indicated, shall be of the size and type indicated and shall be open-hearth, basic oxygen or electric-furnace steel conforming to the properties specified for grade 60 in ASTM A 615. The free end of dowel bars shall be smooth and free of shearing burrs.

When indicated, one end of each dowel bar shall be encased in an approved cap having an inside diameter of 1/16 inch (16 mm) greater than the diameter of the dowel bar. The cap shall be of such strength, durability and design as to provide free movement of the dowel bar and shall be approved by the Engineer or designated representative prior to use. One end of the cap shall be filled with a soft felt plug or shall be void in order to permit free movement of the dowel bar for a distance equivalent to 150 percent of the width of the expansion joint used. The dowel caps and dowel bars shall be held securely in place by bar ties as indicated on the drawings. Mechanical methods of

implanting dowel bars in the plastic concrete may be used when approved by the Engineer or designated representative.

Where required, dowel bars shall be coated with a plastic material meeting the requirements indicated.

Where red lead and oil bar coating is indicated, the red lead may be of any standard commercial grade and the oil shall be clean and no lighter than Standard No. 30 SAE grade. Approved thinner and dryer may be added to the red lead, but the material upon application shall be of such consistency that will provide a uniform and heavy coating on the bar. Where asphalt bar coating is indicated, the material may be any standard grade of oil asphalt and shall be applied hot. Cutback asphalt will not be permitted for bar coating.

M. Metal Installing Devices for Joint Assembly

Metal installing devices for expansion and contraction joint assemblies (such as welded wire bar chairs, bar stakes and marker channels, channel caps, etc.) shall be as indicated or may be similar devices of equivalent or greater strength, approved by the Engineer or designated representative, that will secure joint assembly in correct position during the placing and finishing of concrete. Load transmission devices used in joint assemblies shall be secured in position by a transverse metal brace of the type and design indicated or may be secured in position by other approved devices of equivalent or greater strength that will provide positive mechanical connection between the brace and each unit (or than by wire tie) and prevent transverse movement of each load transmission device.

N. Steel Reinforcement

Steel reinforcing bars as required including tie bars shall be open-hearth, basic oxygen or electric-furnace new billet steel of Grade 60 or Grade 40 for concrete reinforcement as indicated. Bars that require bending shall be Grade 40 conforming to the requirements of ASTM A 615.

High yield reinforcing steel shall be either (a) open-hearth, basic oxygen or electric-furnace new billet steel conforming to ASTM A 615 Grade 60 or (b) rail steel bars for concrete reinforcement, conforming to ASTM A 616 Grade 60. Bars produced by piling method will not be accepted. High yield reinforcing steel bars shall be further identified by a special marking rolled into each bar. All reinforcing steel shall be deformed bars conforming to the requirements of pertinent ASTM Specifications.

Where prefabricated deformed wire mats are indicated or permitted, the wire shall be cold worked deformed steel wire conforming to the requirements of ASTM A 496, except that steel shall be made by open-hearth, electric-furnace or basic oxygen processes. The prefabricated deformed wire mats shall conform to the requirements of ASTM A 497, except that wires used shall be deformed and transverse wires shall project beyond the centerline of each edge longitudinal wire as indicated. Mats that have been bent or wires dislocated or parted during shipping or project handling shall be realigned to within ½ inch (13 mm) of original horizontal plane of the mat. Mats with any portion of the wires out of vertical alignment more than ½ inch (13 mm) after realignment and/or wires dislocated or mutilated so that, in the opinion of the Engineer, they do not represent the original mat, shall be rejected. The reinforcement may be clamped or wired so that the reinforcement will retain the horizontal and vertical alignment as indicated or as approved by the Engineer or designated representative. Deformed wire may be used for tie bars and load transfer bars that require bending. The nominal size, area and theoretical weight of reinforcing steel wires covered by this provision are as listed in Table II. When fabricated steel bars or rod mats are indicated, the mats shall meet requirements of ASTM A 184.

Steel wire fabric reinforcement shall be of the gage and spacing indicated and shall conform to the requirements of ASTM A 82. Longitudinal and transverse wires shall be electrically welded together at all points of intersection and the welds shall be of sufficient strength that they will not be broken

during handling or placing. All welding and fabrication of fabric sheets shall conform to the requirements of ASTM A 185. Welded steel wire fabric shall be furnished in sheets as indicated and steel having been previously bundled into rolls will not be accepted. An approved hinge will be permitted in each sheet to provide for each sheet longitudinally. When wire fabric is used, it will replace only the longitudinal and transverse bars. The tie bars and load transmission units at joints will not be affected.

Table II: DIMENSIONAL REQUIREMENTS FOR DEFORMED STEEL WIRE FOR CONCRETE REINFORCEMENT

Deformed Wire Size No.	Unit Weight Pounds Per Ft. (Kgs per Meter)	Diameter Inches (Centimeters)	Cross-Sectional Area, Sq. Inches (Sq. Centimeters)	Perimeter Inches (Centimeters)
Column 1	Column 2	Column 3	Column 4	Column 5
D-1	0.034 (.051)	0.113 (.287)	0.01 (.06)	0.355 (.902)
D-2	0.068 (.101)	0.159 (.404)	0.02 (.13)	0.499 (1.267)
D-3	0.102 (.152)	0.195 (.495)	0.03 (.19)	0.612 (1.554)
D-4	0.136 (.202)	0.225 (.572)	0.04 (.26)	0.706 (1.793)
D-5	0.170 (.253)	0.252 (.640)	0.05 (.32)	0.791 (2.009)
D-6	0.204 (.304)	0.276 (.701)	0.06 (.39)	0.867 (2.202)
D-7	0.238 (.354)	0.296 (.752)	0.07 (.45)	0.936 (2.377)
D-8	0.272 (.405)	0.319 (.810)	0.08 (.52)	1.002 (2.545)
D-9	0.306 (.455)	0.338 (.859)	0.09 (.58)	1.061 (2.695)
D-10	0.340 (.506)	0.356 (.904)	0.10 (.65)	1.118 (2.840)
D-11	0.374 (.557)	0.374 (.950)	0.11 (.71)	1.174 (2.982)
D-12	0.408 (.607)	0.390 (.991)	0.12 (.77)	1.225 (3.112)
D-13	0.442 (.658)	0.406 (1.031)	0.13 (.84)	1.275 (3.239)

D-14	0.476 (.708)	0.422 (1.072)	0.14 (.90)	1.325 (3.366)
D-15	0.510 (.759)	0.437 (1.110)	0.15 (.97)	1.372 (3.485)
D-16	0.544 (.810)	0.451 (1.146)	0.16 (1.03)	1.416 (3.600)
D-17	0.578 (.860)	0.465 (1.181)	0.17 (1.10)	1.460 (3.708)
D-18	0.612 (.911)	0.478 (1.214)	0.18 (1.16)	1.501 (3.813)
D-19	0.646 (.961)	0.491 (1.247)	0.19 (1.23)	1.542 (3.917)
D-20	0.680 (1.012)	0.504 (1.280)	0.20 (1.29)	1.583 (4.021)
D-21	0.714 (1.063)	0.517 (1.313)	0.21 (1.35)	1.624 (4.125)
D-22	0.748 (1.113)	0.529 (1.344)	0.22 (1.42)	1.662 (4.221)
D-23	0.782 (1.164)	0.541 (1.375)	0.23 (1.48)	1.700 (4.318)
D-24	0.816 (1.214)	0.553 (1.405)	0.24 (1.55)	1.737 (4.412)
D-25	0.850 (1.265)	0.564 (1.433)	0.25 (1.61)	1.772 (4.500)
D-26	0.884 (1.316)	0.575 (1.461)	0.26 (1.68)	1.806 (4.587)
D-27	0.918 (1.366)	0.586 (1.488)	0.27 (1.74)	1.841 (4.676)
D-28	0.952 (1.417)	0.597 (1.516)	0.28 (1.81)	1.876 (4.765)
D-29	0.986 (1.467)	0.608 (1.544)	0.29 (1.87)	1.910 (4.851)
D-30	1.020 (1.518)	0.618 (1.570)	0.30 (1.94)	1.942 (4.933)
D-31	1.054 (1.569)	0.628 (1.595)	0.31 (2.00)	1.973 (5.011)

O. Polyethylene Film

Polyethylene film shall be opaque pigmented white in color and shall be manufactured from virgin resin without additives or scrap. It shall be sufficiently strong and tough to permit its use under the conditions existing on street paving work without being torn or otherwise rendered unfit for the purpose during the curing period. The film shall have a minimum thickness of 4 mils (0.004 inch), shall have a minimum tensile strength of 1,700 psi at 77°F (11,720 kPa at 25°C) in the longitudinal direction and 1,200 psi at 77°F (8,275 kPa at 25°C) in the transverse direction and shall have a minimum elongation of 200 percent at 77°F (25°C) in the longitudinal direction and 150 percent at 77°F (25°C) in the transverse direction. The permissible percent moisture loss shall not exceed 2 percent after 24 hours and 4 percent after 72 hours. Tests for tensile strength and elongation will be conducted in accordance with ASTM Designation: D 882, Method A. Tests for moisture retention will be conducted in accordance with ASTM Designation: C 156.

P. Membrane Curing Compound

Membrane curing compound shall conform to Item No. 409S, "Membrane Curing," Type 2 white pigmented.

Q. Asphalt Curing

Where asphalt is to be placed on a concrete base, asphalt shall be used for curing concrete base, the material shall conform to Item No. 301S, "Asphalts, Oils and Emulsions" for RS-2 or RS-2h or as indicated on the drawings.

360S.4 - Equipment

A. General

All equipment necessary for construction of this item shall be on the Project and shall be approved by Engineer or designated representative as to conditions before the Contractor will be permitted to begin construction operations on which the equipment is to be used. When approved by the Engineer or designated representative in writing, a commercial or independently operated batching plant for measuring materials outside limits of the project may be used.

B. Mixer

The mixer furnished may be either a paving mixer (operated at site of construction or centrally located), a stationary mixer (central mixer) or a paving mixer (truck mounted) that will produce adequately mixed concrete meeting the specified requirements. The mixer, or mixers, shall conform to the following requirements:

1. Each mixer shall have attached in a prominent place a manufacturer's plate showing rated capacity of the drum in terms of volume of mixed concrete and the recommended speed of rotation of the mixing drum or blades.
2. The stationary mixer (central mixer) or truck mounted paving mixer shall be operated at the manufacturer's recommended speed.
3. The size of the paving mixer shall not be less than that of a 27-E paver, as established by the Mixer Manufacturer's Bureau of Associated General Contractors. The paving mixer shall be operated at a drum speed of not less than 16 revolutions per minute and not more than 22 revolutions per minute. Pickup and throw over blades in the drum of the mixer shall be replaced when worn down 3/4 inch (19 mm) or more.
4. Each truck mounted paving mixer shall be approved by the Engineer or designated representative prior to use on the project. It shall be classified as a "paving mixer" by the manufacturer and shall be so designed that a uniform and low slump concrete (approximately 1½ inch [38 mm] slump) can be mixed without aggregate size segregation. The mixer shall be capable of discharging the low slump concrete at a speed of 10 seconds per cubic yard (13 seconds per cubic meter) or faster.

5. Each mixer shall be equipped with an approved automatic device for satisfactorily timing the mix and locking the discharging device in order to prevent the discharging of the mixer before the end of the required mixing period. This timing device shall operate a sounding device to signal plainly the completion of the mixing time. When permitted by the Engineer a light signal device may be used.

6. Multiple drum mixers will be permitted provided their operation is properly synchronized. The mixing time shall be determined exclusive of the time required to transfer concrete from one drum to the next drum.

7. Each mixer shall be equipped with a water-measuring device so constructed that it will measure the water within 1 percent of the total amount required for each batch. Unless the water is to be weighed, the water measuring equipment shall include an auxiliary tank with a capacity greater than that of the measuring tank and from which the measuring tank will be filled by gravity flow. The measuring tank shall be open to the atmosphere and shall be so placed and constructed that the water for a batch can be discharged into a calibrated tank or weighing device for checking the accuracy of water measurement without seriously delaying the paving operations. The Contractor shall have a calibrated tank or weighing device available at all times at a location satisfactory to the Engineer or designated representative.

8. If a paving mixer is furnished and operated at the site of construction, it shall be equipped with a power controlled boom and bucket, so designed as to permit uniform distribution of the concrete for the full width between pavement forms. Alternate equipment for distributing concrete may be substituted when approved by the Engineer in writing, provided uniform distribution is obtained without segregation.

9. If central mixed concrete is used on the project, the Contractor shall provide equipment designed to provide uniform distribution for the concrete for the full width between pavement forms without segregation.

C. Transit-mix Trucks

When transit-mix (ready-mix) concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to the batch to coat the drum of the mixer or agitator truck. This shall be required for every load of concrete. The mixing speed shall be attained as soon as all ingredients are in the mixer. Each complete batch (containing all the required ingredients) shall be mixed not less than 70 nor more than 100 revolutions of the drum at mixing speed.

A portion of the mixing water, required by the batch design to produce the desired slump, may be withheld and added at the job site, but only with permission of the Engineer and under the Engineer's supervision. When water is added at the job site, 25 revolutions (minimum) at mixing speed, will be required to flush down the blades after charging shall be accurately measured and included in the quantity of mixing water. The introduction of the initial mixing water, except blade wash down water and that permitted in this Article shall be prior to or simultaneous with the charging of the aggregates and cementitious material.

Mixing and agitating speed shall be as designated by the mixer manufacturer. All revolutions after prescribed mixing shall be at agitating speed. Except for short periods of time during discharge, the drum shall be kept in continuous motion from the time the mixing is started until the discharge is completed.

Additional mortar, consisting of 1 sack cement, 3 parts sand and sufficient water, shall be added to the batch to coat the drum of the transit mixer or agitator truck. This shall be required for every load of concrete.

The loading of transit-mixers shall not exceed 63 percent of the drum volume. When used as an agitator only, the loading of truck mixers shall not exceed 80 percent of the drum volume.

The batching plant and transit-mix trucks shall operate under the following system:

1. A ticket system will be used that includes a copy for the construction inspector. The ticket will have machine stamped time/date of water/cement batch; weight of cement, fly ash (if applicable), water, sand and aggregates; exact nomenclature and quantities of admixture. Any item missing or incomplete on the ticket will be cause for rejection. Coded readouts may be used if approved in advance by the Engineer.
2. Sufficient trucks will be available to support continuous placements. The Contractor will satisfy the Engineer that adequate standby trucks are available to support monolithic placement when required.
3. A portion of the mixing water, required by the batch design to produce the desired slump, may be withheld and added at the job site, but only with the permission of the Engineer and under the Inspector's observation. When water is added under these conditions, it will be thoroughly mixed before any slump or strength samples are taken.

D. Hauling Equipment

Batch hauling equipment for the transportation of measured materials from the batching plant to the mixer shall be equipped with tight covers, which shall be used to prevent excessive evaporation of moisture or any loss of material.

If a central mixer is used, concrete may be transported to the point of delivery in truck agitators or non-agitating trucks.

If a truck mounted paving mixer is used, it may be used to transport the concrete after mixing is complete.

If non-agitator trucks are used they shall conform to the following requirements:

The bed of non-agitating hauling equipment shall be a smooth, mortar-tight, metal container. The hauling equipment shall be capable of delivering the concrete to the work site in a thoroughly mixed and uniform mass and capable of discharging the concrete at a satisfactory controlled rate without segregation. If in the opinion of the Engineer any appreciable segregation or accumulation of excess water and/or mortar occurs on the surface of the concrete, this may be cause for rejection and this method of transporting the concrete to the point of delivery shall be suspended as directed by the Engineer.

E. Subgrade or Subbase Planer and Templates

Unless a stabilized subbase is provided, an approved subbase planer shall be provided, mounted on visible rollers riding on the forms and having adjustable cutting blades which shall trim the subgrade to the exact section as indicated. The planer frame shall be heavy enough to remain on the forms at all times and shall be of such strength and rigidity that, under a test made by changing the support from the wheels to the center, it shall not develop a deflection for more than 1/8 inch (3 mm). Tractive power equipment used to pull the planer shall not be such as to produce ruts or indentations in the subgrade.

When the slip form method of paving is to be used, the subgrade planer will be operated on a prepared track grade or controlled by an electronic sensor system operated from a string line that establishes the horizontal alignment and the elevation of the subbase.

A template for checking the contour of the subbase shall be provided and operated by the Contractor. The template shall rest upon the side forms and shall be of such strength and rigidity that, under a test made by changing the support to the center, it shall not show a deflection of more than 1/8 inch (3 mm). It shall be provided with accurately adjustable rods projecting downward to the subgrade at 1-foot (30 cm) intervals and these rods shall be adjusted to the required cross section of the bottom of the slab when the template is resting upon the side forms. Where stabilized subbase is provided, use of a scratch template will be required.

F. Forms

Side forms shall be of metal of approved cross section. The preferred depth of the form shall be equal to the required edge thickness of the pavement. Forms with depth greater than the required edge thickness of the pavement will be permitted.

The length of form sections shall not be less than 10 feet (0.3 meters) and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200-foot (61 meter) radius or less. Forms shall be of ample strength and shall be provided with adequate devices for secure setting so that when in place they will withstand, without visible springing or settlement, the impact and vibration of the spreading and finishing machinery. In no case shall the base be less than 6 inches (15.2 cm) for a form 6 inches (15.2 cm) or more in height. The forms shall be free from warps, bends or kinks and shall be sufficiently true to provide a reasonably straight edge on the concrete. The top of each form section, when tested with a straightedge shall conform to the requirements specified for the surface of the completed pavement. Sufficient forms shall be provided for satisfactory prosecution of the work.

Outside curb forms shall be of wood or metal of a section satisfactory to the Engineer or designated representative, straight, free of warp and shall be in a depth at least equal to the depth of the curb. They shall be mounted on the paving forms and securely attached thereto and maintained in true position during the placing of the concrete. Inside curb forms, if required, shall be of approved material and of such design as to provide the curb required and shall be rigidly attached to the outside forms.

G. Concrete Spreader

Use of concrete spreader shall be required and it shall be a self-propelled machine having sufficient power and traction to spread and strike off concrete without slippage on the forms. It shall be equipped with a power driven device for spreading the concrete uniformly between the forms. The spreading device may be either a reciprocating blade, a screw conveyer or a belt conveyer. The spreader shall be capable of striking off the surface of the concrete between the forms in the longitudinal direction of the slab at any required elevation.

Mechanically operated concrete spreaders of other designs, which uniformly distribute the concrete with a minimum of segregation, may be used when approved by the Engineer.

H. Slipform Paver

With prior approval, the Contractor may place concrete with slip form paver. This paver shall be equipped with a longitudinal transangular finishing float adjustable to crown and grade and be satisfactory to the Engineer or designated representative. The float shall extend across the pavement practically to the side forms and/or the edge of slab. A "string line" shall be used to provide grade control for the paver.

I. Mechanical Vibratory Equipment

All concrete placed for pavement shall be consolidated by approved mechanical vibrators operated ahead of the transverse finishing machine and designed to vibrate the concrete internally and/or from the surface. Vibratory members shall extend across the pavement practically to, but shall not come in contact with the side forms. Mechanically operated vibrators shall be mounted in such manner as not to interfere with transverse or longitudinal joints. The internal-type vibrators shall be spaced at not more than 24 inches (61 cm) and shall be equipped with synchronized vibratory units. Separate vibratory units shall be spaced at sufficiently close intervals to provide uniform vibration and consolidation to the entire width of the pavement. The frequency in air of the interval spud type vibratory units shall be not less than 8,000 cycles per minute and not less than 5,000 cycles per minute for tube types and the method of operation shall be as directed by the Engineer or designated representative. The Contractor shall have a satisfactory tachometer available for checking vibratory the elements.

The pavement vibrators shall not be used to level or spread the concrete but shall be used only for purposes of consolidation. The vibrators will not be operated where the surface of the concrete, as spread, is below the elevation of the finished surface of the pavement, except for the first lift of concrete where double strike off method of placement is employed and the vibrators shall not be operated for more than 15 seconds while the machine upon which they are installed is standing still.

The pan type vibratory units shall apply the vibrating impulses directly to the surface of the concrete. The operating frequency shall be not less than 3,500 cycles nor more than 4,200 cycles per minute in air. The Contractor shall have a satisfactory tachometer available for checking the speed of the vibratory elements.

Approved hand manipulated mechanical vibrators shall be furnished in the number required for provision of proper consolidation of the concrete along forms, at joints and in areas not covered by mechanically controlled vibrators. These vibrators shall be sufficiently rigid to insure control of the operating position of the vibrating head.

Complete and satisfactory consolidation of the concrete pavement is a most important requirement of this specification. Cores taken shall be carefully examined for voids, honeycombing or other evidence of incomplete consolidation. If such evidence is present, changes in the consolidation procedures and/or equipment will be made to insure satisfactory consolidation.

J. Finishing Equipment

1. Transverse Finishing Machine

The Transverse finishing machine shall be provided with 2 screeds accurately adjusted to the crown of the pavement, shall be self-propelled and mounted in a substantial frame equipped to ride on the forms, or may be slip form finished, and shall be so designed and operated as to strike off and consolidate the concrete.

2. Longitudinal Finishing

A transverse drag float may be used in lieu of the longitudinal finishing machine with the Engineer's approval. Finishing machines shall be maintained in a tight and good operating condition, accurately adjusted to the required crown or profile and free from deflection, wobble or vibration tending to affect the precision of finish. Machines failing to meet these requirements will be rejected by the Engineer or designated representative and the Contractor shall provide approved equipment.

Where hand finishing is permitted under this specification, the Contractor shall provide a strike template and a tamping template both of 4 by 10 inch (10 by 25 cm) lumber or equivalent metal section and at least 2 feet longer than the width of the pavement. Both templates to conform to the crown section of the pavement and the tamp, if of wood, shall have a steel face not less than 3/8 inch (9.5 mm) in thickness. The Contractor shall also provide a longitudinal float of approved design and not less than 14 feet (4.25 meters) in length.

The Contractor shall furnish and maintain at least two standard 10-foot (3.05 meter) steel straightedges on the work site at all times during the paving operations. The Contractor shall operate same in the presence of the Engineer or designated representative.

The Contractor shall furnish a sufficient number of bridges to ride on the forms and span the pavement for finishing operations and for the installation and finishing of joints. All necessary finishing and edging tools shall be furnished as may be required to complete the pavement as indicated.

360S.5 - Proportioning of Concrete

A. Proportions

Concrete shall be composed of Cementitious Materials, fine aggregate, coarse aggregate, mineral filler and/or admixture if used and water, mixed in the proportions designated by the approved Mix Design and in the manner set forth in this specification. On the basis of job and laboratory investigations of the proposed materials, the Contractor will fix proportions by weight of water, coarse aggregate, fine aggregate, cementitious materials, admixture and mineral filler where required, in order to produce concrete of the specified strength and workability for the actual delivery time and site conditions to be encountered. Where curbs are placed separately, the Engineer or designated representative may allow aggregate gradation conforming to Class A Concrete, Item No. 403, "Concrete for Structures."

B. Concrete Strength

The concrete mix to be designed to produce a concrete with the following requirements:

Table 1: CONCRETE PAVEMENT

Item	Test	Value
Entrained Air	Tex-416-A	3 to 6 percent
Water-Cement Ratio gal. (liter)/sack, Maximum		6.25 (23.66)
Sacks Cement, Minimum, 94 pounds (42.6 KG) ea		6 per cubic yard (7.85 per cubic meter)
Coarse Aggregate Factor		0.65 min—0.85 max.
Compressive Strength after 7 Days, psi (kPa)	Tex-418-A	4000 (27,600)
Compressive Strength after 28 Days, psi (kPa)	Tex-418-A	4500 (31,000)
Maximum Concrete Mix Temperature °F (°C)		95 (35)
Retarder: Regular Concrete increase in time over 360S.7(3), minutes, Maximum	60	

Table 2: HIGH EARLY STRENGTH CONCRETE		
Item	**Test**	**Value**
Cement Type		III
Entrained Air	Tex-416-A	3 to 6 percent
Water-Cement Ratio gal. (liter)/sack, Maximum		6.25 (23.66)
Sacks Cement, Minimum, 94 pounds (42.6 KG) ea		7 per cubic yard (9.16 per cubic meter)
Coarse Aggregate Factor		0.65 min-0.85 max
Slump, inches (Centimeters)	Tex-415-A	½ to 2 (1.25 to 5.0)
Compressive Strength, after 24 hours, psi (kPa)	Tex-418-A	2,100 (14,500)
Compressive Strength, after 3 Days, psi (kPa)	Tex-418-A	2,750 (19,000)
Compressive Strength, after 7 Days, psi (kPa)	Tex-418-A	4,500 (31,000)
Compressive Strength, after 28 Days, psi (kPa)	Tex-418-A	4,925 (34,000)
Maximum Concrete Mix, Temperature °F (°C)		95 (35)

The Contractor may submit a mix design using high range water reducing admixtures conforming to Item No. 405S, "Concrete Admixtures" in lieu of the concrete pavement mix specified and shall meet the following requirements:

Table 3: HIGH RANGE WATER REDUCING ADMIXTURES: SUPERPLASTERSIZER CONFORMING TO SPECIFICATION ITEM NO. 405S, "CONCRETE ADMIXTURES"		
Item	**Test**	**Value**
Entrained Air	Tex-416-A	3 to 6 percent
Water-Cement Ratio, gal. (liter)/sack, Maximum		6.25

Sacks Cement, Minimum, 94 pounds (42.6 KG) ea		6 per cubic yard (7.85 per cubic meter)
Coarse Aggregate Factor		0.65 min.—0.85 max.
Slump, inches (cms) before Admixture	Tex-415-A	½ to 2 (1.25 to 5)
Slump, Inches (cms) after Admixture	Tex-415-A	4 to 10 (2.5 to 25)
Compressive Strength, after 3 Days, psi (kPa)	Tex-418-A	3,125 (21,500)
Compressive Strength, after 7 Days, psi (kPa)	Tex-418-A	4,500 (31,000)
Compressive Strength, after 28 Days, psi (kPa)	Tex-418-A	4,925 (34,000)
Maximum Concrete Mix, Temperature, °F (°C)		100 (37.8)
Retarder, Regular Concrete Over 360S.7C, Minutes, Maximum	120	

Table 4: Over Design Required to Meet Compressive Strength Requirements [1]

Number of Tests [2, 3]	Standard Deviation, psi (mPa)				
	300 (20.6)	400 (2.75)	500 (3.44)	600 (4.13)	700 (4.82)
15	470 (3.24)	620 (4.27)	850 (5.85)	1,120 (7.71)	1,390 (9.57)
20	430 (2.96)	580 (3.99)	760 (5.23)	1,010 (6.95)	1,260 (8.67)
30 or more	400 (2.75)	530 (3.65)	670 (4.61)	900 (6.20)	1,130 (7.78)

Notes:

1. When designing the mix, add the tabulated amounts to the minimum design strength in Tables 1, 2 or 3.Maximum water-cement or water-cementitious ratio by weight

2. Number of tests of a concrete mixture used to estimate the standard deviation of a concrete production facility. Test of another mix within 1,000 psi (6.88 MPa) of the specified strength may be used.

3. If less than 15 prior tests are available, the overdesign should be 1,200 psi (8.26 MPa) for specified strengths from 3,000 to 5,000 psi (20.65 to 34.42 MPa) and 1,400 psi (9.64 MPa) for specified strengths greater than 5,000 psi (34.42 MPa).

High range water reducing admixtures shall be capable of maintaining the original slump until placement and screeding, which may be 2 hours, without the addition of water, additional admixture or other retempering or remixing techniques.

C. Workability of Concrete

Concrete shall be uniformly plastic, cohesive and workable. Workable concrete is defined as concrete which can be placed without honeycomb and without voids in the surface of the pavement after the specified finishing machine has been over a given area twice. Workability shall be obtained without producing a condition such that free water appears on the surface of the slab when being finished as specified. Where water appears on the surface of the concrete after finishing and this condition cannot be corrected by reasonable adjustment in the batch design, the bleeding to be immediately corrected by one of the following measures or a combination of two or more of the following listed measures:

1. Redesign of the batch;
2. Addition of mineral filler to fine aggregates;
3. Increase of cement content; or
4. Use of an approved air entraining agent or approved admixture.

In the event that the measures taken do not eliminate the bleeding immediately, concrete placement operations will be suspended, as directed by the Engineer or designated representative, by placing a bulkhead or "header" as indicated and according to applicable requirements for intentional stoppage of placement of concrete under Item No. 360S, "Concrete Pavement" and will remain suspended until such time as additional trial mixes demonstrate that a non-bleeding batch design has been achieved. Failing to achieve a satisfactory laboratory batch design the Contractor will be required to use different materials and to submit samples thereof for additional trial mixes and pilot cylinders.

The mix will be designed with the intention of producing concrete, which will have a slump of 1½ inches (3.8 cms). The slump shall not be less than ½ inch (1.25 cms) nor more than 2 inches (5 cms).

D. Mix Design

The Contractor shall perform at the Contractor's own expense and be responsible for the design of the concrete mix. The mix design shall be prepared and sealed by a person qualified and experienced in such work. Establish proportions on the basis either of laboratory trial batches or of field experience with the materials to be employed.

When ice is used to lower the concrete temperature during hot weather, concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures"), the Contractor shall furnish a mix design (Section 6 of Standard Specification Item No. 403S, "Concrete for Structures") acceptable to the Engineer or designated representative for class of concrete specified. The addition of ice shall not exceed 50 percent of the total mix water weight.

Complete concrete mix design data shall be submitted to the Engineer or designated representative for approval at least 10 days before concrete placement begins. Submittal of the mix shall be accompanied by such test data and certifications as may be necessary to demonstrate compliance

with specification requirements. Approval of this mix design shall in no way relieve the Contractor of responsibility for the quality of the concrete.

It shall also be the responsibility of the Contractor to determine and measure batch quantity of each ingredient, including water, not only for batch designs but for all concrete produced for the project, so that the mix conforms to these specifications.

Trial batches shall be made and tested using all the proposed ingredients prior to the placing of concrete and also when the aggregate and/or type, brand or source of cement or admixture is changed. When the brand and/or source of cement only is changed, the Engineer or designated representative may waive trial batches only if a prior record of satisfactory performance of the cement has been established.

Mix designs used successfully on previous or concurrent jobs may be approved by the Engineer or designated representative without trial batches if it is shown that there is no substantial change in any of the proposed ingredients.

The Contractor shall prepare a minimum of four concrete test cylinders of each mix design, cure and test two each at the age of 7 and 28 days. From these preliminary tests the water-cement ratio required to produce concrete of the specified strength will be selected by the Contractor for approval by the Engineer or designated representative. The Contractor may at any time present in writing a suggested mix design and if the Engineer or designated representative concurs with the suggested design, the Contractor shall conduct trial batches necessary to determine its acceptability under these specification requirements.

The Contractor shall furnish and operate the mixer approved for use on this project unless the concrete is to be furnished from a transit mix (ready-mix) plant. For mixing the concrete to be used in making the preliminary test specimens, a minimum 1 cubic yard (1 cubic meter) batch shall be mixed or a batch of sufficient size to afford proper mixing, whichever is the greater. In lieu of the above mixer and procedure, the Contractor may furnish a portable mixer of sufficient rated capacity to mix a minimum 3-sack batch; in which case, the batch mixed for the preliminary test not to be less than the rated capacity of the mixer furnished. A coating batch will be mixed prior to mixing for test cylinders.

No additional compensation to be allowed for equipment, materials or labor involved in making job mix design test specimens.

After the mix proportions and water-cement ratio required to produce concrete of the specified strength have been determined, placing of the concrete may be started. The strength of the concrete in the completed pavement will be determined by a minimum of four compressive strength test specimens made, cured with a minimum of two each tested at 7 and 28 days as provided in TxDOT Bulletin C-11. Modifications of the mix design may be requested by the Contractor on basis of conformity of the strength of these test specimens with the requirements and intent of this specification.

Changes in the water-cement ratio and the mix design, including an increase in cement factor if necessary, will be made when the average 7 day and/or 28 day compressive strength of the concrete, as indicated by the last 10 compressive strength values obtained from tests of cylinders made from concrete of the same water-cement ratio, departs from the desired minimum average strength by more than 4 percent.

E. Construction Testing

Straightedge surface testing to be carried out as prescribed above.

The Engineer shall take test cylinders for compressive strength values on a random basis. The comparative results shall consist of the average of 2 cylinders each at 7 and 28 days for regular concrete, high early strength concrete and high range water reducing admixture concrete. Tests shall

be made for each 500 square yards constructed, in accordance with TxDOT Bulletin C-11. Additional tests may be taken as determined by the concrete placement conditions or for adequately determining the strength of concrete where the early opening of the pavement to traffic is dependent upon concrete strength tests. No extra compensation will be allowed for materials and work involved in fulfilling these requirements.

360S.6 - Construction Methods

A. Preparation of Subgrade

Where stabilized subbase is not provided, the subgrade shall be excavated as required, all unstable or otherwise objectionable material removed and all holes, ruts and depressions filled with approved material and compacted. Rolling and sprinkling shall be performed when and to the extent required and the roadbed shall be completed to or above the plane of the typical sections, lines and grades indicated or as established by the Engineer or designated representative. The subgrade shall be proof rolled and any soft areas shall be repaired before the forms are placed. In the event that the proof rolled subgrade is exposed to rainfall or other conditions, which may soften the subgrade, corrective measures shall be taken and the subgrade shall be proof rolled again.

The subgrade planer shall be operated from approved forms immediately ahead of paving operations and the subgrade shall be finished to the exact section of the bottom of the pavement as indicated. Where traveling form pavers are used, the subgrade planer shall operate on a prepared track grade or be controlled by electronic sensors operating from a stringline that establishes line and grade. It shall be tested with the approved template, operated and maintained by the Contractor. The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the pavement is placed and shall be kept thoroughly wetted down sufficiently in advance of placing any pavement to insure its being in a firm and moist condition for at least 2 inches (5 cms) below the prepared surface. Sufficient subgrade shall always be prepared in advance to insure satisfactory prosecution of the work.

No equipment or hauling shall be permitted on the prepared subgrade, except by special permission of the Engineer or designated representative, which will be granted only in exceptional cases and only where suitable protection in the form of 2-ply timber mats or other approved material is provided.

B. Placing and Removing Forms

The subgrade under the forms shall be firm and cut true to grade so that each form section when placed will be firmly in contact for its whole length and base width and exactly at the established grade. Any subgrade under the forms below established grade shall be corrected, using suitable material, placed, sprinkled and rolled as directed. Forms shall be staked with at least 3 pins for each 10-foot (3-meter) section. A pin shall be placed at each side of every joint. Form sections shall be tightly joined and keyed to prevent relative displacement. Forms shall be cleaned and oiled each time they are used.

Forms shall be set for a sufficient distance in advance of the point where concrete is being placed to permit a finished and approved subgrade length of not less than 300 feet (90 meters) ahead of the mixer. Conformity of the grade and alignment of forms shall be checked immediately prior to placing concrete and necessary corrections made by the Contractor. Where any form has been disturbed or any subgrade becomes unstable, the form shall be reset and rechecked. In exceptional cases, the Engineer or designated representative may require suitable stakes driven to the grade of the bottom of the forms to afford additional support. Sufficient stability of forms to support the equipment operated and to withstand its vibration without springing or settlement shall be required. If forms settle and/or deflect over 1/8 inch (3 mm) under finishing operations, paving operations shall be stopped and the forms shall be reset to line and grade.

Forms shall be leveled using cement-stabilized material containing not less than 1½ sacks of cement per ton (1 2/3 sacks of cement per MG) of mix as placed. The aggregate gradation and water content shall be determined by the Contractor. The cement-stabilized material shall be sufficiently plastic to insure filling voids underneath the paving forms. Paving equipment will not to be permitted on the forms until the cement-stabilized material has cured for at least 12 hours.

Forms shall remain in place for not less than 8 hours after the concrete has been placed. Forms shall be carefully removed in such a manner that little or no damage will be done to the edge of the pavement. Any damage resulting from this operation shall be immediately repaired. After the forms have been removed, the ends of all joints shall be cleaned and any honeycombed areas pointed up with approved mortar and the surfaces protected with curing material conforming to Item No. 409S, "Membrane Curing."

Immediately after pointing is complete, the form trench, if used, shall be filled with granular material or earth from the shoulders in such manner as to shed water from rainfall and prevent curing material from washing away from the edge of pavement. On completion of the required curing, the subgrade or shoulders adjacent to the pavement shall be placed and compacted in condition to maintain drainage.

360S.7 - Concrete Mixing and Placing

A. Mixing Methods

The concrete shall be mixed in a mixer conforming to the requirements of this item.

B. Mixing

The aggregates, mineral filler if required, cementitious materials and water shall be measured separately, introduced into the mixer and mixed for a period of not less than 50 seconds nor more than 90 seconds, measured from the time the last aggregate enters the drum to the time discharge of the concrete begins. The required water shall be introduced into the mixing drum during the first 15 seconds of mixing. The entire contents of the drum shall be discharged before any materials of the succeeding batch are introduced.

The Engineer or designated representative may increase the minimum mixing time to that necessary to produce thoroughly mixed concrete based on inspection or appropriate uniformity tests. The mixing time may be varied at any time as necessary to produce acceptable concrete.

If a central mixer is used, the concrete shall be discharged into the specified hauling equipment and delivered to the road site. If truck agitators are used, the concrete shall be continuously agitated at not less than 1 nor more than 6 rpm as directed by the Engineer or designated representative.

The maximum size of the concrete batch, absolute volume, shall not exceed 120 percent of the rated size of the mixer (40.8 cubic feet maximum batch for 34 cubic foot paver - 1.2 cubic meter maximum batch for 1 cubic meter paver). Spilling of material from the mixer drum shall be corrected by reducing the size of the batch. Retempering or remixing of concrete will not be permitted.

The initial batch of concrete mixed after each time the mixer is washed out shall be enriched by additional mortar. The additional mortar shall be 1 sack of cement and 3 parts of sand.

When transit-mix (ready-mix) concrete is permitted, the batching plant shall meet the requirements of Item No. 403S, "Concrete for Structures."

C. Placement

Unless otherwise indicated, the concrete may be placed by using forms or by use of a slipform paver. Any concrete not placed as herein prescribed within 30 minutes after mixing shall be rejected and disposed of as directed except as provided otherwise herein. If in the opinion of the Engineer or

designated representative, the temperature, wind and/or humidity conditions are such that the quality of concrete will not be adversely affected, the specified placing time may be extended by a maximum of 45 minutes. Concrete with high range water reducing admixture shall not be placed after the slump has dropped by 3 inches (7.5 cms) or more. Except by specific written authorization of the Engineer or designated representative, concrete shall not be placed when the temperature is below 40°F (4.5°C) and falling but may be placed when the temperature is above 35°F (1.7°C) and rising, the temperature being taken in the shade and away from artificial heat.

When the temperature of the air is above 85°F (29.4°C), an approved retarding agent will be required in concrete. The maximum temperature of all regular concrete placed shall not exceed 95°F (35.0°C), unless otherwise specified.

When concrete is being placed in cold weather, the Contractor shall have available a sufficient supply of an approved covering material to immediately protect concrete if the air temperature falls to 32°F (0°C) or below, before concrete has been placed 4 hours. Such protection shall remain in place during the period the temperature continues below 32°F (0°C) or for a period of not more than 5 days. Neither salt nor other chemical admixtures shall be added to the concrete to prevent freezing. The Contractor shall be responsible for the quality and strength of concrete under cold weather conditions and any concrete damaged by freezing shall be removed and replaced at the Contractor's expense. Concrete shall not be placed before sunrise and shall not be placed later than will permit finishing of the pavement during sufficient natural light.

Concrete shall be placed only on approved subgrade or subbase and unless otherwise indicated on the drawings, the full width of the pavement shall be constructed monolithically. The concrete shall be deposited on the subgrade or subbase in such manner as to require as little rehandling as possible. Where hand spreading is necessary, concrete shall be distributed to the required depth by use of shovels. The use of rakes will not be permitted. Workers will not be permitted to walk in the concrete with any earth or foreign material on their boots or shoes. The placing of concrete shall be rapid and continuous.

When the concrete is to be placed in separate lanes, the junction line shall not deviate from the true line more than ½ inch (1.25 cm) at any point and shall be finished as indicated on the drawings.

The mixer shall not be located on completed pavement, except as herein provided, but may be located on the subgrade of that lane of the pavement being constructed, as provided under "Preparation of Subgrade." When limited space, in the opinion of the Engineer or designated representative, requires operation of the mixer on completed pavement, the mixer may be so operated provided the concrete has attained the minimum average compressive strength required and provided suitable protection to the pavement in the form of 2 ply timber mats or otherwise approved material is provided.

Concrete shall be distributed to such depth that when consolidated and finished, the slab thickness indicated will be obtained at all points and the surface shall not, at any point, be below established grade. Special care shall be exercised in placing and spading concrete against forms and at all joints to prevent the forming of honeycombs and voids.

Concrete for the monolithic curbs shall be the same as for the pavement and if carried back from the paving mixer shall be placed within 20 minutes after being mixed. It may be placed from the separate mixer, if desired, but in any case must be placed while the pavement concrete is still plastic. When sawed joints are used, curbs shall be doweled as indicated and poured after sawing. Curbs doweled on and placed separately may be placed with an extrusion machine.

If a central mixer or batcher is used, the Contractor shall provide a system satisfactory to the Engineer or designated representative for determining that concrete delivered to the road meets the specified requirements for mixing and time of placing.

Unless otherwise indicated, 2 mixers or transit mixers will be required where the double strike off method is employed.

D. Reinforcing Steel and Joint Assemblies

All reinforcing steel, including steel, welded wire fabric reinforcement, tie bars, dowel bars and load transmission devices used in accordance with plan provisions shall be accurately placed and secured in position in accordance with details indicated on the drawings. Reinforcing bars shall be securely wired together at alternate intersections, following a pattern approved by the Engineer or designated representative and at all splices and shall be securely wired to each dowel intersected. When wire fabric is used, it shall replace only the longitudinal and transverse bars and shall be securely wired together at all splices and to each dowel intersected. When welded wire fabric is selected, the Contractor shall pour the lower half of the slab, place the welded wire fabric and place the remaining concrete. Tie bars shall be installed in the required position by the method and device indicated. Bar coating indicated and of material specified, shall be completed and the bars and coating shall be free of dirt or other foreign matter at the time of installation in the concrete.

Tightly adhered scale or rust which resists removal by vigorous wire brushing need not be removed except that excessive loss of section to the reinforcement due to rust shall be cause for rejection. Excessive loss of section shall be defined as loss of section to the extent that the reinforcement will no longer meet the physical requirements for the size and grade of steel specified.

Where indicated on the drawings, an assembly of parts at pavement joints, the assembly shall be completed, placed at required location and elevated and all parts rigidly secured in required position by the method and devices indicated on the drawings. Dowel bars shall be accurately installed in joint assemblies as indicated on the drawings, each parallel to the pavement surface and to the center line of the pavement and shall be rigidly secured in the required position by such means as indicated that will prevent their displacement during placing and finishing of the concrete. Unless specifically authorized by the Engineer or designated representative in writing, the load transmission devices shall be accurately installed in joint assemblies indicated, each unit vertical with its length parallel to the center line of the pavement and all units shall be rigidly secured in required position by such means as indicated that will prevent their displacement during placing and finishing of the concrete. Header boards, joint filler and other material used for forming joints shall be accurately notched to receive each load transmission device. All load transmission devices shall be free of rust and clean when installed in the concrete.

The Contractor has the option of substituting welded wire fabric in place of reinforcement bars. The welded wire fabric selected shall have an area and distribution of steel at least equal to the plan requirements. The Contractor shall submit their proposed design to the Engineer for approval before any material is ordered.

If welded wire fabric is used, the entire width of the bottom layer of concrete shall be struck off to conform to the cross section and elevation indicated on the drawings. The reinforcement shall then be placed immediately upon the concrete, after which the top layer of concrete shall be placed, struck off and screeded. Any portion of the bottom layer of concrete which has been placed more than 15 minutes without being covered with the top layer of concrete shall be removed and replaced with freshly mixed concrete at the Contractor's expense.

E. Joints

1. General

All transverse and longitudinal joints when required in the pavement shall be of the types indicated and shall be at required location, on required alignment, in required relationship to tie bars and joint assemblies and in accordance with details indicated. When no transverse joints are indicated, joints shall not exceed 40 feet (13.1 meters). Such stakes, braces, brackets or other devices shall be used as necessary to keep the entire joint assembly in true vertical and

horizontal position. Where concrete base is overlaid by asphaltic concrete, the joints to be prepared as specified herein, but joint sealing will not be required unless indicated.

If necessary for proper installation of the sealer, excessive spalling of the joint groove shall be repaired to the satisfaction of the Engineer.

Care shall be exercised during the construction of all joints to insure that the concrete sections are completely separated by an open joint or by the joint materials and to insure that the joints will be true to the outline indicated on the drawings. The Contractor shall install joint materials, which will function as a compatible system. Joint sealer shall not be placed where a bond breaker is present.

Green concrete or wet sawed joints are permitted provided the Contractor cleans the joint within 5 minutes after cutting with a 3,000 psi (20.7 mPa) water blast followed by a minimum of 7 day cure and sand blast the saw cut immediately prior to placing joint sealer.

Dry sawed joints are permitted provided the Contractor sand blasts the saw cut immediately prior to placing joint sealer.

2. Expansion Joints

Transverse expansion joints shall be formed perpendicular to the centerline and surface of pavement and shall be constructed in accordance with the sequence of operations indicated on the drawings. After the transverse finishing machine and before the longitudinal finishing machine have passed over the joint, the Contractor shall test the joint filler for correctness of position and make any required adjustment in the position of the filler and shall install the joint seal space form as indicated on the drawings. After removal of the joint seal form as indicated on the drawings, the joint seal space above the joint filler shall be thoroughly sandblasted or machine routed to remove all projecting concrete, laitance, dirt or foreign matter. The concrete faces of the joint seal space shall be left true to line and section throughout the entire length of the joint. On completion of curing of the pavement, the joint sealing filler of the type specified shall be placed as indicated. The faces of the joint seal space shall be clean and surface dry at the time joint sealing filler is placed. On completion of the joint seal, the pavement adjacent to the joint shall be left free of joint sealing material. The joint seal space shall be exactly above and not narrower than the joint filler with no concrete overhangings.

3. Weakened Plane Joints

Weakened plane joints shall consist of transverse contraction joints and longitudinal joints and shall be formed or sawed as indicated on the drawings. When the joints are sawed, the saw shall be power driven, shall be manufactured especially for the purpose of sawing concrete and shall be capable of performing the work. Saw blades shall be as indicated. Tracks adequately anchored, the chalk, string line or other approved methods shall be used to provide true alignment of the joints. The concrete saw shall be maintained in good operating condition and the Contractor shall keep a standby power saw on the project at all times when concrete operations are under way.

If membrane curing is used, the portion of the seal, which has been disturbed by sawing operations, shall be restored by the Contractor by spraying the areas with additional curing seal.

Forming, finishing and sealing of the joint seal space shall conform to this item, described above and details indicated on the drawings.

4. Contraction Joints

Transverse contraction joints shall be formed or sawed joints perpendicular to the centerline and surface of the pavement and shall be constructed by the method and in the sequence of operations as indicated. Where sawed joints are used, contraction joints at intervals indicated

shall be sawed as soon as sawing can be accomplished without damage to the pavement and before 24 hours after the concrete has been placed, the exact time to be approved by the Engineer or designated representative. The remaining contraction joints shall be sawed in a uniform pattern as directed by the Engineer or designated representative and they shall be completed before uncontrolled cracking of the pavement takes place. All joints shall be completed before placing concrete in succeeding lanes and before permitting traffic to use the pavement.

5. Longitudinal Joints

Longitudinal joints shall be of the type or alternate types indicated and shall be constructed of specified materials in accordance with provisions indicated on the drawings. Longitudinal joints shall be constructed accurately to required lines, shall be perpendicular to the pavement surface at the joint and the pavement surface over and adjacent to the joint shall be finished as specified on the drawings.

Longitudinal joints shall be sawed as soon as sawing can be accomplished without damage to the pavement. Sawing shall not cause damage to the pavement and the groove shall be cut with a minimum of spalling. No traffic (including construction traffic) shall be permitted on pavement until the longitudinal joint is cut.

6. Construction Joints

Intentional stoppage of the placing of the concrete shall be at either an expansion joint or at a weakened plane joint. The following provisions shall govern for each type of joint at which the placing of concrete is stopped:

a) When the placing of concrete is stopped at an expansion joint, the complete joint assembly shall be installed and rigidly secured in required position as indicated. A bulkhead of sufficient cross sectional area to prevent deflection, accurately notched to receive the load transmission devices or dowels, as the case may be, and shaped accurately to the cross section of the pavement shall be provided and installed as a back-up for the joint filler and rigidly secured in required position to permit accurate finishing of the concrete up to the joint. After the concrete has been finished to the joint, formation of the joint seal space and finishing of the joint shall be executed as specified herein and as indicated. The backup bulkhead shall remain in place until immediately prior to the time when concrete placement is resumed, then it shall be carefully removed in such manner that no element of the joint assembly will be disturbed. The exposed portion of the joint assembly shall be free of adherent concrete, dirt or other material at the time placing of concrete is resumed.

b) When placing of concrete is stopped at a weakened plane joint, all applicable provisions of paragraph (a) above shall apply in addition to the following requirement:

The face of the bulkhead adjoining the slab end shall be notched and grooved to fit the exposed half section of the joint assembly and shall be shaped to form the slab end at the center of the joint as indicated on the drawings. The ½ width of joint seal space may be formed by a strip of required section placed and removed as indicated for construction of transverse contraction joints. The Contractor shall have available a bulkhead shaped to section of the pavement. This bulkhead must be drilled to permit the continuation of all longitudinal reinforcing steel through the construction joint and shall be of sufficient section and strength to prevent deflection.

c) When load transmission devices are not provided in the design, intentional stopping of placement of concrete shall occur in the middle of a slab. Provisions shall be made to provide a bulkhead, which will accommodate tie bars of the same length, size and spacing as tie bars used for the longitudinal joints. When the concrete placement is resumed, the bulkhead shall be removed without bending tie bars or damaging the concrete. The joint seal space and sealer shall be the same as for longitudinal joints.

Immediately upon the unintended stoppage of the placing of concrete, the Contractor shall place the available concrete to a line and install the above-described bulkhead at right angles to the centerline of the pavement, perpendicular to the surface and at the required elevation. Concrete shall be placed and finished to this bulkhead. Any concrete remaining on the subgrade ahead shall be removed and disposed of as directed by the Engineer or designated representative. When placing of concrete is resumed before the concrete has set to the extent that the concrete will stand on removal of the bulkhead, the new concrete shall be rodded with the first. An edge created by a construction joint of this type shall have a joint seal space and shall be sealed as required for contraction joints.

F. Joint Sealers

1. Class 2 Material

This material shall conform to Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)".

For placement in vertical joints (curb faces, etc.) either of the following procedures may be used.

a) An amount of the mixed material may be set aside until partial curing has taken place and carefully trowelled into the joint with a suitable tool.

b) The portion of the joint in the roadway shall be poured and cured. The vertical curb faces shall then be taped or formed and the material poured into the vertical joint from the top.

2. Class 5 Material

This material together with backer rods shall be applied as indicated in accordance with manufacturer's recommendations.

G. Asphalt Board

Premolded materials, wherever used, shall be anchored to the concrete on one side of the joint by means of copper wire or nails not lighter than No. 12 B and S gage. Such anchorage shall be sufficient to overcome the tendency of the material to fall out of the joint. The Contractor shall not contaminate joints to receive Class 5 Joint Material with asphalt from the asphalt board.

H. Curbs

The curb shall be constructed in lengths equal to the adjoining pavement slab lengths and expansion joints shall be provided in the curb opposite each transverse expansion joint in the pavement. Expansion joint material shall be of the same thickness, type and quality as indicated for the pavement and shall be of the section as indicated for the curb. All expansion joints shall be carried through the curb, sidewalk and retaining walls when these items are indicated.

When sawed joints are provided for the pavement, the curb placement shall be delayed until all transverse joints have been sawed. To provide bond for the curb, dowel bars shall be placed as indicated on the drawings, while the pavement concrete is still plastic.

Weakened plane joints shall be formed in monolithic curbs at a spacing to coincide with the joints in the concrete pavement. The joints shall be formed by inserting in the curb an asphaltic board strip cut to conform to the shape of the curb. When the concrete is sufficiently set, the joint on the top and face of curb shall be grooved with an approved type of grooving tool.

A finish coat of mortar shall be applied on the exposed surfaces of the monolithic curbs. The mortar shall be composed of 1 part of Portland Cement and 2 parts of fine aggregate. A mortar coat will not be required for extruded curbs.

The curb face, lower radius and top of curb shall be plastered with the sand-cement mortar. The mortar shall be applied with a template or "mule" made to conform to the curb dimensions as indicated. All exposed surfaces of the curb shall be finished with a steel trowel and brushed to a smooth and uniform surface. The mortar finish as required shall be included in the unit price bid for this item.

I. Machine Finishing

All concrete pavement shall be finished mechanically with approved self-propelled machines, except as herein provided. Hand finishing will be permitted on the transition from a crowned section to a superelevated section without crown on curves, on straight line superelevation sections less than 300 feet (91.4 meters) in length, on that portion of a widened pavement outside normal pavement width and on sections where the pavement width is not uniform, isolated, narrow in width or required monolithic widths are greater than that of available finishing machines.

Machine finishing of pavement shall include the use of power-driven vibrators, power-driven transverse strike off and screed or such alternate equipment as may be substituted and approved under this item.

All concrete pavement shall be consolidated by a mechanical vibrator. As soon as concrete has been spread between the forms, the approved mechanical vibrator shall be operated to consolidate the concrete and remove all voids. Hand manipulated vibrators shall be used for areas not covered by the mechanical vibratory unit.

The transverse finishing machine shall first be operated to compact and finish pavement to the required section and grade, without surface voids. The machine shall be operated over each area as many times and at such intervals as directed. At least 2 trips will be required and the last trip over a given area shall be a continuous run of not less than 40 feet (12.2 meters). After completion of finishing with the transverse finishing machine, a transverse drag float may be used.

The consistency of the concrete as placed should allow completion of finishing operations without the addition of water to the surface. When field conditions are such that additional moisture is needed for the final concrete surface finishing operation, the required water shall be applied to surface by fog spray only and shall be held to a minimum.

After finishing is complete and the concrete still workable, the surface shall be tested by the Contractor for trueness with an approved 10 foot (3.05 meter) straightedge. The straightedge shall be operated from the side of the pavement, placed parallel to the pavement centerline and passed across the slab to reveal any high spots or depressions. The straightedge shall be advanced along the pavement in successive stages of not more than ½ its length. Practically perfect contact of the straightedge with the surface will be required and the pavement shall be leveled to this condition, in order to insure conformity with the surface test required below after the pavement has fully hardened. Any correction of the surface required shall be accomplished by adding concrete if required and by operating the longitudinal float over the area. The surface test with the straightedge shall then be repeated.

For one lane pavement placement and uniform widening, the equipment for machine finishing of concrete pavement shall be as directed by the Engineer or designated representative but shall not exceed requirements of these specifications.

After completion of the straightedge operation, as soon as construction operations permit, texture shall be applied with 1/8 inch (3 mm) wide metal tines with clear spacing between the tines being not less than ¼ inch (6.3 mm) nor more than ½ inch (12.7 mm).

If approved by the Engineer or designated representative, other equipment and methods may be used, provided that a surface texture meeting the specified requirements is obtained. The texture shall be applied transversely. It is the intent that the average depth resulting from the number of tests

directed by the Engineer or designated representative be not less than 0.060 inch (1.52 mm) with a minimum texture depth of 0.050 inch (1.27 mm) for any one test when tested in accordance with TxDOT Test Method Tex-436-A. Should the texture depth fall below that intended, the finishing procedures shall be revised to produce the desired texture.

1. Emergency Procedures

The Contractor shall have available at all times hand rakes with tines for the purpose of providing textures in the event of equipment breakdown.

The Contractor also shall have available a conventional garden spray type can containing a commercially available monomolecular film compound. This shall be applied in the case of equipment breakdown or other emergencies to prevent the pavement from drying too rapidly. The use of this product will give the Contractor additional time to provide adequate texturing.

After completion of texturing and about the time the concrete becomes hard, the edge of the slab and joints shall be carefully finished with an edger and the pavement shall be left smooth and true to line.

J. Hand Finishing

Hand finishing shall be resorted to only in those conditions provided for above and upon specific authorization by the Engineer or designated representative. When hand finishing is permitted, concrete shall be struck off with an approved strike off screed to such elevation that when consolidated and finished the surface of the pavement to conform to the required section and grade. The strike template shall be moved forward with a combined transverse and longitudinal motion in the direction work is progressing, maintaining the template in contact with the forms and maintaining a slight excess of material in front of the cutting edge. The Concrete shall then be tamped with an approved tamping template to compact the concrete thoroughly and eliminate surface voids and the surface screed to required section.

After completion of a strike off, consolidation and transverse screeding, a hand-operated longitudinal float shall be operated to test and level the surface to the required grade.

Workers shall operate the float from approved bridges riding on the forms and spanning the pavement. The longitudinal float shall be held in contact with the surface and parallel to the centerline and operated with short longitudinal strokes while being passed from one side of the pavement to the other. If contact with the pavement is not made at all points, additional concrete shall be placed, if required and screed and the float shall be used to produce a satisfactory surface. Care shall be exercised to keep the ends of the float from digging into the surface of the pavement. After a section has been smoothed so that the float maintains contact with the surface at all points in being passed from one side to the other, the bridges may be moved forward half the length of the float and the operations repeated.

Other operations and surface tests shall be as required for machine finishing.

K. Surface Testing

After the concrete has been placed 12 hours or more, the Engineer or designated representative will test the surface of the pavement with a 10-foot (3.05 meter) straightedge placed parallel to the centerline. Unless specified otherwise, the surface shall not vary from the straightedge by more than 1/16 inch per foot (5 mm per meter) from the nearest point of contact and in no case shall the maximum ordinate from a straightedge to the pavement be greater than 1/8 inch (3 mm). Any high spots causing a departure from the straightedge in excess of that specified shall be ground down by the Contractor to meet the surface test requirements. Where the texture of the pavement is removed by extensive grinding, the texture shall be restored by grooving the concrete to meet the surface finishing specifications.

L. Curing

All concrete pavement shall be cured by protecting it against loss of moisture for a period of not less than 72 hours from the beginning of the curing operations. Immediately after finishing operations have been completed, the entire surface of the newly laid concrete shall be covered and cured in accordance with the requirements specified for whichever of the following methods the Contractor may elect. Newly laid concrete base to be overlaid by asphaltic concrete shall not be cured by "Membrane Curing" and surfaces not to be overlaid by asphaltic concrete shall not be cured by "Asphalt Curing." In all cases in which curing requires the use of water, the curing shall have prior right to water supply or supplies. Failure to provide sufficient cover material of the type the Contractor elects to use, failure to maintain saturation in wet curing methods, lack of water to adequately take care of both curing and other requirements or other failures to comply with curing requirements shall be cause for immediate suspension of concreting operations. The covering material used in curing shall be removed as necessary to saw joints or to comply with the requirements for "Surface Test." The concrete surface shall be maintained wet with a water spray if indicated and the covering material replaced immediately on completion of sawing and testing and any required surface correction.

1. Waterproofed Paper Curing

Immediately after the finishing of the surface has been completed and the concrete has taken its initial set, it shall be wetted with water applied in the form of a fine spray and covered with waterproofed paper so placed and weighted as to cause it to remain in intimate contact with the surface. Waterproofed paper used for the curing of concrete pavement shall be of a type and quality approved by the Engineer. It shall be sufficiently strong and tough to permit its use under the conditions existing on street paving work without being torn or otherwise rendered unfit for the purpose during the curing period. The paper covering shall be maintained in place continuously for not less than the specified curing period.

The waterproofed paper shall be prepared to form blankets of sufficient width to cover the entire surface and both edges of the pavement slab and such blankets shall not be more than 60 feet in length. All joints in the blankets occasioned by joining paper sheets shall lap not less than 5 inches (12.7 cms) and shall be securely sealed with asphalt cement having a melting point of approximately 180°F (82.2°C). Blankets shall be placed to secure an overlap of at least 12 inches (30.5 cms) and this lap securely weighted to form a closed joint.

The waterproofed paper blankets shall be adequately weighted to prevent displacement or billowing due to wind and the paper folded down over the side of the pavement shall be secured by a continuous bank of earth. Plowing of this windrow into place will not be permitted.

All tears or holes appearing in the paper during the curing period shall be immediately repaired by cementing patches over such defects. It shall be the Contractor's responsibility to prevent damage to paper blankets, which would affect their serviceability and effectiveness as a concrete curing method. Blankets may be rejected by the Engineer or designated representative at any time if it appears they do not provide an airtight covering.

Paper blankets rejected on account of pinholes or minor tears may be continued in service by folding the blanket over lengthwise, first thoroughly spraying ½ the blanket with the asphalt cement used for seams. The 2 thicknesses shall be firmly pressed together and well cemented. Blankets shall be of a width sufficient to cover the pavement surface and both edges. Doubled blankets may be rejected for the same cause as provided for single blankets. All paper blankets rejected by the Engineer shall be immediately marked by the Contractor for identification and then destroyed or stored entirely separate from approved blankets.

No walking on paper shall be permitted at any time and, in locations where pedestrian traffic cannot be entirely controlled, the Contractor shall provide walkways and barricades or shall substitute other permissible curing methods on such sections of pavement.

2. Polyethylene Film Curing

Immediately after the finishing of the surface has been completed and the concrete has taken its initial set, it shall be wetted with water applied in the form of a fine spray and covered with the polyethylene film so placed and weighted as to cause it to remain in intimate contact with the surface. The polyethylene film covering shall be maintained in place continuously for not less than the specified curing period.

The film shall be prepared to form blankets of sufficient width to cover the entire surface and both edges of the pavement slab. All joints in the blankets occasioned by joining film sheets shall lap not less than 12 inches (30.5 cms). All joints shall be sealed in a manner acceptable to the Engineer or designated representative to provide a moisture-proof lap.

The polyethylene film blankets shall be adequately weighted to prevent displacement or billowing due to wind and the film folded down over the side of the pavement shall be secured by a continuous bank of earth. Plowing of this windrow into place not to be permitted.

All tears or holes appearing in the polyethylene film during the curing period shall be immediately repaired by placing acceptable moisture proof patches over such defects or by replacing the blankets. It shall be the Contractor's responsibility to prevent damage to the film blankets, which would affect their serviceability and effectiveness as a concrete curing method. Blankets may be rejected by the Engineer at any time if it appears they do not provide an airtight covering.

Polyethylene film blankets rejected on account of pinholes or minor tears may be continued in service when repaired to an airtight condition. All polyethylene film blankets rejected by the Engineer or designated representative shall be immediately marked by the Contractor for identification and then destroyed or stored entirely separate from approved blankets.

Should the film blanket be damaged or torn for any cause during the first 72 hours of the curing period such damage shall be repaired immediately.

3. Membrane Curing

Immediately after the finishing of pavement has been completed and after the free surface moisture has disappeared, the pavement shall be sprayed uniformly with a curing compound. Membrane curing shall conform to Standard Specification Item No. 409S, "Membrane Curing," Type 2 white pigmented. Should the film of compound be damaged from any cause before the expiration of 72 hours after original application, the damaged portions shall be repaired with additional compound. Unless otherwise indicated on the drawings, membrane curing shall be used when the concrete (except that concrete to be used as a base) is placed with a slip form paver.

4. Asphalt Curing

Where emulsified asphalt is used for curing concrete base, the material shall conform to Item No. 301S, "Asphalts, Oils and Emulsions," for the type and grade shown on the drawings. The rate of application may vary between the limits of 1 gallon per 180 square feet and 1 gallon per 90 square feet (1 liter per 4.4 square meters and 1 liter per 2.2 square meters). The rate of application will be determined by the Engineer or designated representative, after observation of sections where amounts varying between the above limits have been applied. If it is found necessary to add water to the emulsion for the proper distribution through the spray, this may be done upon approval of the Engineer or designated representative. When the emulsion is diluted with water the amount of the applied mixture shall be increased to give a coverage of the original emulsion between the limits as set out herein. Care shall be taken to properly mix the emulsion and water and to keep the mixture well agitated during application.

M. Protection of Pavement

The Contractor shall erect and maintain the barricades indicated on the drawings and such other standard and approved devices as will exclude public traffic and traffic of the Contractor's employees and agents from the newly placed pavement for a minimum of 14 days. Portions of the roadway or crossings of the roadbed required to be maintained open for use by traffic shall not be obstructed by above required barricades. Crossings of the pavement indicated on the drawings or by construction sequence, during the period prior to opening to traffic as herein indicated, shall be provided with an adequate and substantial bridge approved by the Engineer or designated representative.

Curb shall be backfilled to the full height of the concrete, tamped and sloped as indicated on the drawings or as directed by the Engineer. The top 4 inches (10 cms) of backfill shall be of clean, friable soil capable of supporting plant life. This material shall also be free of stones and all other debris.

N. Opening Pavement to Traffic

The pavement shall be closed to traffic, including vehicles of the Contractor, until the concrete is at least 14 days old and has attained an average compressive strength acceptable to the Engineer or designated representative. This period of closure to traffic may be extended if, in the opinion of the Engineer or designated representative, weather or other conditions make it advisable to provide an extension of the time of protection.

At the end of the 14 day period and as long thereafter as ordered by the Engineer or designated representative and if so desired by the Contractor, the pavement may be opened for use by vehicles of the Contractor provided the gross weight (vehicle plus load) of such vehicles does not exceed 14,000 pounds (6,350 KGs). Such opening, however, shall in no manner relieve the Contractor from responsibility for the Contractor's work. On those sections of the pavement thus opened to traffic, all joints shall first be sealed, the pavement cleaned and topsoil placed against the pavement edges or behind the curb where turf or vegetation is to be established before permitting vehicles thereon.

After the concrete in any section is 14 days old or as long thereafter as ordered by the Engineer, such section of pavement may be opened to all traffic indicated on the drawings or when so directed by the Engineer or designated representative. On those sections of the pavement thus opened to traffic, all joints shall first be sealed, the pavement cleaned and 4 inches (10 cms) of top soil placed against the pavement edges and all other work performed as required for the safety of traffic. Such opening, however, shall in no manner relieve the Contractor from responsibility for the Contractor's work performed.

When High Early Strength Concrete, resulting from the use of Type III cement as indicated on the drawings is used, the pavement may be opened to all traffic after the concrete is 7 days old or as long thereafter as ordered by the Engineer or designated representative, subject to the same provisions governing the opening after 14 days as above indicated.

Where the Contractor desires to move any equipment not licensed for operation on public streets, on or across any pavement opened to traffic, the Contractor shall protect the pavement from damage by means of 2 ply timber mats of 2 inch (5 cm) stock or runways of heavier material laid on a layer of earth, all as approved by the Engineer or designated representative.

1. Emergency Opening to Traffic

The Engineer or designated representative may require the opening of pavement to traffic prior to the minimum time specified above under conditions of emergency, which in the Engineer's or designated representative's opinion require such action in the interest of the public. In no case will the Engineer or designated representative order opening of the pavement to traffic within less than 72 hours after the last concrete in the section is placed. The Contractor shall remove all obstructing materials, place earth against pavement edges and perform other work involved in providing for the safety of traffic as required by the Engineer or designated representative in

ordering emergency opening. Orders for emergency opening of the pavement to traffic will be issued by the Engineer or designated representative in writing.

360S.8 - Penalty for Deficient Pavement Thickness or Strength

The adjustment in unit prices provided for in this item will apply only when measurement for payment is by the square yard.

It is the intent of this specification that the pavement be constructed in strict conformity with the thickness, strength and typical sections indicated on the drawings. Where any pavement is found not so constructed, the following rules relative to adjustment of payment for acceptable pavement and to replacement of faulty pavement shall govern.

A. Pavement

The pavement will be core drilled after any grinding operations have been completed for surface corrections prior to final acceptance. Locations of core tests may be selected by the Engineer or designated representative; however, spacing interval for core tests, as specified herein, shall be maintained. The thickness of the pavement will be determined by measurement of the cores in accordance with TxDOT Test Method Tex-424-A.

For the purpose of establishing an adjusted unit price for pavement, units to be considered separately are defined as 1,000 linear feet of pavement in each traffic lane starting at the end of the pavement bearing the smaller station number. The last unit in each lane shall be 1,000 feet plus the fractional part of 1,000 feet remaining. Traffic lane width will be as shown on typical sections and pavement design standards.

For the purpose of establishing an adjusted unit price for ramps, widening, acceleration and deceleration lanes that are machine placed, isolated pavements of traffic lane width but less than 1,000 feet in length and other areas designated by the Engineer or designated representative, units will be considered separately and are defined as 1,000 square yards of pavement or fraction thereof.

One core will be taken at the location selected by the Engineer or designated representative or at random in each unit. When the measurement of the core from any unit is not deficient more than 0.2 inches from the plan thickness, full payment will be made. When the measurement of the core from any unit is deficient more than 0.2 inch but not more than 0.75 inch from the plan thickness, 2 additional cores will be taken from the unit and the average of the 3 cores determined. The 2 additional cores from any 1,000-foot unit will be taken at intervals of not less than 300 feet. The 2 additional cores from any 1,000 square yard unit will be taken at locations such that the pavement in the unit will be well represented. If the average measurement of these 3 cores is not deficient more than 0.2 inches from the plan thickness, full payment will be made. If the average thickness of the 3 cores is deficient by more than 0.2 inch but not more than 0.75 inch from the indicated thickness, an adjusted unit price as provided below will be paid for the areas represented by these cores.

In calculating the average thickness of the pavement, measurements which are in excess of the specified thickness by more than 0.2 inch will be considered as the specified thickness plus 0.2 inch and measurements which are less than the specified thickness by more than 0.75 inch will be considered as the specified thickness less 0.75 inch.

When the measurement of any core is less than the specified thickness by more than 0.75 inch, the actual thickness of pavement in this area will be determined by taking additional cores at 10 foot intervals parallel to the center line in each direction from the deficient core until, in each direction, a core is taken which is not deficient by more than 0.75 inch. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine the length of pavement in a unit that is to be left in place without pay and/or removed and replaced as provided herein.

For new Concrete Pavement roadways, and for Concrete Pavement rehabilitation and overlay projects, if cracks develop in the pavement surface within the one year warranty period, the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)", or perform other corrective measures as directed by the Engineer. Payment for this work will be considered subsidiary to Concrete Pavement, unless included as a separate pay item in the Contract.

For new Concrete Pavement roadways, and for Concrete Pavement rehabilitation and overlay projects, if cracks develop in the pavement surface within the one year warranty period, the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)", or perform other corrective measures as directed by the Engineer. Payment for this work will be included in the unit price bid for Concrete Pavement, unless included as a separate pay item in the Contract.

Irrespective of an acceptable overall project average for any or all of the Pay-Adjustment Acceptance Factors, limited substandard portions of the work, as determined by the Engineer or designated representative, shall be remedied or removed and replaced to the satisfaction thereof.

B. Price Adjustments

After any grinding or milling operations have been completed to meet the surface-testing requirement of this specification, if average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than 0.75 inch, payment will be made at an adjusted price as specified in the following table:

Concrete Pavement Deficiency	
Deficiency in Thickness Determined by Cores, Inches	**Proportional Part of Contract Price Allowed**
0.00 to 0.20	100 percent
0.21 to 0.30	80 percent
0.31 to 0.40	72 percent
0.41 to 0.50	68 percent
0.51 to 0.75	57 percent

Any area of pavement found deficient in thickness by more than 0.75 inch but not more than 1 inch or 1/8 of the indicated thickness, whichever is greater, shall be evaluated by the Engineer. If, in the judgment of the Engineer, the area of such deficiency should not be removed and replaced, there will be no payment for the area retained. If, in the judgment of the Engineer, the area of such deficiency warrants removal, the area shall be removed and replaced at the Contractor's entire expense, with concrete of the thickness indicated on the drawings.

Any area of pavement found deficient in thickness by more than 1 inch or more than 1/8 of the indicated thickness, whichever is greater, shall be removed and replaced, at the Contractor's entire expense, with concrete of the thickness indicated on the drawings.

No additional payment over the Contract unit price will be made for any pavement of a thickness exceeding that indicated on the drawings.

If the average compressive strength based on concrete test cylinders at 28 days is less than the specified minimum strength of the concrete, then payment will be made at an adjusted price as specified in the following table.

Pay Adjustment Factor for Deficient Compressive Strength	
Ratio of Average Strength from Test Cylinders to Specified Minimum Compressive Strength both at 28 Days	Proportional Part of Contract Price Allowed
More then 0.95	100 percent
0.90 to 0.95	85 percent
0.85 to 0.90	70 percent
0.80 to 0.85	60 percent
Less than 0.80	0 percent (Remove & Replace)

When, in the opinion of the Engineer or designated representative, the compressive strength test results appear unrepresentative, additional testing of field cores may be authorized. To be considered acceptable for consideration the field cores shall be acquired, properly handled and tested in accordance with ASTM C 42/C 42M, "Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete" within 45 days of the original concrete placement date. The retesting will be at the expense of the Contractor and the results of the retesting shall be averaged with the results of the original testing. If the results of retesting indicate that the original test results were erroneous in the opinion of the Engineer or designated representative, the original test results will be discarded. In the instance of erroneous original test results the subsequent first set of retests will be at the expense of the City of Austin.

When, in the opinion of the Engineer or designated representative, the concrete compressive strength is deemed unacceptable for the intended use of the pavement, the concrete shall be removed and replaced to the limits indicated by test results.

360S.9 - Measurement

A. When indicated, concrete pavement will be measured by the square yard of surface area of completed and accepted work. The surface area shall be so measured to also include that portion of pavement slab extending beneath the curb. When concrete pavement is to be measured by the square yard and monolithic curb is required, measurements for "Monolithic Curb" will be by the linear foot complete in place.

B. When indicated on the drawings, concrete pavement, including monolithic curb when required, will be measured by the cubic yard of absolute volume of materials entering the mixture.

360S.10 - Payment

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Pavement," of the depth indicated on the drawings, "Concrete Pavement (High Early Strength)" of the depth indicated on the drawings and "Monolithic Curb" of the type indicated on the drawings (when pavement is measured by the square yard), as required or adjusted unit price for pavement of deficient thickness as provided under "Deficient Pavement Thickness", which price shall be full compensation for shaping and fine grading the roadbed, including furnishing and applying all water required; for furnishing, loading and unloading, storing, hauling and handling all concrete ingredients, including all freight and royalty involved; for placing and adjusting forms, including supporting material or preparing track grade; for mixing, placing, finishing, sawing, cleaning and sealing joints and curing all concrete; for furnishing and installing all reinforcing steel; for furnishing all materials for sealing joints and placing longitudinal, expansion and weakened plane joints, including all steel dowel caps and load transmission devices required and wire and devices for placing, holding and supporting steel bars, load transmission devices and joint filler material in proper position, for coating steel bars where complete the work.

Excavation required by this item in the preparation of the subgrade and for completion of the parkway will be measured and paid for in accordance with provisions governing the Items of "Street Excavation" and "Borrow," respectively, with provision that yardage to be measured and paid for once only, regardless of manipulations involved. Measurement of subgrade excavation for payment shall be limited to a total width of that of pavement plus 1 foot on each side.

Sprinkling and rolling required for the compaction of the rough subgrade in advance of fine grading will be measured and paid for as indicated in the governing items of excavation. Maintenance of a moist condition of the subgrade in advance of fine grading and concrete placing will not be paid for directly but shall be included in the unit price bid, as provided above.

Payment will be made under one of the following:

Pay Item No. 360S-A:	In. Concrete Pavement	Per Square Yard.
Pay Item No. 360S-AH:	In. Concrete Pavement (High Early Strength)	Per Square Yard.
Pay Item No. 360S-AS:	In. Concrete Pavement (High Range Water Reducing Admixture)	Per Square Yard.
Pay Item No. 360S-B:	Monolithic Curb	Per Linear Foot.
Pay Item No. 360S-C:	Concrete Pavement Including Monolithic Curb	Per Cubic Yard.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 360S, "Concrete Pavement"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 313S	Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)
Item No. 403S	Concrete for Structures
Item No. 405S	Concrete Admixtures
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finishes for Concrete
Item No. 413S	Cleaning and/or Sealing Joints and Cracks (PCC)
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM C 42/C 42M	Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete"
ASTM A 82	Specification for Steel Wire, Plain, for Concrete Reinforcement
ASTM A 184	Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A 185	Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 496	Specification for Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615	Specification for Deformed and Plain Billet-Steel Bars, for Concrete Reinforcement
ASTM A 616	Specification Rail-Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM C 94	Specification for Ready-Mixed Concrete
ASTM C 150	Specification for Portland Cement
ASTM C 156	Test Method for Water Retention by Concrete Curing Materials
ASTM D 2240	Test Method for Rubber Property-Durameter Hardness
ASTM D 882, Method A	Test Methods for Tensile Properties of Thin Plastic Sheeting
Texas Department of Transportation: Publications	
Designation	Description
Bulletin C-11	Construction Bulletin
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
TEX-203-F	Sand Equivalent Test
TEX-401-A	Sieve Analysis of Fine and Coarse Aggregate
TEX-406-A	Mineral Finer than 75 µm (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
TEX-408-A	Organic Impurities in Fine Aggregate for Concrete

TEX-410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
TEX-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
TEX-413-A	Determination of Deleterious Materials in Mineral Aggregate
TEX-415-A	Slump of Portland Cement Concrete
TEX-416-A	Air Content of Freshly-Mixed Concrete by the Pressure Method
Tex-418-A	Compressive Strength of Cylindrical Concrete
Tex-424-A	Obtaining and Testing Drilled Cores of Concrete
Tex-436-A	Measurement of Texture Depth by the Sand Patch Method
Tex-524-C	Testing Premolded Joint Filler for Concrete
Tex-612	Acid Insoluble Residue
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS 8900	Fly Ash
American Association of State Highway & Transportation Officials, AASHTO Standard	
Designation	Description
Method T 26	Quality of Water to be Used in Concrete

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 360S, "Concrete Pavement"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Hydraulic Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 520	Weighing and Measuring Equipment
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants"
DMS-6100	Epoxy and Adhesives
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM C 685	Concrete Made By Volumetric Batching and Continuous Mixing
ASTM C-1260	Standard Test Method for Potential Alkali Reactivity of Aggregates
ASTM D-512	Test Methods for Chloride Ion in Water

ASTM D-516	Test Methods for Sulfate Ion in Water
ASTM D-4191	Test Method for Sodium in Water by Atomic Absorption
ASTM D-4192	Test Method for Potassium Water by Atomic Absorption

American Concrete Institute, ACI

Designation	Description
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
TEX-418-A	Compressive Strength of Cylindrical Concrete Specimens

End

ITEM NO. 403S - CONCRETE FOR STRUCTURES 9-26-12

403S.1 - Description

This item shall govern quality, storage, handling, proportioning and mixing of materials for hydraulic cement concrete construction of buildings, bridges, culverts, slabs, prestressed concrete and incidental appurtenances.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

403S.2 - Submittals

The submittal requirements of this specification item may include:

A. Mix design option(s) of the class of concrete required on the project,

B. The supplier of the concrete mix design(s) and type of mixing equipment, and

C. Type of admixtures to be used with the concrete mixes.

403S.3 - Materials

Concrete shall be composed of hydraulic cement or hydraulic cement and supplementary cementing materials, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

A. Cementitious Materials

Hydraulic cement shall conform to ASTM C 150, Type I (General Purpose), Type II (General Purpose with Moderate Sulfate Resistance) and Type III (High Early Strength). Type I shall be used when none is specified or indicated on the drawings. Type I and Type III cements shall not be used when a Type II cement is specified or indicated on the drawings. Type III cement may be used in lieu of a Type I cement, when the anticipated air temperature for the succeeding 12 hours will not exceed 60°F (15.6°C). A Type III cement shall only be used in precast concrete or when otherwise specified or allowed. All cement shall be of the same type and from the same source for a monolithic placement.

Unless otherwise specified the cementitious material content shall be limited to no more than 700 lbs. per cubic yard (417 kg per cubic meter). When supplementary cementing materials are used, cement is defined as "cement plus supplementary cementing material." Supplementary cementing materials include fly ash (DMS 4610), ultra-fine fly ash (DMS-4610), ground granulated blast furnace slag grade 100 or 120 (DMS-4620), silica fume (DMS-4630) and metakaolin (DMS-4635).

Supplementary cementing materials shall not be used when white hydraulic cement is specified.

Class C flyash shall not be used in sulfate-resistant concrete.

Hydraulic cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

When sulfate-resistant concrete is required for a project, mix design options 1, 2, 3 or 4 presented in Section 403S.8, "Mix Design Options" shall be used to develop appropriate mix design utilizing Type I/II, II, V, IP or IS cement.

B. Mixing Water

Water for use in concrete and for curing shall be potable water free of oils, acids, organic matter or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl or sulfates as SO4.

Water from the City of Austin will not require testing. Contractor may request approval of water from other sources. Contractor shall arrange for samples to be taken from the source and tested at the Contractor's expense. When water from other sources is proposed, test reports shall be provided that indicates compliance with Table 1 before use.

Table 1: Chemical Limits for Mix Water

Contaminant	Test Method	Maximum Concentration (ppm)
Chloride (CL) Prestressed concrete Bridge decks & superstructure All other concrete	ASTM D-512	 500 500 1,000
Sulfate (SO_4)	ASTM D-516	1,000
Alkalies ($NA_2O + 0.658\ K_2O$)	ASTM D-4191 & D-4192	600
Total Solids	AASHTO T-26	50,000

Water that has an adverse effect on the air-entraining agent or any other chemical admixture or on strength or time of set of the concrete shall not be used. Water used in white Portland cement concrete shall be free from iron and other impurities, which may cause staining, or discoloration.

C. Coarse Aggregate

Coarse aggregate shall consist of durable particles of crushed or uncrushed gravel, crushed blast furnace slag, crushed stone or combinations thereof; free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material either free or as an adherent coating. When white hydraulic cement is specified, the coarse aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout.

The coarse aggregate from each source shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TXDOT Test Method TEX-413-A. The coarse aggregate from each source shall have a wear of not more than 40 percent when tested in accordance with TXDOT Test Method TEX-410-A.

Unless otherwise indicated on the drawings, the coarse aggregate from each source shall be subjected to 5 cycles of the soundness test conforming to TXDOT Test Method TEX-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

Coarse aggregate shall be washed. The Loss by Decantation (TXDOT Test Method TEX-406-A), plus allowable weight of clay lumps, shall not exceed 1 percent or the value indicated on the drawings or in the project manual, whichever is less. If material finer than the # 200 (75 micrometer) sieve is definitely established to be dust of fracture of aggregates made primarily from crushing of stone, essentially free from clay or shale as established by Part III of TXDOT Test Method TEX-406-A, the percent may be increased to 1.5. When crushed limestone coarse aggregate is used in concrete pavements, the decant may exceed 1% but not more than 3% if the material finer than the #200 (75 micrometer) sieve is determined to be at least 67% calcium carbonate in accordance with TxDoT Test Method Tex-406-A, Part III.

The coarse aggregate factor may not be more than 0.82; however, when voids in the coarse aggregate exceed 48 percent of the total rodded volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor may not be less than 0.68 except for a Class I machine extruded mix that shall not have a coarse aggregate factor lower than 0.61.

When exposed aggregate surfaces are required, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable for exposed aggregate finishes.

When tested by approved methods, the coarse aggregate including combinations of aggregates when used, shall conform to the grading requirements shown in Table 2.

Table 2: Coarse Aggregate Gradation Chart (Percent Passing)

Grade	Nom. Size	2½″ (62.5mm)	2″ (50mm)	1½″ (37.5mm)	1″ (25mm)	¾″ (19mm)	½″ (12.5mm)	3/8″ (9.5mm)	No. 4 (4.75mm)	No. 8 (2.36mm)
1	2″ (50 mm)	100	80—100	50—85		20—40			0—5	
2 (467)*	1½″(37.5 mm)		100	95—100		35—70		10—30	0—5	
3	1″ (50 mm)		100	95—100		60—90	25—60		0—5	
4 (57)*	1″ (50 mm)			100	95—100		25—60		0—10	0—5
5 (67)*	¾″ (19 mm)				100	90—100		20—55	0—10	0—5
6 (7)*	½″ (12.5 mm)					100	90—100	40—70	0—15	0—5

7	3/8 ″ (9.5 mm)						100	70—95	0—25	
8	3/8 ″ (9.5 mm)						100	95—100	20—65	0—10

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.
2. The use of recycled crushed hydraulic cement concrete as a coarse aggregate shall be limited to Concrete Classes A, B and D (see Table 5).

D. Fine Aggregate

Fine aggregate shall be washed and consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. When white hydraulic cement is specified, the fine aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps in accordance with TEX-413-A. When subjected to color test for organic impurities per TXDOT Test Method TEX-408-A, it shall not show a color darker than standard.

Unless indicated otherwise on the drawings the acid insoluble residue of fine aggregate used in slab concrete subject to direct traffic shall not be less than 60 percent by weight (mass) when tested conforming to TXDOT Test Method TEX-612-J.

Unless indicated otherwise on the Drawings, fine aggregate shall be blended, when necessary, to meet the acid insoluble residue requirement.

When blending the following equation shall be used:

Acid Insoluble (%) = {(A1)(P1)+(A2)(P2)}/100

Where:

A1 = acid insoluble (%) of aggregate 1,

A2 = acid insoluble (%) of aggregate 2,

P1 = % by weight of A1 of the fine aggregate blend, and

P2 = % by weight of A2 of the fine aggregate blend.

When tested in accordance with TxDoT Test Method Tex-401-A, the fine aggregate, including mineral filler and combinations of aggregates, when used, shall conform to the grading requirements shown in Table 3.

Table 3: Fine Aggregate Gradation Chart [1] (Grade 1 - Percent Passing)							
3/8 (9.5 mm)	No. 4 (4.75 mm)	No. 8 (2.36 mm)	No. 16 (1.18mm)	No. 30 (600 µm)	No. 50 (300 µm)	No. 100 (150 µm)	No. 200 (75 µm)
100	95—100	80—100	50—85	25—65	10—351	0—10	0—32

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.
2. The use of recycled crushed hydraulic cement concrete as a fine aggregate shall be limited to Concrete Classes A, B and D (see Table 5).
3. 6 to 35 when sand equivalent value is greater than 85.
4. 0 to 6 for manufactured sand.

Sand equivalent per TXDOT Test Method TEX-203-F shall not be less than 80 nor less than otherwise indicated on the drawings, whichever is greater.

The fineness modulus will be determined by adding the percentages by weight retained on sieve Nos. 4, 8, 16, 30, 50 and 100 (4.75 mm, 2.36 mm, 1.18mm, 600 µm, 300 µm, and 150 µm) and dividing the sum of the six sieves by 100. For all classes of concrete except K (see Table 5), the fineness modulus shall be between 2.30 and 3.10. For Class K concrete, the fineness modulus shall be between 2.40 and 2.90, unless indicated otherwise on the Drawings.

E. Mineral Filler

Mineral filler shall consist of stone dust, clean crushed sand or other approved inert material. When tested in accordance with TxDoT Test Method Tex-401-A, it shall conform to the following gradation:

Passing the No. 30 (600 µm) Sieve	100 percent
Passing the No. 200 (75 µm) Sieve	65 to 100 percent

F. Mortar and Grout

Unless otherwise specified, indicated on the drawings or approved by the Engineer or designated representative mortar and grout shall consist of 1 part cement, 2 parts finely graded sand and enough water to make the mixture plastic. When required to prevent color difference, white cement shall be added to produce color required. When required by the Engineer or designated representative, approved latex adhesive may be added to the mortar. Mortar shall be provided with a consistency such that the mortar can be easily handled and spread by trowel. Grout shall be provided of a consistency that will flow into and completely fill all voids.

G. Admixtures

All chemical admixtures including water reducing, placticizers and air entrainment shall conform to TxDoT DMS-4640, "Chemical Admixtures for Concrete". Calcium chloride-based admixtures shall not be approved. Admixtures shall be included in the prequalified concrete admixtures list maintained by TxDot's Construction Division. High-range water-reducing admixtures (TxDoT Type F or G) and accelerating admixtures (TxDoT Type C or E) shall not be used in bridge deck concrete.

H. Air Entrainment

Unless indicated otherwise on the drawings, all concrete classes with the exception of Class B shall be air entrained in accordance with Table 8. If the air content is more than 1½ percentage points below or 3 percentage points above the required air, the load of concrete will be rejected. If the air content is more than 1½ but less than 3 percentage points above the required air, the concrete may be accepted based on strength test results.

403S.4 - Storage of Materials

A. Cement, Supplementary Cementing Materials and Mineral Filler

All cement, supplementary cementing materials and mineral filler shall be stored in separate and well ventilated, weatherproof buildings or approved bins, which will protect the material from dampness or absorption of moisture. Storage facilities shall be easily accessible and each shipment of packaged cement shall be kept separated to provide for identification and inspection. The Engineer or designated representative may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

B. Aggregates

The method of handling and storing concrete aggregates shall prevent contamination with foreign materials. If the aggregates are stored on the ground, the sites for the stockpiles shall be clear of all vegetation and shall be level. Aggregates shall be stockpiled in sizes to facilitate blending. If the aggregate is not stockpiled on a hard, non-contaminant base, the bottom 6-inch (150 mm) layer of the stockpile shall not be used without recleaning the aggregate.

When conditions require the use of 2 or more grades of coarse aggregates, separate stockpiles shall be maintained to prevent intermixing. Where space is limited, stockpiles shall be separated by walls or other appropriate barriers.

Aggregate shall be stockpiled and protected from the weather a minimum of 24 hours prior to use to minimize free moisture content. When stockpiles are too large to protect from the weather, accurate and continuous means acceptable to the Engineer or designated representative shall be provided to monitor aggregate temperature and moisture. Aggregates shall be stockpiled and handled such that segregation and contamination are minimized.

The stockpiles shall be sprinkled to control moisture and temperature as necessary. A reasonably uniform moisture content shall be maintained in aggregate stockpiles.

C. Admixtures

Admixtures shall be stored in accordance with manufacturer's recommendations and shall be protected against freezing.

D. Hot Weather Concrete Mixes

Ice may be used during hot weather concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures") to lower the concrete temperature; however, the Contractor shall furnish a mix design acceptable to the Engineer or designated representative for class of concrete specified. The addition of ice shall not exceed 50% of the total mix water weight.

403S.5 - Measurement of Materials

Water shall be accurately metered. Fine and coarse aggregates, mineral filler, bulk cement and fly ash shall be weighed separately. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates and admixtures. Volumetric and weight measuring devices shall be acceptable to the Engineer or designated representative. Measurement of materials in non-volumetric and volumetric mixers shall conform to Section 421.4.D of TxDot Specification Item 421, "Hydraulic Cement Concrete".

Batch weighing of sacked cement is not required; however, bags, individually and entire shipments, may not vary by more than 3 percent from the specified weight of 94 pounds (42.6 kilograms) per bag. The average bag weight of a shipment shall be determined by weighing 50 bags taken at random.

403S.6 - Mix Design

The Contractor shall furnish a mix design acceptable to the Engineer or designated representative for the class of concrete required in accordance with Table 5. The mix shall be designed by a qualified commercial laboratory and signed/sealed by a registered Professional Engineer, licensed in the state of Texas to conform with requirements contained herein, to ACI 211.1 or TXDOT Bulletin C-11 (and supplements thereto). The maximum water-to-cementitious material ratio identified in Table 5 for specific classes of concrete shall not be exceeded.

A higher-strength class of concrete with equal or lower water-to-cementituous-material ratio may be substituted for the specified class of concrete.

The mix design shall be over-designed in accordance with Table 5 in order to account for production variability and to ensure minimum compressive strength requirements are met.

Allowable mix design options are presented in Section 403S.8.

The Contractor shall perform, at the Contractor's expense, the work required to substantiate the design, including testing of strength specimens. Complete concrete design data shall be submitted to the Engineer or designated representative for approval. The mix design will be valid for a period of one (1) year provided that there are no changes to the component materials.

When there are changes in aggregates or in type, brand or source of cement, supplementary cementing material or chemical admixtures, the mix shall be evaluated as a new mix design. A change in vendor does not necessarily constitute a change in materials or source. When only the brand or source of cement is changed and there is a prior record of satisfactory performance of the cement with the ingredients, the submittal of new trial batches may be waived by the Engineer or designated representative.

At the end of one (1) year, a previously approved mix may be resubmitted for approval if it can be shown that no substantial change in the component materials has occurred and that test results confirming the adequacy of the mix designs have been acquired during the previous year. The resubmittal analysis must be reviewed, signed and sealed by a registered Professional Engineer, licensed in the state of Texas. This resubmittal shall include a reanalysis of specific gravity, absorption, fineness modulus, sand equivalent, soundness, wear and unit weights of the aggregates. Provided that the fineness modulus did not deviate by more than 0.20 or that the re-proportioned total mixing water, aggregate and cement (or cement plus fly ash) are within 1, 2, and 3 percent, respectively, of pre-approved quantities, a one-year extension on the approval of the mix may be granted by the Engineer or designated representative. Updated cement, fly ash, and admixture certifications shall accompany the resubmittal.

Approved admixtures that are included in the prequalified concrete admixtures list maintained by TxDot's Construction Division may be used with all classes of concrete at the option of the Contractor provided that specific requirements of the governing concrete structure specification are met. Water reducing and retarding agents shall be required for hot weather, large mass, and continuous slab placements. Air entraining agents may be used in all mixes but must be used in the classes indicated on Table 5. Unless

approved by the Engineer or designated representative, mix designs shall not exceed air contents for extreme exposure conditions as recommended by ACI 211.1 for the various aggregate grades.

403S.7 - Consistency and Quality of Concrete

Concrete shall be workable, cohesive, possess satisfactory finishing qualities and of stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements specified in Table 4 without the development of segregation or honeycombing. No concrete will be permitted with a slump in excess of the maximums shown unless water-reducing admixtures have been previously approved. Concrete that exceeds the maximum acceptable placement slump at time of delivery will be rejected. Slump values shall be conducted in accordance with TXDOT Test Method TEX-415-A.

Consistency and quality of concrete should allow efficient placement and completion of finishing operations before initial set. Re-tempering (i.e. addition of water and reworking concrete after initial set) shall not be allowed. When field conditions are such that additional moisture is needed for final concrete surface finishing operation, the required water shall be applied to surface by fog spray only and shall be held to a minimum. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder.

Table 4: Slump Requirements

	Slump [1], inches (mm)	
Type of Construction	**Maximum**	**Minimum**
Cased Drilled Shafts	4 (100)	3 (75)
Reinforced Foundation Caissons and Footings	3 (75)	1 (25)
Reinforced Footings and Substructure Walls	3 (75)	1 (25)
Uncased Drilled Shafts	6 (150)	5 (125)
Thin-walled Sections; 9 inches (225 mm) or less	6½ (165)	4 (100)
Prestressed Concrete Members1	6½ (165)	4 (100)
Precast Drainage Structures	6 (150)	4 (100)
Wall Sections over 9 inches (225 mm)	5 (125)	3 (75)
Reinforced Building Slabs, Beams, Columns and Walls	4 (100)	1 (25)
Bridge Decks	4 (100)	2 (50)

Pavements, Fixed-form	6½ (165)	4 (100)
Pavements, Slip-form	3 (75)	1½ (37.5)
Sidewalks, Driveways and Slabs on Ground	4 (100)	2 (50)
Curb & Gutter, Hand-vibrated	3 (75)	1 (25)
Curb & Gutter, Hand-tamped or spaded	4 (100)	2 (50)
Curb & Gutter, Slip-form/extrusion machine	2 (50)	½ (12.5)
Heavy Mass Construction	2 (50)	1 (25)
High Strength Concrete	4 (100)	3 (75)
Riprap and Other Miscellaneous Concrete	6 (150)	1 (25)
Under Water or Seal Concrete	8½ (213)	6 (150)

1. Slump values when a high range water reducer (HRWR) is not used.
2. When a high range water reducer (HRWR) is used, maximum acceptable placement slump will be 9 in (225 mm).

During progress of the work, the Engineer or designated representative shall cast test cylinders as a check on compressive strength of concrete actually placed. The Engineer or designated representative may also perform slump tests, entrained air tests and temperature checks to ensure compliance with specifications.

Proportioning of all material components shall be checked prior to discharging. Excluding mortar material for pre-coating of the mixer drum [see section 403S.8.B] and adjustment for moisture content of admixtures and aggregates, material components shall fall within the range of + 1% for water, + 2% for aggregates, + 3% for cement, +2% for fly ash and within manufacturer recommended dosage rates for admixtures except that air entrainment shall be within + 1½ percentage points of the mix design requirements.

Unless otherwise specified or indicated on the drawings, concrete mix temperature shall not exceed 90°F (32°C) except in mixes with high range water reducers where a maximum mix temperature of 100°F (38°C) will be allowed. Cooling an otherwise acceptable mix by addition of water or ice during agitation will not be allowed.

Test cylinders will be required for small placements such as manholes, inlets, culverts, wing walls, etc. The Engineer or designated representative may vary the number of tests to a minimum of 1 for each 25 cubic yards (1 for each 19 cubic meters) placed over a several day period.

Test cylinders shall be required for each monolithic placement of bridge decks or superstructures, top slabs of direct traffic culverts, cased drilled shafts, structural beams and as otherwise directed by Engineer or designated representative for design strength confirmation or early form removal. Test cylinders made for early form removal or for consideration of use of structure will be at Contractor's expense, except when required by Engineer or designated representative.

A strength test shall be defined as the average breaking strength of 2 cylinders. A minimum of four test cylinders shall be prepared; two each to be tested at 7 and 28 days. Specimens will be tested conforming to TXDOT Test Method TEX-418-A. If required strength or consistency of class of concrete being produced cannot be secured with minimum cementitious material specified or without exceeding maximum water/cementitious material ratio, Contractor will be required to furnish different aggregates, use a water reducing agent, an air entraining agent or increase the cement content in order to provide concrete meeting these specifications.

Slump tests will be performed in accordance with TxDoT Test Method Tex-415-A. Entrained air tests will be performed in accordance with TxDoT Test Method Tex-416-A.

Test specimens shall be cured using the same methods and under the same conditions as the concrete represented. Design strength cylinders shall be cured conforming to TXDOT Bulletin C-11 (and supplements thereto).

When control of concrete quality is by 28-day compressive tests, job control testing will be by 7-day compressive strength tests. The minimum strength requirement for seven (7) day test will be 70 percent of the specified minimum 28-day compressive strength. If the required 7-day strength is not secured with the quantity of cement specified in Table 4, changes in the mix design shall be made and resubmitted for approval. For an occasional failure of the seven-day compressive test, the concrete may be tested at 28 days for final evaluation.

Table 5: Classes of Concrete

Class	Cement Sks Per CY	Minimum Strength, psi (MPa)		Maximum W/C Ratio [1]	Coarse Aggr. Grade [2,3,4]	Air Entrain.
		28 Days	7 Days			
A	5.0 (280 kg/m ^{3})	3000 (20.6)	2100 (14.5)	0.6	1,2,3,4,8	Yes
B	4.0 (225 kg/m ^{3})	2000 (13.8)	1400 (9.7)	0.6	2,3,4,5,6,7	No
C [5]	6.0 (335 kg/m ^{3})	3600(24.8)	2520 (17.4)	0.45	1,2,3,4,5,6	Yes
D	4.5 (252 kg/m ^{3})	2500 (17.2)	1750 (12.1)	0.6	2,3,4,5,6,7	No

H [5]	6.0 (335 kg/m ^{3})	As indicated	As Indicated	0.45	3,4,5,6	Yes
I	5.5 (308 kg/m ^{3})	3500 (24.1)	2450 (16.9)	0.45	2,3,4,5	Yes
J	2.0 (112 kg/m ^{3})	800 (5.5)	560 (3.9)	N/A	2,3,4,5	No
S [5]	6.0 (335 kg/m ^{3})	4000 (27.6)	2800 (19.3)	0.45	2,3,4,5	Yes

Notes:

1. Maximum water-cement or water-cementitious ratio by weight
2. Unless otherwise allowed, Grade 1 coarse aggregate shall only be used in massive foundations with 4-in (100-mm) minimum clear spacing between reinforcing steel bars.
3. Grade 1 coarse aggregate grading shall not be used in drilled shafts.
4. Unless otherwise allowed, Grade 8 coarse aggregate shall be used in extruded curbs.
5. Structural concrete classes.
6. When Type II cement is used in Class C, S or A concrete, the 7-day compressive strength requirement will be 2310 psi (15.9 MPa) for Class C, 2570 psi (17.7 MPa) for Class S and 1925 psi (13.3 MPa) for Class A minimum.

Table 6: Over Design Required to Meet Compressive Strength Requirements [1]

Number Of Tests [2,3]	**Standard Deviation, psi (MPa)**				
	300 (2.06)	400 (2.75)	500 (3.44)	600 (4.13)	700 (4.82)
15	470 (3.24)	620 (4.27)	850 (5.85)	1,120 (7.71)	1,390 (9.57)
20	430 (2.96)	580 (3.99)	760 (5.23)	1,010 (6.95)	1,260 (8.67)
30 or more	400 (2.75)	530 (3.65)	670 (4.61)	900 (6.20)	1,130 (7.78)

Notes:

1. When designing the mix, add the tabulated amounts to the minimum design strength in Table 5. Maximum water-cement or water-cementitious ratio by weight
2. Number of tests of a concrete mixture used to estimate the standard deviation of a concrete production facility. Test of another mix within 1,000 psi (6.88 MPa) of the specified strength may be used.
3. If less than 15 prior tests are available, the overdesign should be 1,000 psi (6.88 MPa) for specified strength less than 3,000 psi (20.65 MPa), 1,200 psi (8.26 MPa) for specified strengths from 3,000 to 5,000 psi (20.65 to 34.42 MPa) and 1,400 psi (9.64 MPa) for specified strengths greater than 5,000 psi (34.42 MPa).

Table 7: Expected Usage of Concrete Classes

Class	General Usage
A	Inlets, manholes, curb, gutter, curb & gutter, concrete retards, sidewalks, driveways, backup walls and anchors
B	Riprap, small roadside signs and anchors
C [5]	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, and cast-in-place concrete traffic barrier
D	Riprap
H [5]	Prestressed concrete beams, boxes, piling and precast concrete traffic barrier
J	Utility trench repair
S [5]	Bridge slabs and top slabs of direct traffic culverts

Table 8: Air Entrainment [1]

Nominal Maximum Aggregate Size In (mm)	% Air Entrainment	
	Moderate Exposure	Severe Exposure
3/8 (9.5)- Grades 7 & 8	6	7½
½ (12.5)- Grades 6	5½	7

¾ (19)- Grades 5	5	6
1 (25)- Grades 4	4½	6
1½ (37.5)- Grades 2 & 3	4½	5½
2 (50)- Grades 2	4	5

1. For specified concrete strengths above 5,000 psi (34.42 MPa) a reduction of 1 percentage point is allowed.

403S.8 - Mix Design Options

For the structural concretes identified in Table 5 (Classes C, H and S) and any other class of concrete designed using more than 520 lbs. of cementitious material per cubic yard (310 kgs per cubic meter), one of the mix design options presented below shall be used.

For the non-structural concretes identified in Table 5 (Classes A, B, D and I) and any other class of concrete designed using less than 520 lbs. of cementitious material per cubic yard (310 kgs per cubic meter), one of the mix design options presented below will be used, except that Class C fly ash may be used instead of Class F fly ash for Options 1, 3 and 4 unless a sulfate-resistant concrete is required.

A. Option 1: Twenty (20) to thirty-five (35) percent of the cement may be replaced with Class F fly ash.

B. Option 2: Thirty-five (35) to fifty (50) percent of the cement may be replaced with ground granulated blast-furnace slag.

C. Option 3: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class F fly ash, ground granulated blast-furnace slag or silica fume. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.

D. Option 4: Type IP or Type IS will be used and up to ten (10) percent of the cement may be replaced with Class F fly ash, ground granulated blast-furnace slag or silica fume.

E. Option 5: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class C fly ash and at least six (6) percent of silica fume, ultra fine fly ash or metakaolin. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.

F. Option 6: A lithium nitrate admixture will be added at a minimum dosage of 0.55 gal. of thirty (30) percent lithium nitrate solution per pound of alkalis present in the hydraulic cement.

G. Option 7: When hydraulic cement only is used in the design, the total alkali contribution from the cement in the concrete does not exceed 4.0 lbs. per cubic yard, when calculated as follows:

alkali (lbs. per CY) = .01 (lbs cement/CY) (% Na_2O equivalent in cement)

where (% Na_2O equivalent in cement) is assumed to be the maximum cement alkali content reported on the cement mill certificate.

H. Option 8: When there are deviations from Options 1 through 7, the following shall be performed:

1. Conduct tests on both coarse and fine aggregate separately in accordance with ASTM C-1260, using 440 g of the proposed cementitious in the same proportions of hydraulic cement to supplementary cementing material to be used in the mix.
2. Prior to use of the mix, a certified test report signed and sealed by a Professional Engineer, licensed in the state of Texas shall be submitted that demonstrates that ASTM C 1260 test results for each aggregate do not exceed 0.10 percent expansion.

403S.9 - Mixing and Mixing Equipment

All equipment, tools and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work without excessive delays for repairs and replacement. Mixing shall be done in a mixer of approved type and size that will produce uniform distribution of material throughout the mass and shall be capable of producing concrete meeting requirements of ASTM C 94, Ready-mixed Concrete and these specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities. Entire contents of the drum shall be discharged before any materials are placed therein for a succeeding batch. Improperly mixed concrete shall not be placed in a structure. For all mixers an adequate water supply and an accurate method of measuring the water shall be provided.

The mixer may be batched by either volumetric or weight sensing equipment and shall be equipped with a suitable timing device that will lock the discharging mechanism and signal when specified time of mixing has elapsed.

A. Proportioning and Mixing Equipment

For all miscellaneous concrete placements, a mobile, continuous, volumetric mixer or a volumetric or weight batch mixer of the rotating paddle type may be used.

When approved by Engineer or designated representative in writing or when specified for use in other items, these mixers may be used for other types of concrete construction, including structural concrete, if the number of mixers furnished will supply the amount of concrete required for the particular operation in question.

These mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging.

For continuous volumetric mixers, the materials delivered during a revolution of the driving mechanism or in a selected interval, will be considered a batch and the proportion of each ingredient will be calculated in the same manner as for a batch type plant.

Mixing time shall conform to recommendations of manufacturer of mixer unless otherwise directed by Engineer or designated representative.

B. Ready-mixed Concrete

Use of ready-mixed concrete will be permitted provided the batching plant and mixer trucks meet quality requirements specified herein. When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the mixer drum. Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

1. A ticket system will be used that includes a copy for the Inspector. Ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

2. Sufficient trucks will be available to support continuous placements. The Contractor will satisfy the Engineer or designated representative that adequate standby trucks are available to support monolithic concrete placement requirements.

3. A portion of mixing water required by the mix design to produce the specified slump may be withheld and added at the job site, but only with permission of the Engineer or designated representative and under the Inspector's observation. When water is added under these conditions, the concrete batch will be thoroughly mixed before any slump or strength samples are taken. Additional cement shall not be added at the job site to otherwise unacceptable mixes.

4. A metal plate(s) shall be attached in a prominent place on each truck mixer plainly showing the various uses for which it was designed. The data shall include the drum's speed of rotation for mixing and for agitating and the capacity for complete mixing and/or agitating only. A copy of the manufacturer's design, showing dimensions of blades, shall be available for inspection at the plant at all times. Accumulations of hardened concrete shall be removed to the satisfaction of the Engineer or designated representative.

5. The loading of the transit mixers shall not exceed capacity as shown on the manufacturer's plate attached to the mixer or 63 percent of the drum volume, whichever is the lesser volume. The loading of transit mixers to the extent of causing spill-out en route to delivery will not be acceptable. Consistent spillage will be cause for disqualification of a supplier.

6. Excess concrete remaining in the drum after delivery and wash water after delivery shall not be dumped on the project site unless approval of the dump location is first secured from the Engineer or designated representative.

C. Volumetric Batching

Use of volumetric batched concrete will be permitted provided the batching and continuous mixing operations conform to ASTM C 685, "Concrete Made By Volumetric Batching and Continuous Mixing". This type concrete shall be made from materials continuously batched by volume, mixed in a continuous mixer and delivered to the site in a freshly mixed and unhardened state. Tests and criteria for batching accuracy and mixing efficiency shall be as specified in ASTM C 685.

1. A ticket system will be used that includes a copy for the Inspector. The ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

2. Each batching or mixing unit, or both, shall carry in a prominent place a metal plate or plates on which are plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed and the weight-calibrated constant of the machine in terms of a revolution counter or other output indicator. The mixer shall produce a thoroughly mixed and uniform concrete.

3. The batcher-mixer unit shall contain in separate compartments all the necessary ingredients needed for the manufacture of concrete. The unit shall be equipped with calibrated proportioning devices to vary the mix proportions and it shall produce concrete as required by the Work and ASTM C 685.

D. Truck-mixed Concrete

The concrete shall be mixed in a truck mixer from 70 to 100 revolutions at the mixing speed designated by the manufacturer that will produce a uniform concrete mix. The concrete shall be delivered to the project in a thoroughly mixed and uniform mass and shall be discharged with a satisfactory degree of uniformity. Additional mixing at the job site, at the mixing speed designated by the manufacturer, may be allowed by the Engineer or designated representative as long as the concrete is discharged before the drum has revolved a total of 300 revolutions after the introduction of the mixing water to the cement and the aggregates.

Re-tempering or adding concrete chemical admixtures is only permitted at the job site when concrete is delivered in a truck mixer. Water shall not be added after introduction of mixing water at the batch

plant except on arrival at the job site with approval of the Engineer or designated representative, in order to adjust the slump of the concrete. When this water is added, the mix design water-cementitious-material ratio shall not be exceeded. The drum or blades shall be turned at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete. Water or chemical admixtures shall not be added to the batch after any concrete has been discharged.

When the concrete contains silica fume, mixing times and batching operations shall be adjusted as necessary to ensure that the material is completely and uniformly dispersed in the mix. The dispersion of the silica fume within the mix shall be verified in trial batches.

E. Hand-mixed Concrete

Hand mixing of concrete may be permitted for small placements or in case of an emergency and then only on authorization of the Engineer or designated representative. Hand-mixed batches shall not exceed a 4 cubic foot (0.113 cubic meters) batch in volume. Material volume ratios shall not be leaner than 1 part cement, 2 parts large aggregate, 1 part fine aggregate and enough water to produce a consistent mix with a slump not to exceed 4 inches (100 mm). Admixtures shall not be used unless specifically approved by the Engineer or designated representative.

403S.10 - Excavation, Placing of Concrete, Finishing, Curing and Backfill

Excavation, placing of concrete, finishing, curing and backfill shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill", Standard Specification Item No. 410S, "Concrete Structures" and Standard Specification Item No. 411S, "Surface Finishes for Concrete".

403S.11 - Measurement

Where measurement of concrete for a structure is not provided by another governing pay item, measurement shall be made under this specification in accordance with the following.

The quantities of concrete of the various classifications which constitute the completed and accepted structure or structures in place will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.308 cubic yards), each, square yard (square meter: 1 square yard equals 0.836 square meters) or linear foot as indicated in the Contract Documents. Measurement will be as follows:

A. General

1. Measurement based on dimensions shall be for the completed structure as measured in place. However, field-measured dimensions shall not exceed those indicated on the drawings or as may have been directed by the Engineer or designated representative in writing.
2. No deductions shall be made for chamfers less than 2 inches (50 mm) in depth, embedded portions of structural steel, reinforcing steel, nuts, bolts, conduits less than 5 inches (125 mm) in diameter, pre/post tensioning tendons, keys, water stops, weep holes and expansion joints 2 inches (50 mm) or less in width.
3. No measurement shall be made for concrete keys between adjoining beams or prestressed concrete planks.
4. No measurement shall be made for fill concrete between the ends or adjoining prestressed concrete planks/box beams at bent caps or between the ends of prestressed concrete planks/box beams and abutment end walls.
5. No measurement shall be made for inlet and junction box invert concrete.
6. No measurement shall be made for any additional concrete required above the normal slab thickness for camber or crown.

B. Plan Quantity. For those items measured for plan quantity payment, adequate calculations have been made. If no adjustment is required by Article 403S.11, additional measurements or calculations will not be required or made.

C. Measured in Place. For those items not measured for Plan Quantity payment, measurement will be made in place, subject to the requirements of Article 403S.10.A.1 above.

403S.12 - Payment

The work performed and materials furnished as prescribed by this item and measured in accordance with the applicable provisions of "Measurement" above will be paid for as follows.

The quantity to be paid for will be that quantity indicated in the contract documents and/or shown on the drawings, regardless of errors in calculations, except as may be modified by the following.

Plan Quantities will be adjusted:

A. When a complete structure element has been erroneously included or omitted from the drawings, the quantity shown on the drawings for that element will be added to or deducted from the plan quantity and included for payment. A complete structure element will be the smallest portion of a total structure for which a quantity is included on the drawings. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

B. When the plan quantity for a complete structure element is in error by 5 percent or more, a recalculation will be made and the corrected quantity included for payment. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.

C. When quantities are revised by a change in design, the "plan quantity" will be increased or decreased by the amount involved in the design change. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The party to the contract requesting the adjustment shall present to the other, a copy of the description and location, together with calculations of the quantity for the structure element involved. When this quantity is certified correct by the Engineer or designated representative, it will become the revised plan quantity.

Payment for increased or decreased costs due to a change in design on those items measured as "Cubic Yard", "Each", "Square Foot", "Square Yard" or "Linear Foot" will be determined by Change Order. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The unit prices bid for the various classes of concrete shown shall include full compensation for furnishing, hauling, and mixing all concrete material; placing, finishing and curing all concrete; all grouting, pointing and finishing; furnishing and placing drains; furnishing and placing metal flashing strips; furnishing and placing expansion joint material required by this item; and for all forms and false work, labor, tools, equipment and incidentals necessary to complete the work.

Pay Item No. 403S-CY:	(Structure or Structural Component)	Per Cubic Yard.
Pay Item No. 403S-EA:	(Structure or Structural Component)	Per Each.
Pay Item No. 403S-SY:	(Structure or Structural Component)	Per Square Yard.
Pay Item No. 403S-LF:	(Structure or Structural Component)	Per Lineal Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 403S, "Concrete For Structures"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 401S	Structural Excavation and Backfill
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finishes for Concrete
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4640	Chemical Admixtures for Concrete
American Association of State Highway & Transportation Officials, AASHTO Standard Method of Test for	
Designation	Description
Method T 26	Quality of Water to be Used in Concrete
American Concrete Institute, ACI	
Designation	Description

ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM C 94	Specification For Ready-Mixed Concrete
ASTM C 150	Specification For Portland Cement
ASTM C 685	Concrete Made By Volumetric Batching and Continuous Mixing
ASTM C-1260	Standard Test Method for Potential Alkali Reactivity of Aggregates
ASTM D-512	Test Methods for Chloride Ion in Water
ASTM D-516	Test Methods for Sulfate Ion in Water
ASTM D-4191	Test Method for Sodium in Water by Atomic Absorption
ASTM D-4192	Test Method for Potassium Water by Atomic Absorption
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
TEX-203-F	Sand Equivalent Test
TEX-401-A	Sieve Analysis of Fine and Coarse Aggregate
TEX-406-A	Mineral Finer than 75 µm (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
TEX-408-A	Organic Impurities in Fine Aggregate for Concrete

TEX-410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
TEX-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
TEX-413-A	Determination of Deleterious Materials in Mineral Aggregate
TEX-415-A	Slump of Portland Cement Concrete
TEX-416-A	Air Content of Freshly-Mixed Concrete by the Pressure Method
TEX-418-A	Compressive Strength of Cylindrical Concrete Specimens
TEX-612-J	Acid Insoluble Residue

Texas Department of Transportation: Publications

Designation	Description
Bulletin C-11	Construction Bulletin

Texas Department of Transportation: Departmental Material Specifications

Designation	Description
DMS-4610	Fly Ash
DMS-4620	Ground Granulated Blast-Furnace Slag
DMS-4630	Silica Fume
DMS-4635	Metakaolin

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 403S, "Concrete For Structures"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Hydraulic Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 520	Weighing and Measuring Equipment
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants
DMS-6100	Epoxy and Adhesives
DMS 8900	Fly Ash

End

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ITEM NO. 405S - CONCRETE ADMIXTURES 11-13-07

405S.1 - Description

This item shall govern material requirements of admixtures for Portland cement concrete.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

405S.2 - Submittals

The submittal requirements of this specification item include:

A. Type and manufacturer of any proposed admixture.

B. Certification that proposed admixture meet the requirements of this specification, ASTM C260 and ASTM C494.

C. For a specific mix design, a statement of compatibility of products shall be submitted when admixtures from multiple manufacturers are proposed.

405S.3 - Materials

All admixture submittals must be approved by the Engineer or designated representative. No admixture shall be chloride-based or have chloride(s) added in the manufacturing process. Admixtures must be pretested by the Texas Department of Transportation (TXDOT) Materials and Tests Engineer and be included in the State's current approved admixture list. All admixtures must retain an approved status through the duration of a mix design's one-year approval period.

(1) **Air Entraining Admixture:**

An "Air Entraining Admixture" is defined as a material which, when added to a concrete mixture in the proper quantity, will entrain uniformly dispersed microscopic air bubbles in the concrete mix. The admixture shall meet the requirements of ASTM Designation: C 260 modified as follows:

(a) The cement used in any series of test shall be either the cement proposed for the specific work or a "reference" Type I cement from one mill.

(b) The air entraining admixture used in the reference concrete shall be Neutralized Vinsol Resin.

(2) **Water-reducing Admixture:**

A "Water-reducing Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and required strength. This admixture shall conform to ASTM C 494, Type A.

(3) **Accelerating Admixture:**

An "Accelerating Admixture" is defined as an admixture that accelerates the setting time and the early strength development of concrete. This admixture shall conform to ASTM C 494, Type C. The accelerating admixture will contain no chlorides.

(4) **Water-reducing, Retarding Admixture:**

A "Water-reducing, Retarding Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and retard the initial set of the concrete. This admixture shall conform to ASTM C 494, Type D.

(5) **High-range Water Reducing Admixtures:**

A "High-range Water Reducing Admixture", referred to as a superplasticizer, is defined as a synthetic polymer material which, when added to a low slump concrete mixture increases the slump without adversely affecting segregation, impermeability or durability of the mix. This admixture shall conform to ASTM C 494, Type F or G.

(6) **Fly Ash:**

Fly ash used in Portland cement concrete as a substitute for Portland cement or as a mineral filler shall comply with TXDOT Materials Specification D-9-8900 and be listed on TXDOT's current list of approved fly ash sources. Fly ash obtained from a source using a process fueled by hazardous waste (30 Texas Administrative Code, Section 335.1) shall be prohibited. This applies to any other specification concerning the use of fly ash. Contractor shall maintain a record of source for each batch. Supplier shall certify that no hazardous waste is used in the fuel mix or raw materials.

405S.4 - Certification and Product Information

The Contractor shall submit the name of the admixture proposed and manufacturer's certification that the selected admixtures meet the requirements of this item and of ASTM C 260 and C 494 as applicable. Admixtures for a mix design shall be of the same brand. If more than one admixture is proposed in the concrete mix, a statement of compatibility of components shall accompany certification. Manufacturer's product literature shall specify when in the batching/mixing operation the admixture must be added.

The Engineer or designated representative may request additional information such as infrared spectrophotometry scan, solids content, pH value, etc., for further consideration. Any unreported changes in formulation discovered by any of the tests prescribed herein may be cause to permanently bar the manufacturer from furnishing admixtures for Owner's work.

405S.5 - Construction Use of Admixtures

All admixtures used shall be liquid except high-range water reducers which may be a powder. Liquid admixtures shall be agitated as needed to prevent separation or sedimentation of solids; however, air agitation of Neutralized Vinsol Resin will not be allowed.

No admixture shall be dispensed on dry aggregates. Admixtures shall be dispensed at the batching site separately, but at the same time as the mixing water. Only high range water reducers may be introduced into the mix at the job site.

When other admixtures are used with fly ash, the amount of the other admixture to be used shall be based on the amount of Portland cement only and not the amount of Portland cement and fly ash.

When high-range water reducers are to be added at the job site, transit mixers shall be used. Admixture manufacturer literature shall indicate recommended mixing methods and time for the specific equipment and mix design used. The transit mix equipment shall not be loaded in excess of 63 percent of its rated capacity to ensure proper mixing of the admixture at the site. If during discharging of concrete a change in slump in excess of 30% is noted, the remaining concrete shall be rejected unless prior approval was given by the Engineer or designated representative to retemper a load with a second charge of admixture. Retempering with water shall not be allowed.

Accelerating admixtures will not be permitted in combination with Type II cement.

All mixes with air entrainment shall have a minimum relative durability factor of 80 in accordance with ASTM C 260. Dosage of air entrainment admixtures may be adjusted by the Contractor to stay within the specified tolerances for air entrainment of Standard Specification Item No. 403S, "Concrete for Structures".

405S.6 - Measurement and Payment

The requirements of this specifications shall not be measured and paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 405S, "Concrete Admixtures"	
City of Austin Standard Specifications	
Designation	Description
Item No. 403S	Concrete for Structures
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C495	Chemical Admixtures for Concrete
Texas Department of Transportation: Department Material Specification	
Designation	Description
DMS-8900	Fly Ash

RELATED CROSS REFERENCE MATERIALS
Specification Item No. 405S, "Concrete Admixtures"

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 437	Concrete Admixtures
Item 520	Weighing and Measuring Equipment
Item 522	Portland Cement Concrete Plants
Item 524	Hydraulic Cement

End

ITEM NO. 406S - REINFORCING STEEL 9-26-12

406S.1 - Description

This item shall govern furnishing and placement of reinforcing steel, deformed and smooth, of the size and quantity indicated on the drawings and in accordance with these specifications.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

406S.2 - Submittals

The submittal requirements of this specification item may include:

A. Evidence that the steel reinforcement producer is included on the TxDoT list of approved producing mills

B. Listing of the size, grade, type and quantity of reinforcing steel proposed for the project.

C. If welding of reinforcing steel is proposed, evidence that carbon equivalent (C.E.) of the proposed steel is at least 0.55% with a report of chemical analysis showing the percentages of elements necessary to establish C.E.

D. If epoxy coated steel is proposed, evidence that the steel reinforcement producer is included on the TxDoT list of approved epoxy coating applicators

E. If epoxy coated steel is proposed, written certification that the epoxy-coated reinforcing steel meets the requirements of this Item with a copy of the manufacturer's control tests.

F. When mechanical splices are proposed, the types of couplers proposed for use.

406S.3 - Materials

A. Approved Mills

Prior to furnishing reinforcing steel, the producing mills must be included on the list of approved producing mills that is maintained by the Construction Division of the State of Texas Department of Transportation

B. Deformed Bars and Wire Reinforcement

Unless indicated otherwise on the drawings, Bar reinforcement shall be Grade 60 and deformed. Reinforcing steel must conform to one of the following:

ASTM A615/615M, Grades 40 or 60 (300 or 420)

ASTM A996/996M, Type A, Grades 40 or 60 (300 or 420)

ASTM A996/996M, Type R, Grade 60 (420), permitted in concrete pavement only (furnished as straight bars only without bends. Bend tests are not required)

ASTM A706/706M

In cases where the provisions of this item are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this item shall govern.

The nominal size, area and weight (mass) of reinforcing steel bars covered by these specifications are as follows:

Bar Size Number 1/8 ins (mm)	Nominal Diameter, inches (mm)	Nominal Area, Sq. ins. (mm^2)	Weight/Linear Foot Lbs. (kg)
2 (6)	0.250 (6.6)	0.05 (32)	0.167 (.075)
3 (10)	0.375 (9.5)	0.11 (71)	0.376 (.171)
4 (13)	0.500 (12.5)	0.20 (127)	0.668 (.303)
5 (16)	0.625 (15.5)	0.31 (198)	1.043 (.473)
6 (19)	0.750 (19.0)	0.44 (285)	1.502 (.681)
7 (22)	0.875 (22.0)	0.60 (388)	2.044 (.927)
8 (25)	1.000 (25.5)	0.79 (507)	2.670 (2.211)
9 (29)	1.128 (28.5)	1.00 (641)	3.400 (1.542)
10 (32)	1.270 (32.0)	1.27 (792)	4.303 (1.952)
11 (36)	1.410 (36.0)	1.56 (958)	5.313 (2.410)
14 (43)	1.693 (43.0)	2.25 (1552)	7.65 (3.470)
18 (57)	2.257 (57.5)	4.00 (2565)	13.60 (6.169)

Smooth, round bars shall be designated by size number through a No. 4. Smooth bars above No. 4 shall be designated by diameter in inches.

C. Smooth Bar and Spiral Reinforcement

Smooth bars and dowels for concrete pavement must have a minimum yield strength of 60 ksi (414 MPa) and meet ASTM A615/615M. Smooth bars that are greater in diameter than a No. 3 (10 mm) designation shall conform to ASTM A615 or meet the physical requirements of ASTM A36.

Spiral reinforcement shall be either smooth or deformed bars or wire of the minimum size or gauge indicated on the drawings. Bars for spiral reinforcement shall comply with ASTM A615 Grade 40(300), ASTM A996, Type A, Grade 40 (300); or ASTM A675, Grade 80(550), meeting dimensional

requirements of ASTM A615. Smooth wire shall comply with ASTM A82, and deformed wire shall comply with ASTM A496.

D. Weldable Reinforcing Steel

Reinforcing steel to be welded must comply with ASTM A706 or have a carbon equivalent (C.E.) of at most 0.55%. A report of chemical analysis showing the percentages of elements necessary to establish C.E. is required for reinforcing steel that dose not meet ASTM A706 to be structurally welded. No tack welding will be allowed. All welding shall conform to the requirements of AWS D1.1/D1.1M.

Carbon Equivalent (C.E.) shall be calculated as follows:

C.E. = %C + 1.67*(% Mn) + .025*(% Cu) + .05*(% Ni) + .01*(%Cr) - .02*(%Mo) - .1*(%V)

Where C is carbon,

Mn is manganese

Cu is copper

Ni is nickel

Cr is chromium

Mo is molybdenum, and

V is vanadium.

The requirements above do not apply to the following miscellaneous welding applications:

Splicing reinforcing steel to extend bars in the bottom of a drilled shaft;

Attaching chairs to the reinforcing steel cage of a drilled shaft;

Armor joints and their supports;

Screed rail and form hanger supports where permitted on steel units;

Reinforcing steel to R-bars for lateral stability between prestressed beams, spirals, or bands of reinforcing bars in drilled shaft cages;

Permanent bridge deck forms;

Steel added in railing when slip-form construction is used; and

Other similar miscellaneous members that have no load carrying capacity in the completed structure.

E. Welded Wire Fabric

Wire shall conform to the requirements of the Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A 82 or A 496. Wire fabric, when used as reinforcement, shall conform to ASTM A 185 or A 497.

When wire is ordered by size numbers, the following relation between size number, diameter in inches and area shall apply unless otherwise indicated on the drawings:

Size, W Number 1/100 in ^{2} (mm ^{2})	Nominal Diameter inch (mm)	Nominal Area, sq. inches (mm ^{2})
31 (200)	0.628 (16.0)	0.310 (200)
30 (194)	0.618 (15.7)	0.300 (194)
28 (181)	0.597 (15.2)	0.280 (181)
26 (168)	0.575 (14.6)	0.260 (168)
24 (155)	0.553 (14.0)	0.240 (155)
22 (142)	0.529 (13.4)	0.220 (142)
20 (129)	0.505 (12.8)	0.200 (129)
18 (116)	0.479 (12.2)	0.180 (116)
16 (103)	0.451 (11.5)	0.160 (103)
14 (90)	0.422 (10.7)	0.140 (90)
12 (77)	0.391 (9.9)	0.120 (77)
10 (65)	0.357 (9.1)	0.100 (65)
8 (52)	0.319 (8.1)	0.080 (52)
7 (45)	0.299 (7.6)	0.070 (45)
6 (39)	0.276 (7.0)	0.060 (39)
5.5 (35)	0.265 (6.7)	0.055 (35)
5 (32)	0.252 (6.4)	0.050 (32)
4.5 (29)	0.239 (6.1)	0.045 (29)

4 (26)	0.226 (5.7)	0.040 (26)
3.5 (23)	0.211 (5.4)	0.035 (23)
3 (19)	0.195 (5.0)	0.030 (19)
2.5 (16)	0.178 (4.5)	0.025 (16)
2 (13)	0.160 (4.1)	0.020 (13)
1.5 (9)	0.138 (3.5)	0.015 (9.7)
1.2 (8)	0.124 (3.1)	0.012 (7.7)
1 (6)	0.113 (2.9)	0.010 (6.5)
0.5 (3)	0.080 (2.0)	0.005 (3.2)

Where deformed wire is required, the size number shall be preceded by D and for smooth wire the prefix W shall be shown.

Welded wire fabric shall be designated as follows: 6 x 12 - W16 x W8, which indicates a 6 in. (150 mm) longitudinal wire spacing and 12-in (300 mm) transverse wire spacing with smooth No. 16 (103) wire longitudinally and smooth no. 8 (52) wire transversely.

F. Epoxy Coating

Epoxy coating shall be required as indicated on the drawings. Prior to furnishing epoxy-coated reinforcing steel, the epoxy applicator must be included on the list of approved applicators that is maintained by the Construction Division of the State of Texas Department of Transportation.

The reinforcing steel shall be epoxy coated in accordance with the following.

Epoxy Coating Requirements for Reinforcing Steel

Material	Specification
Bar	ASTM A775 or A934
Wire or Fabric	ASTM A884 Class A or B

Mechanical Coupler	As indicated on the drawings
Hardware	As indicated on the drawings

The epoxy coating material and coating repair material shall comply with TxDoT's DMS-8130, "Epoxy Powder Coating for Reinforcing Steel". The applicator shall not patch more than ¼ inch total length in any foot (20 mm total length in any meter) at the applicator's plant.

The epoxy-coated reinforcing steel shall be sampled and tested in accordance with TxDoT Test Method Tex-739-I, "Sampling and Testing Epoxy Coated Reinforcing Steel".

The identification of all reinforcing steel shall be maintained throughout the epoxy coating and fabrication and until delivery to the project site.

Written certification that the epoxy-coated reinforcing steel meets the requirements of this Item shall be provided along with a copy of the manufacturer's control tests.

G. Mechanical Couplers

When mechanical splices in reinforcing steel bars are indicated on the drawings, the following types of couplers may be used:

Sleeve-filler

Sleeve-threaded

Sleeve-swaged, or

Sleeve-wedge.

H. Chairs and Supports

Chairs and Supports shall be steel, precast mortar or concrete blocks cast in molds meeting the approval of the Engineer or designated representative of sufficient strength to position the reinforcement as indicated on the drawings when supporting the dead load of the reinforcement, the weight of the workers placing concrete and the weight of the concrete bearing on the steel. Chairs shall be plastic coated when indicated on the drawings.

Chair Types and Applicable Uses	
Structural or Architectural Elements (columns, beams, walls, slabs) exposed to weather, not subjected to sand blasting, water blasting or grinding.	Galvanized steel or steel chairs with plastic coated feet.
Structural or Architectural Elements exposed to weather and subject to sand blasting, water blasting or grinding.	Stainless steel chairs.

Structural or Architectural Elements not exposed to weather or corrosive conditions.	Uncoated steel chairs
Slabs and grade beams cast on grade.	Steel chairs with a base with 9 inch ^{2} (58 cm ^{2}) minimum area or sufficient area to prevent the chair from sinking into fill or subgrade. Precast mortar or concrete blocks meeting the requirements of this item may be used.

406S.4 - Bending

The reinforcement shall be bent cold, true to the shapes indicated on the drawings. Bending shall preferably be done in the shop. Irregularities in bending shall be cause for rejection. Improperly fabricated, damaged or broken bars shall be replaced at no additional expense to the City. Damaged or broken bars embedded in a previous concrete placement shall be repaired using a method approved by the Engineer or designated representative.

Unless otherwise indicated on the drawings, the inside diameter of bar bends, in terms of the nominal bar diameter (d), shall be as follows:

Bends of 90 degrees and greater in stirrups, ties and other secondary bars that enclose another bar in the bend.

Bar Number in1/8inches (mm)	**Diameter**
3, 4, 5 (10, 13, 16)	4d
6, 7, 8	6d

All bends in main bars and in secondary bars not covered above.

Bar Number in1/8inches (mm)	**Diameter**
3 thru 8 (10 thru 25)	6d
9, 10, 11 (29, 32, 36)	8d

14, 18 (43, 57)	10d

406S.5 - Tolerances

Fabricating tolerances for bars shall not be greater than shown on Standard (Detail) 406S-1.

406S.6 - Storing

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, paint, grease, oil or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross sectional area and tensile properties of a hand wire brushed specimen meets the physical requirements for the size and grade of steel indicated on the drawings.

406S.7 - Splices

Splicing of bars, except when indicated on the drawings or specified herein, will not be permitted without written approval of the Engineer or designated representative. No substitution of bars will be allowed without the approval of the Engineer or designated representative. Any splicing of substituted bars shall conform to the requirements in the Table below.

Splices not indicated on the drawings will be permitted in slabs not more than 15 inches (380 mm) in thickness, columns, walls and parapets.

Splices will not be permitted in bars 30 feet (9.1 meters) or less in plan length unless otherwise approved. For bars exceeding 30 feet (9.1 meters) in plan length, the distance center to center of splices shall not be less than 30 feet (9.1 meters) minus 1 splice length, with no more than 1 individual bar length less than 10 feet (3 meters). Splices not indicated on the drawings, but permitted hereby, shall conform to the Table below. The specified concrete cover shall be maintained at such splices and the bars placed in contact and securely tied together.

Minimum Lap Requirements		
Bar Number in1/8inches (mm)	**Uncoated Lap Length**	**Coated Lap Length**
3 (10)	1 foot 4 inches (0.4 meters)	2 foot 0 inches (0.610 meters)
4 (13)	1 foot 9 inches (0.533 meters)	2 foot 8 inches (0.813 meters)
5 (16)	2 foot 2 inches (0.660 meters)	3 feet 3 inches (0.991meters)
6 (19)	2 foot 7 inches (0.787 meters)	3 feet 11 inches (1.194 meters)

7 (22)	3 feet 5 inches (1.041 meters)	5 feet 2 inches (1.575 meters)
No. 8 (25)	4 feet 6 inches (1.372 meters)	6 feet 9 inches (2.057 meters)
No. 9 (29)	5 feet 8 inches (1.727 meters)	8 feet 6 inches (2.591 meters)
No. 10 (32)	7 feet 3 inches (2.210 meters)	10 feet 11 inches (3.327 meters)
No. 11 (36)	8 feet 11 inches (2.718 meters)	13 feet 5 inches (4.089 meters)

Spiral steel shall be lapped a minimum of 1 turn. Bar No. 14 and No. 18 may not be lapped.

Welded wire fabric shall be spliced using a lap length that includes an overlap of at least 2 cross wires plus 2 inches (50 mm) on each sheet or roll.

Splices using bars that develop equivalent strength and are lapped in accordance with the table above are permitted.

Welding of reinforcing bars may be used only where indicated on the drawings or as permitted herein. All welding operations, processes, equipment, materials, quality of work and inspection shall conform to the requirements indicated on the drawings. All splices shall be of such dimension and character as to develop the full strength of the bar being spliced.

End preparation for butt-welding reinforcing bars shall be done in the field, except Bar No. 6 and larger shall be done in the shop. Delivered bars shall be of sufficient length to permit this practice.

For box culvert extensions with less than 1 foot (0.3 meters) of fill, the existing longitudinal bars shall have a lap with the new bars as shown in the table above. For box culvert extensions with more than 1 foot (0.3 meters) of fill, a minimum lap of 12 inches (300 mm) will be required.

Unless otherwise indicated on the drawings, dowel bars transferring tensile stresses shall have a minimum embedment equal to the minimum lap requirements shown in the table above. Shear transfer dowels shall have a minimum embedment of 12 inches (300 mm).

406S.8 - Placement

Reinforcement shall be placed as near as possible in the position indicated on the drawings. Unless otherwise indicated on the drawings, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than ¼ inch (6 mm). Cover of concrete to the nearest surface of steel shall be as follows:

	Minimum Cover, Inches (mm)
(a) Concrete cast against and permanently exposed to earth	3 (76 mm)

(b) Concrete exposed to earth or weather:	
Bar No. 6 (19) through No. 18 bars (57)	2 (51 mm)
Bar No. 5 (16), W31 (W200) or D31 (D200) wire and smaller	1½ (38 mm)
(c) Concrete not exposed to weather or in contact with ground:	
Slabs, walls, joists:	
Bar No. 14 (43) and 18 (57)	1½ (38mm)
Bar No. 11 (36) and smaller	1 (25 mm)
Beams, columns:	
Primary reinforcement, ties, stirrups, spirals	1 ½ (38 mm)
Shells, folded plate members:	
Bar No. 6 (19) and larger	1 (25 mm)
Bar No. 5 (16), W31 (W200) or D31 (D200) wire, and smaller	1 (25 mm)

Vertical stirrups shall always pass around the main tension members and be attached securely thereto.

The reinforcing steel shall be located accurately in the forms and held firmly in place before and during concrete placement by means of bar supports that are adequate in strength and number to prevent displacement and to keep the steel at the required distance from the form surface. Bars shall be supported by means of approved galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, plastic spacers or approved precast mortar or concrete blocks when supports are in contact with removable or stay-in-place forms. Bright basic bar supports shall be used to support reinforcing steel placed in slab overlays on concrete panels or on existing concrete slabs. Bar supports in contact with soil or subgrade shall be approved.

For bar supports with plastic tips, the plastic protection must be at least 3/32 in. (2.4 mm) thick and extend upward on the wire to a point at least ½ in. (12.5 mm) above the formwork.

For approval of plastic spacers on a project, representative samples of the plastic shall show no visible indications of deterioration after immersion in a 5 percent solution of sodium hydroxide for 120 hours.

All accessories such as tie wires, bar chairs, supports, or clips used with epoxy-coated reinforcement shall be of steel, fully coated with epoxy or plastic. When approved by the Engineer or designated representative, plastic supports may also be used with epoxy-coated reinforcement.

All reinforcing steel shall be tied at all intersections, except that where spacing is less than 1 foot (300 mm) in each direction, alternate intersections only need be tied. For reinforcing steel cages for other structural members, the steel shall be tied at enough intersections to provide a rigid cage of steel. Mats of wire fabric shall overlap each other 1 full space as a minimum to maintain a uniform strength and shall be tied at the ends and edges.

Where prefabricated deformed wire mats are specified or if the Contractor requests, welded wire fabric may be substituted for a comparable area of steel reinforcing bar plan, subject to the approval of the Engineer or designated representative.

Mortar or concrete blocks shall be cast to uniform dimensions with adequate bearing area. A suitable tie wire shall be provided in each block, to be used for anchoring to the steel. Except in unusual cases and when specifically authorized by the Engineer, the size of the surface to be placed adjacent to the forms shall not exceed 2½ inches (63.5 mm) square or the equivalent thereof in cases where circular or rectangular areas are provided. Blocks shall be cast accurately to the thickness required and the surface to be placed adjacent to the forms shall be a true plane, free of surface imperfections. The blocks shall be cured by covering them with wet burlap or mats for a period of 72 hours. Mortar for blocks should contain approximately 1 part hydraulic cement to three parts sand. Concrete for blocks should contain 850 pounds of hydraulic cement per cubic yard (500 kilograms per cubic meter) of concrete

Individual bar supports shall be placed in rows at 4-ft (1.22 meters) maximum spacing in each direction. Continuous type bar supports shall be placed at 4-ft (1.22 meters) maximum spacing. Continuous bar supports shall be used with permanent metal deck forms.

The exposure of the ends of longitudinals, stirrups and spacers used to position the reinforcement in concrete pipe and in precast box culverts or storm drains is not a cause for rejection.

Reinforcing steel for bridge slabs, top slabs of direct traffic culverts, and top slabs of prestressed box beams at all intersections, except tie only alternate intersections where spacing is less than 1 ft. (300 mm) in each direction.

For steel reinforcing cages for other structural members, reinforcement shall be supported and tied in such a manner that a sufficiently rigid cage of steel is provided. Fasten mats of wire fabric securely at the ends and edges. If the cage is not adequately supported to resist settlement or floating upward of the steel, overturning of truss bars or movement in any direction during concrete placement, permission to continue concrete placement will be withheld until corrective measures are taken. Sufficient measurements shall be made during concrete placement to insure compliance with the above.

No concrete shall be deposited until the Engineer or designated representative has reviewed the placement of the reinforcing steel and all mortar, mud, dirt, etc, shall be cleaned from the reinforcement, forms, workers' boots and tools. Do not place concrete until authorized by the Engineer or designated representative

406S.9 - Handling, Placement and Repair of Epoxy-coated Reinforcement Steel

A. Handling

Systems for handling coated-reinforcement with padded contact areas shall be provided. Handling bands shall be padded to prevent damage to the coating. Bundles of coated reinforcement shall be lifted with a strongback, spreader bar, multiple supports or a platform bridge. The bundled reinforcement shall be carefully transported and stored on protective cribbing. The coated reinforcement should not be dropped or drug during handling.

B. Construction Methods

Coated reinforcement shall not be flame-cut but shall be sawn or shear-cut only when approved. Cut ends shall be coated as specified in Section C, "Repair of Coating".

Coated reinforcement steel shall not be welded or mechanically coupled except where specifically indicated on the drawings. When welding or coupling is indicated on the drawing, the epoxy coating shall be removed at least 6 in. (150 mm) beyond the weld limits before welding and 2 in. (50 mm) beyond the limits of the mechanical coupler before assembly. After the welding or coupling operation is completed the steel shall be cleaned of oil, grease, moisture, dirt, welding contamination (slag or acid residue) and rust to a near-white finish. The existing epoxy coating shall be examined for damage and any damaged or loose epoxy shall be removed to expose sound epoxy coating.

After cleaning the coated-steel, the splice area shall be coated with epoxy repair material to a thickness of 7 to 17 mils (0.18 to 0.43 mm) after curing. A second application of the repair material shall be applied to the bar and coupler interface to ensure complete sealing of the joint.

C. Repair of Coating

The material used for coating repair shall comply with the requirements of this Item and ASTM D3963/D3963M, "Specification for Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars". Repairs shall be made in accordance with procedures recommended by the manufacturer of the epoxy coating powder. For areas to be patched, a minimum coating thickness as required for the original coating shall be applied. All visible damage to the coating shall be repaired.

Sawed and sheared ends, cuts, breaks and other damage shall be promptly repaired before additional oxidation occurs. The areas to be repaired shall be cleaned to ensure that they free from surface contaminants. Repairs shall be made in the shop or in the field as required.

406S.10 - Measurement

The measurement of quantities of reinforcement furnished and placed will be based on the calculated weight of the steel actually placed as indicated on the drawings, with no allowance made for added bar lengths for splices requested by the Contractor nor for extra steel used when bars larger than those indicated on the drawings are used or for a higher grade of steel that is substituted with the permission of the Engineer or designated representative. Tie wires and supporting devices will not be included in the calculated weights. The calculated weight of bar reinforcement will be determined using the theoretical bar weight set forth in this item.

Measurement required by a change in design will be computed as described above for the actual steel required to complete the work.

406S.11 - Payment

This item shall be paid for at the contract unit price bid per pound of "Reinforcing Steel". The unit bid price shall include full compensation for all work specified herein including furnishing, bending, fabricating, welding and placing reinforcement, for all clips, blocks, metal spacers, ties, chairs, wire or other materials used for fastening reinforcement in place and for all tools, labor, equipment and incidentals necessary to complete the work.

Reinforcing steel will generally not be paid for directly, but shall be included in the unit price bid for the items of construction in which the reinforcing steel is used.

When specified in the contract bid form as a separate pay item, this item shall be paid for at the contract unit price bid per pound of "Reinforcing Steel". The unit bid price shall include full compensation for all work specified herein including furnishing, bending, fabricating, welding and placing reinforcement, for all

clips, blocks, metal spacers, ties, chairs, wire or other materials used for fastening reinforcement in place and for all tools, labor, equipment and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 406S-RC:	Reinforcing Steel	Per Pound.
Pay Item No. 406S-ERC:	Epoxy-Coated Reinforcing Steel	Per Pound.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 406S, "Reinforcing Steel"	
American Society for Testing and Materials, ASTM	
Designation	Description
ASTM A 36/A 36M	Carbon Structural Steel
ASTM A 82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 496	Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	Deformed and Plain Billet-steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	Low- Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 775/A 775M	Epoxy-Coated Reinforcing Steel Bars
ASTM A 884/A 884M	Epoxy-Coated Steel Wire and Welded Wire Fabric For Reinforcement

ASTM A 934/A 934M	Epoxy-Coated Prefabricated Reinforcing Steel Bars
ASTM A 996/A 996M	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM D3963/D3963M	Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-739-I	Sampling and Testing Epoxy Coated Reinforcing Steel
City of Austin Standard (Details)	
Designation	Description
Standard 406S-1	Reinforced Steel Tolerances
Texas Department of Transportation: Departmental Material Specifications	
Designation	Description
DMS 8130	Epoxy Powder Coating for Reinforcing Steel
American Welding Society	
Designation	Description
AWS D1.1/D1.1M	Structural Welding Code

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 406S, "Reinforcing Steel"

City of Austin Standard Specification Items

Designation	Description
Item No. 360	Concrete Pavement
Item No. 403S	Concrete for Structures
Item No. 410S	Concrete Structures
Item No. 414S	Concrete Retaining Walls
Item No. 420S	Drilled Shaft Foundations
Item No. 830S	Traffic Signal Controller Foundation
Item No. 831S	Traffic Signal Drilled Shaft Foundation

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 360	Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Hydraulic Cement Concrete
Item No. 422	Reinforced Concrete Slab
Item No. 423	Retaining Walls

Item No. 440	Reinforcing Steels

End

ITEM NO. 408S - CONCRETE JOINT MATERIALS 11-13-07

408S.1 - Description

This item shall govern the furnishing and placing of all longitudinal, transverse contraction and expansion joint material in concrete work as herein specified in the various items of these specifications as indicated or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

408S.2 - Submittals

The submittal requirements of this specification item include:

A. Type and manufacturer of all joint materials proposed for use.

B. Technical data indicating that proposed products meet the requirements specified herein.

408S.3 - Materials

(1) Preformed Asphalt Board

Preformed asphalt board formed from cane or other suitable fibers of a cellular nature securely bound together and uniformly impregnated with a suitable asphaltic binder and meeting the requirements of the Standard Specifications for Preformed Expansion Joint Filler for Concrete (Bituminous Type), ASTM D 994.

(2) Preformed Nonbituminous Fiber Material

Preformed nonbituminous fiber material shall meet the requirements of the Standard Specifications for the Preformed Expansion Joint Filler for Concrete Paving and Structural Construction, ASTM D 1751, except that the requirements pertaining to bitumen content, density and water absorption shall be voided.

(3) Boards

Boards obtained from Redwood timber, of sound heartwood, free from sapwood, knots, clustered birdseye, checks and splits. Occasional sound or hollow birdseye, when not in clusters, will be permitted provided the board is free from any other defects that will impair its usefulness as a joint filler.

(4) Joint Sealer (Concrete Pavement)

This material shall be a one part low modulus silicone especially designed to cure at ambient temperatures by reacting with moisture in the air and shall have the following properties:

As Supplied	
Color	Gray
Flow, MIL-2-8802D Sec. 4.8.4	0.2 maximum

Working Time, minutes	10Tack-Free Time at 77°F 2F (25°C 1.66°C) Min.
MIL-2-8802D Sec.4.8.7	60
Cure time, at 77°F (25°C), days	7-14
Full Adhesion, days	14-21
As Cured—-after 7 days at 77°F (25°C) and 40% RH	
Elongation, percent minimum	1200
Durometer Hardness, Shore A, points ASTM 2240	15
Joint Movement Capability, percent	+100/-50
Tensile Strength, maximum elongation,psi (kPa)	100 (689)
Peel Strength, psi (kPa)	25 (172)

The joint sealer shall adhere to the sides of the concrete joint or crack and shall be an effective seal against infiltration of water and incompressibles. The material shall not crack or break when exposed to low temperature.

(5) Backer Rod

Backer Rod shall be expanded closed cell polyethylene foam compatible with sealant. No bond or reaction shall occur between rod and sealant. Backer Rod shall be of sufficient width to be in compression after placement and shall be used with joint sealer.

(6) Joint Sealing Material

Joint Sealing Material for other than pavement use may be a two-component, synthetic polymer or cold-pourable, self leveling type meeting the following requirements:

The material shall adhere to the sides of the concrete joint or crack and shall form an effective seal against infiltration of water and incompressibles. The material shall not crack or break when exposed to low temperatures. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles. It shall cure sufficiently at an average temperature of 77°F 3°F (25°C 1.66°C) so as not to pick up under wheels of traffic in a maximum of 3 hours.

Performance Requirements:

When tested in accordance with Test Method Tex-525-C, the joint sealing material shall meet the above curing times and the requirements as follows:

It shall be of such consistency that it can be mixed and poured or mixed and extruded into joints at temperatures above 60°F (1.66°C).

Penetration 77°F (25°C), 150 gm. Cone, 5 sec., max.-cm	0.90
Bond and Extension 75%, 0F, 5 cycles:	
Dry Concrete Blocks	Pass
Wet Concrete Blocks	Pass
Steel Blocks (Primed if specified by manufacturer)	Pass
Flow at 200 °F (93°C)	None
Water content % by weight, max.	5.0
Resilience:	
Original sample min. % (cured)	50
Oven-aged at 158°F (70°C) min. %	50
For Class 1-a material only, Cold Flow (10 minute)	None

(7) Rebonded Recycled Tire Rubber

This material consists of granular particles of rubber, made by grinding automobile and truck tires, securely bound together by a synthetic resin or plastic binder. The filler must be molded into sheets of the required dimensions, which meet the testing requirements of both ASTM D 1751 and ASTM D 1752, except that the requirements for asphalt content and expansion are waived. The density of the material must be at least 30 lb/ft 3 (440kg/m3).

408S.4 - Construction Methods

The Contractor shall install "Concrete Joint Materials" which will function as a compatible system. Joint sealer shall not be placed where a bond braker is present.

Asphalt, Redwood board or other materials used shall extend the full depth of the concrete and shall be perpendicular to the exposed face. All joints shall be shaped to conform to the contour of the finished section in which they are installed. All material shall be a minimum of ½ inch (12.5 mm) thick or as indicated. Wood materials shall be anchored to the adjacent concrete to permanently hold them in place. Joint sealer shall be installed in accordance with the manufacturer's recommendations.

The material used for side walk expansion joints shall conform to No. 3 above, unless otherwise indicated.

The material used for curb and gutter expansion joints filler shall conform to any of the above, except when placed adjacent to concrete pavement, the joint material shall match the pavement joint material.

408S.5 - Measurement and Payment

No additional compensation will be made for materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item No. 408S, " Concrete Joint Materials"	
American Society for Testing and Materials (ASTM)	
Designation	Description
D 994	Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
D 1751	Specification for Preformed Expansion Joint Filler for Concrete
	Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D 1752	Specification for Preformed Sponge Rubber and Cork Expansion
	Joint Fillers for Concrete Paving and Structural Construction
D 2240	Standard Test Method for Rubber Property-Durameter Hardness
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-525-C	Tests for Asphalt and Concrete Joint Sealers

End

ITEM NO. 409S - MEMBRANE CURING 11-13-07

409S.1 - Description

This item shall govern curing concrete pavement, concrete base, pavement, curbs, gutters, retards, sidewalks, driveways, medians, islands, concrete riprap, cement stabilized riprap, concrete structures and other concrete as indicated by applying an impervious liquid membrane forming material.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

409S.2 - Submittals

The submittal requirements of this specification item include:

A. Type and manufacturer for all membrane curing materials proposed.

B. Proposed curing procedures.

409S.3 - Material

The liquid forming membrane curing compound shall comply with the "Standard Specification for Liquid Membrane-forming Compounds for Curing Concrete", ASTM C 309, Type 1-D clear or translucent, with fugitive dye or Type 2 white pigmented. The material shall have a minimum flash point of 80°F (26.7°C) when tested by the "Pensky-Martin Closed Cup Tester", ASTM D 93.

It shall be of such consistency that it can be satisfactorily applied as a fine mist through an atomizing nozzle by means of approved pressure spraying equipment at atmospheric temperatures above 40°F (4.4°C).

It shall be of such nature that it will not produce permanent discoloration of concrete surfaces nor react deleteriously with the concrete or its components. Type 1 compound shall contain a fugitive dye that will be distinctly visible not less than 4 hours nor more than 7 days after application.

Type 2 compound shall not settle out excessively or cake in the container and shall be capable of being mixed to a uniform consistency by moderate stirring and shall exhibit a daylight reflectance of not less than 60 percent of that of magnesium oxide when tested as indicated.

The compound shall produce a firm, continuous, uniform moisture impermeable film, free from pinholes and shall adhere satisfactorily to the surfaces of damp concrete. When applied to the damp concrete surface at the rate of coverage indicated, the compound shall dry to the touch in not more than 4 hours and shall not be tacky or track off concrete after 12 hours.

It shall adhere to horizontal and vertical surfaces in a tenacious film and shall not run off or show an appreciable sag, disintegrate, check, peel or crack during the required curing period.

Under traffic, the compound shall not pick up or peel and shall gradually disintegrate from the surface.

The compound shall be delivered to the job only in the manufacturer's original containers, which shall be clearly labeled with the manufacturer's name, the trade name of the material and a batch number or symbol with which test samples may be correlated.

The water retention test shall be in accordance with the following:

Percentage loss shall be defined as the water lost after the application of the curing material was applied. The permissible percentage moisture loss (at the rate of coverage specified herein) shall not exceed the following:

24 hours after application	2 percent
72 hours after application	4 percent

409S.4 - Measurement and Payment

The membrane curing compound shall be applied after the surface finishing has been completed and immediately after the free surface moisture has disappeared. The surface shall be sealed with a single uniform coating of the specified type of curing compound applied at the rate of coverage recommended by the manufacturer and directed by the Engineer or designated representative, but not less than 1 gallon per 180 square feet (3.8 liters per 16.7 square meters) of area. The Contractor shall provide satisfactory means and facilities to properly control and check the rate of application of the compound.

The compounds shall not be applied before the surface has become dry, but shall be applied just after free moisture has disappeared.

The compound shall be thoroughly agitated during its use and shall be applied by means of approved mechanical power pressure sprayers for street and bridge applications. The sprayers used to apply the membrane to concrete exposed surfaces shall travel at a uniform speed along the forms and be mechanically driven. The equipment shall be of such design that it will insure uniform and even application of the membrane material. The sprayers shall be equipped with satisfactory atomizing nozzles. On small miscellaneous items or on interim bridge deck curing will the Contractor be permitted to use hand-powered spray equipment. For all spraying equipment, the Contractor shall provide facilities to prevent the loss of the compound between the nozzle and the concrete surface during the spraying operations.

At locations where the coating shows discontinuities, pinholes or other defects or if rain falls on the newly coated surface before the film has dried sufficiently to resist damage, an additional coat of the compound shall be applied immediately at the same rate of coverage specified herein.

To insure proper coverage, the Engineer or designated representative shall inspect all treated areas after application of the compound for the period of time designated in the specification for curing, either for membrane curing or for other methods. Dry areas are identifiable because of the lighter color of dry concrete as compared to damp concrete. All suspected areas shall be tested by placing a few drops of water on the suspected areas. If the water stands in rounded beads or small pools which can be blown along the surface of the concrete without wetting the surface, the water impervious film is present. If the water wets the surface of the concrete as determined by obvious darkening of the surface or by visible soaking into the surface, no water-impervious film is present. Should the foregoing test indicate that any area during the curing period is not protected by the required water-impervious film an additional coat or coats of the compound shall be applied immediately and the rate of application of the membrane compound shall be increased until all areas are uniformly covered by the required water-impervious film.

The compounds shall not be applied to a dry surface and if the surface of the concrete has become dry, it shall be thoroughly moistened prior to the application of the membrane by fogging or mist application. Sprinkling or coarse spraying will not be allowed.

When temperatures are such as to warrant protection against freezing, curing by this method shall be supplemented with an approved insulating material capable of protecting the concrete for the specified curing period.

If at any time there is reason to believe that this method of curing is unsatisfactory or is detrimental to the work, the Contractor, when notified, shall immediately cease the use of this method and shall change to curing by one of the other methods specified under this contract.

Curing compounds shall be compatible with the adhesion of toppings or overlays where curing has been applied to the concrete base surface in order to assure adequate bond.

When forms are stripped before the 4 minimum curing days have passed, curing shall continue by an approved method.

409S.5 - Measurement and Payment

Membrane curing will not be measured for payment. The work and materials prescribed herein will not be paid for directly, but shall be included in the unit price bid for the item of construction in which these materials are used.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 409S, "Membrane Curing"	
American Society for Testing and Materials (ASTM)	
Designation	Description
C 309	Liquid Membrane-forming Compounds for Curing Concrete
D 93	Pensky-Martin Closed Cup Tester

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 409S, "Membrane Curing"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description

Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 437	Concrete Admixtures
Item 520	Weighing and Measuring Equipment
Item 522	Portland Cement Concrete Plants
Item 524	Hydraulic Cement

End

ITEM NO. 410S - CONCRETE STRUCTURES 9-26-12

410S.1 - Description

This item shall govern the construction of all types of structures involving the use of structural concrete, except where the requirements are waived or revised by other governing specifications.

All concrete structures shall be constructed in accordance with the design requirements and details indicated on the drawings, in conformity with the pertinent provisions of the items contracted for, the incidental items referred to and in conformity with the requirements herein.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

410S.2 - Submittals

The submittal requirements of this specification item may include:

Appropriate mix designs for class of concrete for each type of structure or unit;

Appropriate mortar and grout mix designs;

Product name, description, technical information and supplier of any acrylic-polymer latex admixture;

Type, supplier and certified test results for expansion joint materials;

Type of waterstop and confirmation that the product conforms to TxDoT DMS-6160;

Type and manufacturer of proposed evaporation retardant and confirmation that it meets the requirements of test results for TxDoT DMS-4650;

Type and manufacturer of proposed chemical admixtures and confirmation that it meets the requirements of test results for TxDoT DMS-4640;

Type and manufacturer of proposed curing admixtures and confirmation that it meets the requirements of test results for TxDoT DMS-4640;

Type and manufacturer of proposed chemical admixtures and confirmation that it meets the requirements of test results for TxDoT DMS-4640;

Type and manufacturer of proposed epoxy and/or adhesives and confirmation that it meets the requirements of test results for TxDoT DMS-6100;

Reinforcing steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

Contractors formwork plan for placing and consolidating concrete around wall penetrations and at locations designated as having congested reinforcing steel.

410S.3 - Materials

A. Concrete

Concrete shall conform to Item No. 403S, "Concrete for Structures".

The class of concrete for each type of structure or unit shall be as indicated on the drawings or by pertinent governing specifications.

B. Grout or Mortar

When required or shown on the drawings, mortar and grout consisting of 1 part hydraulic cement and 2 parts sand with sufficient water to provide the desired consistency shall be provided. Mortar shall be provided with a consistency that can be handled easily and spread by a trowel. Grout shall be provided with a consistency that will flow into and completely fill all voids.

C. Latex

When required an acrylic-polymer latex admixture (acrylic resin emulsion in accordance with TxDoT DMS-4640, "Chemical Admixtures for Concrete") suitable for producing polymer-modified concrete or mortar shall be provided. The latex shall not be allowed to freeze.

The following information shall be submitted for latex:

Name and information of company contact personnel,

Product name and polymer description, and

The latex shall meet the following requirements.

Table 1: LATEX ADDITIVE REQUIREMENTS

Property	Value
Total Solids, minimum, percent	47
PH	9.0 to 11.0
Brookfield viscosity (# 1 spindle @ 10 rpm), mPas, maximum	60
Butadiene Content, percent	30 to 40
Freeze-thaw stability, 2 cycles. maximum	0.1

Specification targets and production tolerances shall also be provided for the following properties.

1. viscosity (including test method and temperature reference),
2. percent solids,
3. pH,
4. specific gravity, and
5. styrene/butadiene ratio.

D. Reinforcing Steel

Reinforcing steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

E. Expansion Joint Material

The expansion joint material shall conform to the requirements of TxDoT DMS-6310, "Joint Materials and Fillers".

1. Preformed Fiber Sheets

   Unless otherwise indicated on the drawings preformed bituminous fiber material shall be provided. The preformed fiber material shall conform to the dimensions indicated on the drawings. Preformed fiber sheets shall meet the requirements of ASTM D-1751, "Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types). The requirements related to bitumen content, density and water absorption shall not apply to nonbituminous materials.

2. Joint Sealing Material

   Unless otherwise indicated on the drawings a Class 4, 5 or 7 low-modulus silicone sealant shall be provided that conforms to the requirements of TxDoT DMS-6310, "Joint Sealants and Fillers".

3. Timber Boards

   Timber boards shall be made from redwood or cypress and must be free from sapwood, knots, clustered bird's eye, checks and splits. When oven dried at 230°F (110°C) to a constant weight (mass), the density of the board shall be between 20 and 35 lbs. Per cubic foot (between 320 and 560 kgs per cubic meter)

4. Asphalt Board

   Asphalt Board shall conform to the dimensions indicated on the drawings and shall meet the description, general requirements and distortion testing of ASTM D-994, "Preformed Expansion Joint Filler for Concrete (bituminous Type)".

5. Rebonded Neoprene Filler Sheet

   Rebonded neoprene filler shall consist of ground closed cell neoprene particles, rebonded and molded into sheets of uniform thickness of the dimensions indicated on the drawings. These sheets shall meet the requirements of ASTM D-1752, Type I.

   The manufacturer shall furnish the Engineer or designated representative with certified test results as to the compliance with the above requirements.

F. Waterstop

Unless otherwise indicated on the drawings, rubber waterstops or Polyvinyl Chloride (PVC) waterstops that conform to TxDoT DMS-6160, "Waterstops, Nylon Reinforced Neoprene Sheet, and Elastomeric Pads" shall be provided.

G. Evaporation Retardants

Evaporation retardants shall conform to the requirements of TxDoT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants". The evaporation retardant must be a commercially available monomolecular film compound. The evaporation retardant shall have no adverse effect on the cement hydration process or the concrete and shall reduce surface moisture evaporation from the concrete when performing concrete operations in direct sun, wind, high temperatures, or low relative humidity. The producer of the evaporation retardant shall certify that it meets these specified requirements.

H. Curing Materials

1. Liquid Membrane Forming compounds

Liquid Membrane Forming compounds shall conform to the requirements of TxDoT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants". The compound shall be applied to damp concrete as a fine mist through atomizing nozzles at a wet film thickness of 8 to 9 mils (200 to 230 µm). The liquid membrane-forming compound must not react deleteriously with concrete or its components. It must produce a firm, continuous, uniform moisture-impermeable film that is free of pinholes, cracks, or other film defects. It must also exhibit satisfactory adhesion.

The consistency must be such that the compound can be applied satisfactorily by conventional or airless spray at atmospheric and material temperatures above 40°F (5°C) without thinning. When applied at the manufacturer's recommended thickness, not less than 8 mils (200 µm) wet, to vertical surfaces of damp concrete, the compound must not run off or appreciably sag. The liquid membrane-forming compound must not disintegrate, check, peel, or crack during the required curing period. It must not peel or pick up under traffic, and must disappear from the surface of the cured concrete by gradual disintegration.

2. Cotton Mats

Cotton mats shall consist of a filling material of cotton "bat" or "bats" [at least 12 oz. Per square yard (400 grams per square meter)] completely covered with unsized cloth [at least 6 oz. Per square yard (200 grams per square meter)] stitched longitudinally with continuous parallel rows of stitching spaced at less than 4 in. (100 mm), or tuft both longitudinally and transversely at intervals less than 3 in. (75 mm).

The cotton mats shall be free from tears and in good general condition. A flap at least 6 in. (150 mm) wide with two (2) thicknesses of the covering that extends along one side of the mat shall be provided.

3. Polyethylene Sheeting

The polyethylene sheeting shall be at least 4 mils thick (0.1 mm) and free from visible defects. Clear or opaque white sheeting shall be provided when the ambient temperature during curing exceeds 60°F (15°C) or when applicable to control temperature during mass pours.

4. Burlap-Polyethylene Mats

The burlap-polyethylene mats shall be made from burlap impregnated on 1 side with a film of opaque white-pigmented polyethylene, free from visible defects. The laminated mats shall have at least 1 layer of an impervious material such as polyethylene, vinyl plastic, or other acceptable material (either as a solid sheet or impregnated into another fabric) and shall be free of visible defects.

I. Chemical Admixtures

Chemical admixtures including water reducing, placticizers and air entrainment shall conform to TxDoT DMS-4640, "Chemical Admixtures for Concrete" Calcium chloride shall not be used. Admixtures shall be included in the prequalified concrete admixtures list maintained by TxDot's Construction Division.

J. City of Austin Survey Monuments

The Public Works Department may furnish permanent survey monuments to be cast in concrete as indicated on the drawings or as directed by the Engineer or designated representative.

K. Epoxy

Unless indicated otherwise on the drawings, epoxy materials shall conform to TxDoT DMS-6100, "Epoxy and Adhesives".

410S.4 - General Requirements

Before starting work, the Contractor shall inform the Engineer or designated representative fully of the construction methods the Contractor proposes to use, the adequacy of which shall be subject to the review by the Engineer or designated representative. Drawings for forms and falsework for piers and superstructure spans over 20 feet (6 meters) long, bracing systems for girders when the overhang exceeds 3 ft. 6 in. (1 meter) and for all bridge widening details shall be submitted to the Engineer or designated representative for review, if requested. Similar drawings shall be submitted for other units of the structure, if requested by the Engineer or designated representative. The drawings shall be prepared on standard 22 inch by 36-inch (550mm by 900 mm) sheets and shall show all essential details of the proposed forms, falsework and bracing to permit a structural analysis. Four sets of such drawings will be required.

Concurrence on the part of the Engineer or designated representative in any proposed construction methods, approval of equipment or of form and falsework drawings does not relieve the Contractor of the responsibility for the safety or correctness of the Contractor's methods, adequacy of equipment or from carrying out the work in full accordance with the contract.

Unless otherwise indicated on the drawings, the requirements in the succeeding paragraphs shall govern the time sequence in which construction operations may be carried on and for the opening of completed structures to traffic:

Superstructure members, forms, falsework or erection equipment shall not be placed on the substructure before the concrete therein has attained a 3000 psi (20.7 MPa) compressive strength.

Storage of materials on completed portions of a structure will not be permitted until all curing requirements for those particular portions have been met.

No forms shall be erected on concrete footings supported by piling or drilled shafts until the concrete therein has attained a minimum compressive strength of 2500 psi (17.2 MPa). Such work may begin on spread footings after the therein has aged at least 2 curing days. Concrete may be placed as soon as the forms and reinforcing steel are approved by the Engineer or designated representative.

The support of tie beam and/or forms by falsework placed on previously placed tie beams is permissible provided such beams have attained 3000 psi (20.7 MPa) compressive strength, curing requirements are completed and the beams are properly supported to eliminate stresses not provided for in the design.

Bridges and direct traffic culverts shall not be opened to construction traffic or to the traveling public until authorized by the Engineer or designated representative in accordance with the following:

Authorization may be given after the last slab concrete has been in place at least 14 days for light construction traffic not to exceed a ¾-ton (0.68 Mg) vehicle. Authorization to place embankments to allow normal construction traffic and when necessary to the traveling public, may be given after the last slab concrete has been in place 30 days or when the minimum compressive strength (fc') has reached the 28 day strength conforming to Item No. 403S, "Concrete for Structures" or as indicated on the drawings.

410S.5 - Drains

Weep holes and roadway drains shall be installed and constructed as indicated on the drawings.

410S.6 - Expansion Joints

Joints and devices shall be used to provide for expansion and contraction of concrete slabs and shall be constructed as indicated on the drawings.

The bearing area under the expansion ends of concrete slabs and slab and girder spans shall be given a steel trowel finish and finished to the exact grades required on the drawings. The material used to separate expansion surfaces shall be as indicated on the drawings and placed so that concrete or mortar cannot be subsequently worked around or under it. The bridging of concrete or mortar around expansion joint material in bearings and expansion joints shall be prevented.

Concrete adjacent to armor joints and finger joints shall be placed carefully to avoid defective anchorage and porous or honeycombed concrete in such areas.

All open joints and joints to be filled with expansion joint material shall be constructed using forms adaptable to loosening or early removal. To avoid expansion or contraction damage to the adjacent concrete, these forms shall be loosened as soon as possible after final concrete set to permit free movement of the span without requiring full form removal.

Preformed fiber joint material or other material indicated shall be used in the vertical joints of the roadway slab, curb, median or sidewalk. The top 1-inch (25 mm) thereof shall be filled with joint sealing material, as specified herein. The sealer shall be installed in accordance with Standard Specification Item No. 413S, "Cleaning and/or Sealing Joints and Cracks (PC Concrete)" and the manufacturer's recommendations.

Prior to placing the sealing material, the vertical faces of the joint shall be cleaned of all laitance by sandblasting or by mechanical routing. Cracked or spalled edges shall be repaired. The joint shall be blown clean of all foreign material and sealed.

Where preformed fiber joint material is used, it shall be anchored to the concrete on one side of the joint by light wire or nails to prevent the material from falling out.

Finished joints shall conform to the drawing details with the concrete sections completely separated by the specified opening or joint material.

Soon after form removal and where necessary after surface finishing, all projecting concrete shall be removed along exposed edges to secure full effectiveness of the expansion joints.

410S.7 - Construction Joints

The joint formed by placing plastic concrete in direct contact with concrete that has attained its initial set shall be deemed a construction joint. The term monolithic placement shall be interpreted to mean that the manner and sequence of concrete placing shall not create construction joints.

Construction joints shall be of the type and at the locations indicated on the drawings. Additional joints will not be permitted without written authorization from the Engineer or designated representative and when authorized, shall have details equivalent to those indicated for joints in similar locations.

Unless otherwise provided, construction joints shall be square and normal to the forms. Bulkheads shall be provided in the forms for all joints, except when horizontal. All vertical construction joints shall be chamfered. All horizontal construction joints shall be routed or grooved.

Construction joints requiring the use of joint sealing material shall be as indicated on the drawings or as directed by the Engineer or designated representative. The material will be indicated on the drawings without reference to joint type.

A concrete placement terminating at a horizontal construction joint shall have the top surface roughened thoroughly as soon as practicable after initial set is attained. The surfaces at bulkheads shall be roughened as soon as the forms are removed.

The hardened concrete surface shall be thoroughly cleaned of all loose material, laitance, dirt or foreign matter and saturated with water so it is moist when placing fresh concrete against it. Remove all free

water and moisten the surface before concrete or bonding grout is placed against it. Forms shall be drawn tight against the existing concrete and the joint surface flushed with grout just prior to placing the fresh concrete.

The joint surface shall be coated with bonding mortar, grout, epoxy or other material as indicated on the drawings or other items. A Type V epoxy shall be provided in accordance with TxDoT DMS-6100, "Epoxies and Adhesives" for bonding fresh concrete to hardened concrete. The epoxy shall be placed on a clean dry surface and the fresh concrete shall be placed while the epoxy is still tacky. Bonding mortar or grout shall be placed on a surface that is saturated surface dry and the concrete shall be placed before the bonding mortar or grout dries. Other bonding agents shall be placed in accordance with the manufacturer's recommendations.

410S.8 - Foundation and Substructure

Excavation for foundations and substructure shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill".

Concrete for foundation seals, unless otherwise indicated on the drawings, shall be Class C Concrete with a coarse aggregate grade of 2, 3, 4 or 5 and placed in accordance with the requirements herein. The top of the completed seal shall not vary from plan grade or the grade established by the Engineer or designated representative.

Where a concrete seal is indicated on the Drawings, the design will be based on the normal water elevation as indicated on the Drawings. If the foundation concrete can be placed in the dry at the time of construction, the seal will not be required. If additional seal is necessary for the conditions existing during the time of construction, its thickness shall be increased as deemed necessary by the Contractor and at the Contractor's expense. If the conditions existing at the time of construction require a seal for placing the foundation concrete in the dry and none is indicated on the Drawings, the Contractor shall place an adequate seal at the Contractor's expense.

The seal shall be allowed to set for at least 36 hours before the caisson or cofferdam is dewatered, after which the top of the seal shall be cleaned of all laitance or other soft material and all high spots exceeding the above limitation shall be cut off and removed.

410S.9 - Falsework

The Contractor is totally responsible for all falsework. The Contractor shall design and construct it to safely carry the maximum anticipated loads and to provide the necessary rigidity. Details of falsework construction shall be subject to review by the Engineer or designated representative, but Engineer's review shall in no way relieve the Contractor of responsibility of the adequacy and safety of the falsework design.

All timber used in falsework centering shall be sound, in good condition and free from defects which will impair its strength. When wedges are used to adjust falsework to desired elevations, they shall be used in pairs to insure even bearing.

Sills or grillages shall be large enough to support the superimposed load without settlement and unless founded on solid rock, shale or other hard materials, precautions shall be taken to prevent yielding of the supporting material.

Falsework, which cannot be founded on a satisfactory spread footing, shall be placed on piling driven to a bearing capacity sufficient to support the superimposed load without settlement. The safe bearing capacity of piling shall be determined by test loads or by such other methods that may be required or acceptable to the Engineer or designated representative.

In general, each falsework bent shall be capped transversely by a member of proper size. A short cap section forming a T-head may be substituted to permit the removal of portions of the forms without disturbing the falsework. Caps shall be securely fastened to each pile or column in the bent and set at the proper elevation to produce, in conjunction with the use of approved wedges or jacks, permanent camber indicated on the Drawings, plus a construction camber covering allowance for deformation of the forms and falsework. The use of wedges to compensate for incorrectly cut bearing surfaces will not be permitted. Each falsework bent shall be securely braced to provide the stiffness required with the bracing securely fastened to each pile or column it crosses.

In setting falsework for arches, allowances shall be made for settlement of falsework, deflection of the arch and permanent camber. Provision shall be made by suitable wedges, sand jacks or other acceptable devices for the controlled lowering of falsework when the arch is swung. Falsework may be required to be placed on jacks to provide for settlement correction during concrete placement.

When the falsework is no longer required, it shall be removed. Falsework piling shall be pulled or cut off not less than 2 feet (0.6 meter) below finished ground level. Falsework and piling in a stream, lake or bay shall be completely removed to a point specified by the Engineer or designated representative to prevent any obstruction to the waterway.

410S.10 - Forms

Forms for precast prestressed concrete members and for prestressed piling shall be constructed conforming to Item No. 425S, "Prestressed Concrete Structures".

A. General

Except where otherwise indicated on the drawings, forms may be of either timber or metal.

Forms for round columns exposed to view shall be of steel, except that other materials will be allowed with written permission of the Engineer or designated representative.

Forming plans shall be submitted for approval by the Engineer or designated representative. Forms shall be designed for the pressure exerted by a liquid weighing 150 pounds per cubic foot (2.4 Mega grams per cubic meter). The rate of placing the concrete shall be taken into consideration in determining the depth of the equivalent liquid. For job-fabricated forms an additional live load of 50 pounds per square foot (1.675 MPa) shall be allowed on horizontal surfaces. The maximum unit stresses shall not exceed 125 percent of the allowable stresses used by the Engineer or designated representative for the design of structures.

Formwork for wall and/or column pours equal or exceeding 8 feet (2.44 meters) shall be designed in accordance with ACI 347, "Guide to Formwork for Concrete" and sealed by a Registered Civil Engineer Licensed in the State of Texas, who is experienced in formwork design.

Commercially produced structural units used in formwork shall not exceed the manufacturer's maximum allowable working load for moment, shear or end reaction. The maximum working load shall include a live load of 35 pounds per square foot (1.175 MPa) of horizontal form surface and sufficient details and data shall be submitted for use in checking formwork details for approval.

Forms shall be practically mortar-tight, rigidly braced and strong enough to prevent bulging between supports and maintained to the proper line and grade during concrete placement. Forms shall be maintained in a manner that will prevent warping and shrinkage.

Deflections due to cast-in-place slab concrete and railing shown in the dead load deflection diagram shall be taken into account in the setting of slab forms.

All forms and footing areas shall be cleaned of any extraneous matter before placing concrete.

Permission to place concrete will not be given until all of such work is complete to the satisfaction of the Engineer or designated representative.

If, at any stage of the work, the forms show signs of bulging or sagging, the portion of the concrete causing such condition shall be removed immediately, if necessary and the forms shall be reset and securely braced against further movement.

B. Timber Forms

Lumber for forms shall be properly seasoned, of good quality and free from imperfections, which would affect its strength or impair the finished surface of the concrete. The lumber used for facing or sheathing shall be finished on at least 1 side and 2 edges and shall be sized to uniform thickness.

Form or form lumber that will be reused shall be maintained clean and in good condition. Lumber that is split, warped, bulged, or marred or that has defects that will produce inferior forms shall not be used but shall be removed from the work.

Form lining will be required for all formed surfaces, except for the inside of culvert barrels, inlets, manholes and box girders, the bottom of bridge decks between beams or girders, surfaces that are subsequently covered by backfill material or are completely enclosed and any surface formed by a single finished board. Lining will not be required when plywood forms are used.

Form lining shall be of an approved type such as masonite or plywood. Thin membrane sheeting such as polyethylene sheets shall not be used for form lining.

Forms may be constructed of plywood not less than ¾ inch (19 mm) in thickness, with no form lining required. The grain of the face plies on plywood forms shall be placed parallel to the span between the supporting studs or joists.

Plywood used for forming surfaces, which remain exposed, shall be equal to that specified as B-B Plyform Class I or Class II Exterior of the U.S. Department of Commerce Voluntary Product Standard, PS 1.

Studs and joists shall be spaced so that the facing form material remains in true alignment under the imposed loads.

Wales shall be spaced close enough to hold forms securely to the designated lines and scabbed at least 4 feet (1.22 meters) on each side of joints to provide continuity. A row of wales shall be placed near the bottom of each placement.

Facing material shall be placed with parallel and square joints and securely fastened to supporting studs.

Forms for surfaces receiving only an ordinary finish and exposed to view shall be placed with the form panels symmetrical, i.e., long dimensions set in the same direction. Horizontal joints shall be continuous.

Molding specified for chamfer strips or other uses shall be made of materials of a grade that will not split when nailed and which can be maintained to a true line without warping. Wood molding shall be mill cut and dressed on all faces. Unless indicated otherwise on the drawings, forms shall be filleted at all sharp corners and edges with triangular chamfer strips measuring ¾ inch (19 mm) on the sides.

Forms for railings and ornamental work shall be constructed to standards equivalent to first class millwork. All moldings, panel work and bevel strips shall be straight and true with neatly mitered joints designed so the finish work is true, sharp and clean cut. All forms shall be constructed to permit their removal without marring or damaging the concrete. The forms may be given a slight draft to permit ease of removal.

Metal form ties of an approved type or a satisfactory substitute shall be used to hold forms in place and shall be of a type that permits ease of removal of the metal as hereinafter specified.

All metal appliances used inside of forms for alignment purposes shall be removed to a depth of at least ½ inch (13 mm) from the concrete surface. They shall be made so the metal may be removed without undue chipping or spalling and when removed, shall leave a smooth opening in the concrete surface. Burning off of rods, bolts or ties will not be permitted.

Any wire ties used shall be cut back at least ½ inch (13 mm) from the face of the concrete and properly patched.

Devices holding metal ties in place shall be capable of developing the strength of the tie and adjustable to allow for proper alignment.

Metal and wooden spreaders, which are separate from the forms, shall be removed entirely as the concrete is being placed.

Adequate clean-out openings shall be provided for narrow walls and other locations where access to the bottom of the forms is not readily attainable.

Prior to placing concrete, the facing of all forms shall be treated with oil or other bond breaking coating of such composition that it will not discolor or otherwise injuriously affect the concrete surface. Care shall be exercised to prevent coating of the reinforcing steel.

C. Metal Forms

The foregoing requirements for timber forms as regards design, mortar-tightness, filleted corners, beveled projections, bracing, alignment, removal, reuse and wetting shall also apply to metal forms, except that these will not require lining, unless specifically indicated on the drawings.

The thickness of form metal shall be as required to maintain the true shape without warping or bulging. All bolt and rivet heads on the facing sides shall be countersunk. Clamps, pins or other connecting devices shall be designed to hold the forms rigidly together and to allow removal without injury to the concrete. Metal forms, which do not present a smooth surface or line up properly, shall not be used. Metal shall be kept free from rust, grease or other foreign materials.

D. Form Supports for Overhang Slabs

Form supports which transmit a horizontal force to a steel girder or beam or to a prestressed concrete beam will be permitted, but shall not be used unless a structural analysis has been made of the affect on the girder or beam and approval is granted by the Engineer or designated representative.

In normal or skewed spans with standard overhangs not exceeding 3 feet, 1 ½ inches (0.95 meter), beam bracing as shown in the drawings shall be used.

Spans in which the overhang width exceeds 3 feet, 1½ inches (0.95 meter) will require additional support for the outside beams to resist torsion. Details of the Contractor's proposed method of providing additional support shall be included with the slab forming plans submitted to the Engineer or designated representative for review and approval.

Holes in steel members for support of overhang brackets may be punched or drilled full size or may be torch cut to ¼ inch (6 mm) under size and reamed full size. In no case shall the holes be burned full size. The hole shall be left open unless indicated to be filled with a button head bolt. They shall never be filled by welding.

410S.11 - Placing Reinforcement

Reinforcement in concrete structures shall be placed carefully and accurately and rigidly supported as provided in Standard Specification Item No. 406S, "Reinforcing Steel". Reinforcing steel supports shall not be welded to I-beams or girders or stirrups of prestressed concrete beams.

410S.12 - Placing Concrete

A. General

Concrete shall not be placed when impending weather conditions would impair the quality of the finished work. If conditions of wind, humidity and temperature are such that concrete cannot be placed without the potential for shrinkage cracking, the concrete should be placed in early morning, at night or on a schedule with more favorable weather. When mixing, placing and finishing concrete is scheduled during non-daylight hours; the entire placement site should be illuminated to the satisfaction of the Engineer or designated representative.

If changes in weather conditions require protective measures after work starts, adequate shelter shall be provided to protect the concrete against damage from rainfall or from freezing temperatures as outlined in this Item. Operations during rainfall shall only be continued if approved by the Engineer or designated representative. Aggregate stockpiles shall be covered to the extent necessary to control the moisture conditions in the aggregates.

Slab concrete shall be mixed in a plant located off the structure. Carting or wheeling concrete batches over completed slabs will not be permitted until they have aged at least 4 full curing days or timber planking placed on top of the slab for the carts to traverse along. Carts shall be equipped with pneumatic tires. Curing operations shall not be interrupted for the purpose of wheeling concrete over finished slabs.

Exposed concrete surfaces, while still plastic, shall be stamped with an impression having the Contractor's name, the month and year. The stamp shall be of an approved design.

At least 1 day of curing shall be allowed after the concrete has achieved initial set before placing strain on projecting reinforcement to prevent damage to the concrete.

The storing of reinforcing or structural steel on completed roadway slabs generally shall be avoided and when permitted, shall be limited to quantities and distribution that will not induce excessive stresses.

B. Preparation of Surfaces

All forms, prestressed concrete panels, T-beams and concrete box beams on which concrete will be placed shall be thoroughly wetted before the placement of concrete. Puddles of excess water shall be removed before placing the concrete. The various surfaces shall be in a moist, saturated surface dry condition when concrete is placed on or against them.

The subgrade or foundation shall be moist before placing concrete for bridge approach slabs or other concrete placed on grade. If dry the subgrade shall be lightly sprinkled.

C. Placing Temperature

The minimum temperature of all concrete at the time of placement shall not be less than 50°F (10°C). The maximum temperature of any concrete, unless otherwise indicated on the drawings, shall not exceed 95°F (35°C) when placed. The maximum temperature of cast-in-place concrete in bridge superstructures, diaphragms, parapets, concrete portions of railing, curbs and sidewalks and direct traffic box culverts shall not exceed 85°F (30°C) when placed. Other portions of structures, when indicated on the drawings, shall require the temperature control specified.

For continuous placement of the deck on continuous steel units, the initial set of the concrete shall be retarded sufficiently to insure that it remains plastic in not less than 3 spans immediately

preceding the one being placed. For simple spans, retardation shall be required only if necessary to complete finishing operations.

The consistency of the concrete as placed should allow the completion of all finishing operations without the addition of water to the surface. When conditions are such that additional moisture is needed for finishing, the required water shall be applied to the surface by fog spray only and shall be held to a minimum amount. Fog spray for this purpose may be applied with hand operated fogging equipment.

The height of free fall of concrete shall be limited to 5 feet (1.575 meters) to prevent segregation.

D. Transporting Time

The maximum time interval between the addition of cement to the batch and the placing of concrete in the forms shall not exceed the following:

Table 2: Allowable Transportation Times

Air or Concrete Temperature whichever is higher	Maximum Time w/o Retarder	Maximum Time with Retarder	
		*Specific Applications	All others
Non-agitated Concrete			
35°F to 79°F (2°C to 26°C)	45 minutes	45 minutes	45 minutes
Over 80°F (Over 25°C)	30 minutes	45 minutes	45 minutes
Agitated Concrete			
90°F (32°C) or above	45 minutes	75 minutes	105 minutes
75°F to 89°F (24°C to 32°C)	60 minutes	90 minutes	120 minutes
35°F to 74°F (2°C to 23°C)	90 minutes	120 minutes	150 minutes

* Specific applications include Bridge decks, cased drilled shafts and slabs of direct traffic culverts

The use of an approved retarding agent in the concrete will permit the extension of each of the above temperature-time maximums by 30 minutes for bridge decks, top slabs of direct traffic culverts and cased drilled shafts and 1 hour for all other concrete except that the maximum time shall not exceed 45 minutes for non-agitated concrete.

E. Handling and Placing

The Contractor shall give the Engineer or designated representative sufficient advance notice before placing concrete in any unit of the structure to permit the review of forms, reinforcing steel placement and other preparations. Concrete shall not be placed in any unit prior to the completion of formwork and placement of reinforcement therein.

The sequence for placing concrete shall be as indicated on the drawings or as required herein. The placing shall be regulated so the pressures caused by the plastic concrete shall not exceed the loads used in the form design.

The method of handling, placing and consolidation of concrete shall minimize segregation and displacement of the reinforcement and produce a uniformly dense and compact mass. Concrete shall not have a free fall of more than 5 feet (1.5 meters), except in the case of drilled shafts, thin wall sections such as in culverts, or as allowed by other Items. Any hardened concrete spatter ahead of the plastic concrete shall be removed.

Each part of the forms shall be filled by depositing concrete as near its final position as possible. The coarse aggregate shall be worked back from the face and the concrete forced under and around the reinforcement bars without displacing them. Depositing large quantities at one point and running or working it along the forms will not be allowed.

Concrete shall be deposited in the forms in layers of suitable depth but not more than 36 inches (0.9 meter) in thickness, unless otherwise directed by the Engineer or designated representative.

Cold joints in a monolithic placement shall be avoided. The sequence of successive layers or adjacent portions of concrete shall be such that they can be vibrated into a homogeneous mass with the previously placed concrete without a cold joint. Not more than 1 hour (1 ½ hours if a normal dosage of retarding admixture is used) shall elapse between adjacent or successive placements of concrete. Unauthorized construction joints shall be avoided by placing all concrete between the authorized joints in one continuous operation.

An approved retarding agent shall be used to control stress cracks and/or authorized cold joints in mass placements where differential settlement and/or setting time may induce stress cracking, such as on false work, in deep girder stems, etc.

Openings in forms shall be provided, if needed, for the removal of laitance or foreign matter of any kind.

All forms shall be wetted thoroughly before the concrete is placed therein.

F. Consolidation

All concrete shall be carefully consolidated and the mortar flushed to the form surfaces by continuous working with immersion type vibrators. Vibrators which operate by attachment to forms or reinforcement will not be permitted, except on steel forms. At least 1 standby vibrator shall be provided for emergency use in addition to the ones required for placement. For lightweight concrete, vibrators of the high frequency type, which produce a minimum of 7000 impulses per minute, will be required.

The concrete shall be vibrated immediately after deposition. Prior to the beginning of work, a systematic spacing of the points of vibration shall be established to insure complete consolidation and thorough working of the concrete around the reinforcement, embedded fixtures and into the

corners and angles of the forms. Immersion type vibrators shall be inserted vertically, at points 18 to 30 inches (450 to 750 mm) apart and slowly withdrawn. The vibrator may only be inserted in a sloping or horizontal position in shallow slabs. The entire depth of each lift shall be vibrated, allowing the vibrator to penetrate several inches (several cms) into the preceding lift. The vibrator shall not be used to move the concrete to other locations. In addition the vibrator shall not be dragged through the concrete. Concrete along construction joints shall be thoroughly consolidated by operating the vibrator along and close to but not against the joint surface. The vibration shall continue until thorough consolidation and complete embedment of reinforcement and fixtures is produced, but not long enough to cause segregation. Vibration may be supplemented by hand spading or rodding, if necessary, to insure the flushing of mortar to the surface of all forms.

G. Finishing

From the time of initial strike off until final finish is completed and required interim curing is in place, the unformed surfaces of slab concrete in bridge decks and top slab of direct traffic culverts and concrete slabs, shall be kept damp, not wet, to offset the effects of rapid evaporation of mixing water from the concrete due to wind, temperature, low humidity or combinations thereof. Fogging equipment capable of applying water in the form of a fine fog mist, not a spray, will be required. Fogging will be applied at the times and in the manner directed by the Engineer or designated representative.

Fogging equipment may be either water pumped under high pressure or a combination of air and water, either system in combination with a proper atomizing nozzle. The equipment shall be sufficiently portable for use in the direction of any prevailing winds. The equipment shall be adapted for intermittent use to prevent excessive wetting of the surfaces.

Upon completion of the final finish, interim curing will be required for slab concrete in bridge decks and top slabs of direct traffic culverts as follows:

(1) Required water curing shall begin as soon as it can be done without damaging the concrete finish.

(2) Unless otherwise indicated on the Drawings, Type 1-D membrane curing compound that conforms to TxDoT DMS-4650, "Hydraulic Cement Concrete Curing Materials and Evaporation Retardants" shall be applied to the slab surface.

H. Installation of Dowels and Anchor Bolts

Dowels and anchor bolts shall be installed by casting them in place or by grouting with grout, epoxy, or epoxy mortar unless indicated otherwise on the drawings.

Holes for grouting shall be formed or drilled. Holes for anchor bolts shall be drilled to accommodate the bolt embedment required on the drawings. Holes for dowels shall be made at least 12 in. (300 mm) deep unless indicated otherwise on the drawings. When grout or epoxy mortar is specified the diameter of the hole shall be at least twice the dowel or bolt diameter but shall not exceed the dowel or bolt diameter plus 1 ½ in (38 mm). When epoxy is specified the hole diameter should be 1/16 to ¼ in. (1.6 to 6.35 mm) greater than the dowel or bolt diameter.

Holes for anchor bolts in piers, abutments, bents or pedestals may be drilled or formed by the insertion of oiled wooden plugs or metal sleeves in the plastic concrete. Formed holes shall be large enough to permit horizontal adjustments of the bolts. The bolts shall be carefully set in mortar. In lieu of the above, anchor bolts may be set to exact locations when the concrete is placed.

The holes shall be thoroughly cleaned of all loose material, oil, grease or other bond-breaking substance and blow them clean with filtered compressed air. When an epoxy type material is used the holes shall be in a surface dry condition. When hydraulic cement grout is used the holes shall be in a surface moist condition. The void space between the hole and the dowel or bolt shall be

completely filled with grouting material. The requirements for cleaning outlined in the product specification for prepackaged systems shall be followed exactly.

The following should be used as a guide in selection of an appropriate grout, mortar, epoxy or epoxy grout.

Table 3: Guide for Selection of Epoxy, Epoxy Mortar, Grout and Epoxy Grout

Material Type	Recommendation
Epoxy, Epoxy Mortar or other prepackaged Mortar	As Approved
Cast-in-place or Grouted system	1 part hydraulic cement, 2 parts sand and sufficient water for desired consistency
Neat Epoxy	Type III epoxy per TxDoT DMS-6100, "Epoxies and Adhesives"
Epoxy Grout	Type III epoxy per TxDoT DMS-6100, "Epoxies and Adhesives"Provide grout, epoxy or epoxy mortar as the binding agent unless otherwise indicated on the drawings

410S.13 - Placing Concrete in Cold Weather

A. General

The Contractor is responsible for the protection of concrete placed under any and all weather conditions and is responsible for producing concrete equal in quality to that placed under normal conditions. Permission given by the Engineer or designated representative to allow placement of the concrete during cold weather does not relieve the Contractor of the responsibility for producing concrete equal in quality to that placed under normal conditions. Concrete placed under adverse weather conditions that proves to be unsatisfactory shall be removed and replaced at Contractor' expense.

B. Cast-in-Place Concrete

Concrete may be placed when the ambient temperature is not less than 35°F (2°C) in the shade and rising or above 40°F (4°C). Concrete shall not be placed when the ambient temperature in the shade is below 40°F (4°C) and falling unless approved by the Engineer or designated representative. Concrete shall not be placed in contact with any material coated with frost or having a temperature less than 32°F (0°C).

Aggregates shall be free from ice, frost and frozen lumps. When required, in order to produce the minimum specified concrete temperature; the aggregate and/or the water shall be heated uniformly, in accordance with the following:

The water temperature shall not exceed 180°F(82°C) and/or the aggregate temperature shall not exceed 150°F(66°C). The heating apparatus shall heat the mass of aggregate uniformly. The temperature of the mixture of aggregates and water shall be between 50°F(10°C) and 85°F(29°C) before introduction of the cement.

All concrete shall be effectively protected as follows:

1. The temperature of slab concrete of all unformed surfaces shall be maintained at 50°F(10°C) or above for a period of 72 hours from time of placement and above 40°F(4°C) for an additional 72 hours.
2. The temperature at the surface of all concrete in bents, piers, culvert walls, retaining walls, parapets, wingwalls, bottom of slabs and other similar forms shall be maintained at 40°F(4°C) or above for a period of 72 hours from time of placement.
3. The temperature of all concrete, including the bottom slabs of culverts placed on or in the ground, shall be maintained above 32°F(0°C) for a period of 72 hours from time of placement.

   Protection shall consist of providing additional covering, insulated forms or other means and if necessary, supplementing such covering with artificial heating. Avoid applying heat directly to concrete surfaces. Curing shall be provided during this period until all requirements for curing have been satisfied.

   When impending weather conditions indicate the possibility of the need for such temperature protection, all necessary heating and covering material shall be on hand ready for use before permission is granted to begin placement.

   Sufficient extra test specimens will be made and cured with the placement to ascertain the condition of the concrete as placed prior to form removal and acceptance.

C. Precast Concrete

A fabricating plant for precast products which has adequate protection from cold weather in the form of permanent or portable framework and covering, which protects the concrete when placed the forms and is equipped with approved steam curing facilities may place concrete under any low temperature conditions provided:

1. The framework and covering are placed and heat is provided for the concrete and the forms within 1 hour after the concrete is placed. This shall not be construed to be 1 hour after the last concrete is placed, but that no concrete shall remain unprotected longer than 1 hour.
2. Steam heat shall keep the air surrounding the concrete between 50°F (10°C) and 85°F(29°C) for a minimum of 3 hours prior to beginning the temperature rise, which is required for steam curing.

410S.14 - Placing Concrete in Hot Weather

When the temperature of the air is above 85°F (29°C), an approved retarding agent will be required in all exposed concrete, concrete used in superstructures, top slabs of direct traffic culverts and all cased drilled shafts regardless of temperatures. Concrete mix temperatures shall not exceed 90°F (32°C) except for mixes that include high range water reducers where a maximum mix temperature of 100°F (38°C) will be allowed.

If the concrete mix temperature is expected to exceed 90°F (32°C) (or 100°F (38°C) in mixes with high range water reducers) ice may be utilized to lower the concrete mix temperature. Ice may be added to the concrete mix as a portion by weight of the mix water. However the addition of ice shall not exceed 50% of the total mix water weight.

When weather conditions are such that the addition of ice at 50% of the mix water is not sufficient to reduce the concrete mix temperature to an acceptable temperature, concrete work shall not be allowed.

When ice is to be used in hot weather concrete placement, the Contractor shall furnish a mix design (Section 4.4 of Standard Specification Item 360S, "Concrete Pavement" and Section 6 of Standard Specification Item No. 403S, "Concrete for Structures") acceptable to the Engineer or designated representative for class of concrete specified on the drawings.

410S.15 - Placing Concrete in Water

Concrete shall be deposited in water only when indicated on the drawings or with written permission of the Engineer or designated representative. The forms, cofferdams or caissons shall be sufficiently tight to prevent any water current passing through the space in which the concrete is being deposited. Pumping will not be permitted during the concrete placing nor until it has set for at least 36 hours.

The concrete shall be placed with a tremie, pump or other approved method and shall not be permitted to fall freely through the water nor shall it be disturbed after it has been placed. Its surface shall be kept approximately level during placement.

The tremie shall be supported or the pump operated so that it can be easily moved horizontally to cover all the work area and vertically to control the concrete flow. The lower end of the tremie or pump hose shall be submerged in the concrete at all times.

The placing operations shall be continuous until the work is complete.

For concrete to be placed under water, the concrete mix shall be designed in accordance with Standard Specification Item No. 403S, "Concrete For Structures" with a minimum cement content of 650 lb. Per cubic yard (10.4 Mg per cubic meter). An anti-wash admixture may be included in the mix design as necessary to produce a satisfactory finished product.

410S.16 - Placing Concrete in Superstructure

A. General

Unless otherwise indicated on the drawings, simple span roadway slabs shall be placed without transverse construction joints by using a mechanical longitudinal screed or a self-propelled transverse finishing machine or a mechanical longitudinal screed. For small placements or unusual conditions such as narrow widening, variable cross-slopes, or transitions, manually operated screeding equipment may be used if approved by the Engineer or designated representative.

B. Transverse Screeding

Unless otherwise indicated on the drawings, slabs on continuous units shall be placed in one continuous operation without transverse construction joints using a longitudinal screed or a self-propelled transverse finishing machine. Rails for transverse finishing machines supported from the beams or girders shall be installed so they may be removed without damage to the slab. Bond between removable supports and the concrete shall be prevented in a manner acceptable to the Engineer or designated representative. Rail support parts, which remain embedded in the slab, shall not project above the upper mat of reinforcing steel. Rail or screed supports attached to I-beams or girders shall be subject to "General Requirements" stated above. Unless indicated otherwise on the drawings, the minimum rate of concrete placement is 30 lineal feet (9.144 lineal meters) of bridge slab per hour. The concrete shall be deposited parallel to the skew of the bridge so that all girders are loaded uniformly along their length. Slab concrete shall be deposited between the exterior beam and the adjacent beam before placing concrete in the overhang portion of the slab. Personnel and equipment shall be furnished that is capable of placing, finishing and curing the slab at an acceptable rate to ensure compliance with this Item. Concrete shall be placed in transverse strips. On profile grades greater than 1.5 %, placement shall be started at the lower end.

C. Longitudinal Screeding

The screed shall be adequately supported on a header or rail system sufficiently stable to withstand the longitudinal or lateral thrust of the equipment. Unless otherwise indicated on the drawings, temporary intermediate headers will be permitted for placements exceeding 50 feet (15.24 meters) in length for the longitudinal screed, provided the rate of placement is rapid enough to prevent a cold joint and these headers are designed for early removal to permit satisfactory consolidation and finish of the concrete at their locations. The slab concrete shall be deposited between the exterior beam and the adjacent beam before placing concrete in the overhang portion of the slab.

For longitudinal screeding, concrete shall be placed in longitudinal strips starting at a point in the center of the segment adjacent to one side, except as provided herein and the strip completed by placing uniformly in both directions toward the ends except that for spans on a grade of 1.5 percent or more, placing shall start at the lower end. The width of strips shall be such that the concrete therein will remain plastic until the adjacent strip is placed. Where monolithic curb construction is specified, the concrete shall be placed therein in proper sequence to be monolithic with the adjacent longitudinal strips of the slabs.

D. Placements on Continuous Steel Units

Unless otherwise indicated on the drawings, slabs on continuous steel units shall be placed in a single continuous operation without transverse construction joints using a mechanical longitudinal screed or a self-propelled transverse finishing machine. The initial set of the concrete shall be retarded sufficiently to ensure that concrete remains plastic in at least 3 spans immediately preceding the slab being placed. Construction joints shall be used, when required for slab placements on steel beams or girders, as shown on the drawings. When staged placement of a slab is specified in the drawings, it shall be necessary to ensure that the previously placed concrete attains a compressive strength of 3000 psi (20.7 MPa) before placing the next stage concrete. Multiple stages may be placed in a single day if approved by the Engineer or designated representative. When drawings permit staged concrete placement without specifying a particular order of placement, a placing sequence that will not overstress any of the supporting members shall be submitted for the approval of the Engineer or designated representative.

E. Slab and Girder Units

Unless indicated otherwise on the drawings, girders, slab and curbs of slab and girder spans shall be placed monolithically. Concrete girders shall be filled first, and the slab concrete placed within the time limits specified in this Item. If a transverse screed is used, the concrete shall be placed in the stem for a short distance and then the concrete placed in transverse strips. If a longitudinal screed is used, the concrete shall be placed in the outside girder stem first beginning at the low end or side, and then continue the concrete placed in longitudinal strips.

410S.17 - Placing Concrete in Concrete Arches

Concrete shall be placed in arch rings so the loading is kept symmetrical on the falsework. The arch rings and ribs shall be placed in one continuous operation unless otherwise indicated on the drawings or permitted by the Engineer or designated representative. The spandrel walls or columns and the beams shall not be placed until the arch is swung. Floor slab, railing, parapet walls, etc., shall not be placed until all spandrels are complete. Slab placement shall be symmetrical about the transverse centerline so the loading of the arch is kept approximately symmetrical.

The placing sequence shall be as indicated on the drawings.

410S.18 - Placing Concrete in Box Culverts

In general, construction joints will be permitted only where indicated on the drawings.

Where the top slab and walls are placed monolithically in culverts more than 4 feet (1.22 meters) in clear height, an interval of not less than 1 nor more than 2 hours shall elapse before placing the top slab to allow for settlement and shrinkage in the concrete wall.

The base slab shall be trowel finished accurately at the proper time to provide a smooth uniform surface. Top slabs, which carry traffic, shall be finished as specified for roadway slabs in "Finish of Roadway Slabs", below. Top slabs of fill type culverts shall be given a reasonably smooth float finish.

410S.19 - Placing Concrete in Foundations and Substructure

Concrete shall not be placed in footings until the depth and character of the foundation has been inspected by the Engineer or designated representative and permission has been given to proceed.

Placing of concrete footings upon seal courses will be permitted after the caissons or cofferdams are free from water and the seal course cleaned. Any necessary pumping or bailing during the concrete placement shall be done from a suitable sump located outside the forms.

All temporary wales or braces inside cofferdams or caissons shall be constructed or adjusted as the work proceeds to prevent unauthorized construction joints in footings or shafts.

When footings can be placed in a dry excavation without the use of cofferdams or caissons, forms may be omitted if desired by the Contractor and approved by the Engineer or designated representative and the entire excavation filled with concrete to the elevation of the top of footing.

Concrete in columns shall be placed monolithically unless otherwise indicated on the drawings. Columns and caps and/or tie beams supported thereon may be placed in the same operation or separately. To allow for settlement and shrinkage of the column concrete, it shall be placed o the lower level of the cap or tie beam and placement delayed for not less than 1 hour nor more than 2 before proceeding with the cap or tie beam placement.

410S.20 - Treatment and Finishing of Horizontal Surfaces Except Bridge Slabs

All unformed upper surfaces shall be struck off to grade and finished. The use of mortar topping for surfaces under this classification will not be permitted.

After the concrete has been struck off, the surface shall be floated with a suitable float. Bridge sidewalks shall be given a wood float or broom finish or may be striped with a brush as specified by the Engineer or designated representative.

The tops of caps and piers between bearing areas shall be sloped slightly from the center toward the edge and the tops of abutments and transition bents sloped from the back wall to the edge, as directed by the Engineer or designated representative, so that water will drain from the surface. The concrete shall be given a smooth trowel finish. Bearing areas for steel units shall be constructed in such a manner to have a full and even bearing upon the concrete. When the concrete is placed below grade, bearing areas may be raised to grade on beds of Portland cement mortar consisting of 1 part cement, 2 parts sand and a minimum amount of water.

Bearing seat buildups or pedestals for concrete units shall be cast integrally with the cap or with a construction joint. The construction joint area under the bearing shall have the surface roughened thoroughly as soon as practical after initial set is obtained. The bearing seat buildups shall be placed using a latex based grout, an epoxy grout, or an approved proprietary bearing mortar, mixed in accordance with the manufacturer's recommendation. Pedestals shall be placed using Class C concrete, reinforced as indicated on the drawings.

The bearing area under the expansion end of concrete slabs and slab and girder spans shall be given a steel-trowel finish to the exact grades required on the drawings. Bearing areas under elastomeric bearing

pads or nonreinforced bearing seat buildups shall be given a textured wood float finish. The bearing area shall not vary from a level plane more than 1/16 in. (1.6 mm) in all directions.

410S.21 - Finish of Bridge Slabs

In all roadway slab-finishing operations, camber for specified vertical curvature and transverse slopes shall be provided.

For concrete flat slab and concrete slab and girder spans cast in place on falsework, an additional amount of camber shall be provided to offset the initial and final deflections of the span indicated in the drawings. For concrete slab and girder spans using pan forms, a camber of approximately 3/8 in. for 30 ft. (9.5 mm for 9.14 meter) spans and ½ in. for 40 ft. (12.7 mm for 12.19 meter) spans shall be provided to offset initial and final deflections unless otherwise directed by the Engineer or designated representative. When dead load deflection requirements for concrete flat slab and concrete slab and girder spans not using pan forms is not indicated on the drawings, the additional amount of camber shall be 1/8 inch per 10 foot (3.2 mm per 3 meter) of span length but not to exceed ½ inch (12.7 mm).

Bridge slabs supported on prestressed concrete beams, steel beams or girders shall receive no additional camber, except that for slabs without vertical curvature, the longitudinal camber shall be approximately ¼ inch (6.35 mm).

Work bridges or other suitable facilities shall be provided from which to perform all finishing operations and to provide access, if necessary, for the Engineer or designated representative to check measurements for slab thickness and reinforcement cover.

As soon as the concrete has been placed and vibrated in a section of sufficient width to permit working, the surface shall be struck off, leveled and screeded, carrying a slight excess of concrete ahead of the screed to insure filling of all low spots. The screed shall be designed rigid enough to hold true to shape and shall have sufficient adjustments to provide for the required camber. A vibrating screed shall be used in all slabs more than 20 feet (6.1 meters) in width. A vibrating screed may be used if heavy enough to prevent undue distortion. The screeds shall be provided with a metal edge.

Longitudinal screeds shall be moved across the concrete with a saw like motion while their ends rest on headers or templates set true to the roadway grade or on the adjacent finished slab. The transverse screeds shall be moved longitudinally approximately 1/5 of the drum length for each complete out-and-back pass of the carriage.

The surface of the concrete shall be screeded a sufficient number of times and at such intervals to produce a uniform surface, true to grade and free of voids. If necessary, the screeded surface shall be worked to a smooth finish with a long handled wood or metal float of the proper size or hand floated from bridges over the slab. Floating may not be necessary if the pan float attached to a transverse screed produces an acceptable finish. Overworking the concrete surface and overuse of finish water shall be avoided.

The Contractor shall perform in the presence of the Engineer or designated representative sufficient checks with a long handled 16-foot (5 meter) straightedge on the plastic concrete to insure that the final surface will be within the specified tolerances. The check shall be made with the straightedge parallel to the centerline. Each pass thereof shall lap half of the preceding pass. All high spots shall be removed and all depressions over 1/16 inch (1.6 mm) in depth shall be filled with fresh concrete and floated. The checking and floating shall be continued until the surface is true to grade and free of depressions, high spots, voids or rough spots.

Screed-rail support holes shall be filled with concrete and finished to match the top of the slab.

The concrete surface shall be finished to a uniform texture using a carpet drag, burlap drag or broom finish. The surface shall be finished to a smooth sandy texture without blemishes, marks or scratches deeper than 1/16 inch (1.6 mm). The surface texturing shall be applied using a work bridge or platform

immediately after completing the straightedge checks. The carpet or burlap drag shall be drug longitudinally along the concrete surface, adjusting the surface contact area or pressure to provide a satisfactory coarsely textured surface. A broom finish may be performed using a fine bristle broom transversely.

The concrete surface shall be coated immediately after the carpet or burlay drag, or broom finish with a single application of evaporation retardant at a rate recommended by the manufacturer. The time between the texturing at any location and subsequent application of evaporation retardant shall not exceed 10 minutes. The evaporation retardant may be applied using the same workbridge used for surface texturing. The concrete surface shall not be worked once the evaporation retardant has been applied.

Interim and final curing shall be applied in accordance with Section P410S.23, "Curing Concrete".

The Contractor is responsible for the ride quality of the finished bridge slab. The Engineer or designated representative will use a 10-ft. (3.05 meter) straightedge to verify ride quality [1/8 in. or less in 10 ft (3.2 mm or less in 3.05 meters)] and to determine locations where corrections are needed. If the Engineer or designated representative determines that the ride quality is unacceptable, then the Contractor shall submit to the Engineer or designated representative for approval a plan to produce a ride of acceptable quality. All corrections for ride-quality shall be made before saw-cutting grooves.

At the option of the Contractor or when indicated on the drawings, the hardened concrete surface of bridge slabs, bridge approach slabs and direct-traffic culverts shall be given its final texture by saw grooving to meet the above requirements after completion of the required curing period. Grooves shall be cut perpendicular to the structure centerline. The grooves shall be cut continuously across the slab to within 18 in. (450 mm) of the barrier rail, curb or median divider. At skewed metal expansion joints in bridge slabs, groove cutting shall be adjusted by using narrow-width cutting heads so that all grooves end within 6 in. (150 mm) of the joint, measured perpendicular to the centerline of the metal joint. There should not be any ungrooved surface wider than 6 in. (150 mm) adjacent to either side of the joint. The minimum distance to the first groove, measured perpendicular to the edge of the concrete joint or from the junction between the concrete and the metal leg of the joint shall be 1 in. (25 mm), Grooves shall be continuously cut across construction joints or other joints in the concrete that are less than ½ in. (13 mm) wide. The same procedure described above shall be used where barrier rails, curbs or median dividers are not parallel to the structure centerline in order to maintain the 18-in. (450-mm) maximum dimension from the end of the grooves to the gutter line. The grooves shall be cut continuously across formed concrete joints.

When the plans require that a concrete overlay be placed on the slab (new construction) or on prestressed concrete box beams or other precast elements, a carpet drag, burlap drag or broom finish shall be given to all concrete surfaces to be overlaid. Saw grooving is not necessary in this case. An average texture depth for the finish of approximately 0.035 in. (0.9 mm) shall be provided with no individual test falling below 0.020 in. (0.5 mm), unless otherwise indicated on the drawings, when tested in accordance with TxDoT's Tex-436-A, "Measurement of Texture Depth by the Sand Patch Method". If the texture depth falls below what is specified, the finishing procedure shall be revised to produce the desired texture.

When the drawings require an asphalt seal with or without overlay on the slab (new construction), on prestressed concrete box beams or on other precast elements, all concrete surfaces to be covered shall be given a lightly textured broom or carpet drag finish, similar to a sidewalk finish having an average texture depth of approximately 0.025 inch (0.635 mm), when tested in accordance with TxDoT's Tex-436-A, ".

410S.22 - Placing Survey Monuments

The Contractor shall obtain City Survey Monuments, for a fee of 10 dollars, from the Department of Public Works, Construction Inspection Division. Monuments shall be embedded in freshly poured concrete at

locations indicated on the drawings and accessible to survey equipment at the completion of the project. The monuments shall be installed flush with the adjacent concrete.

410S.23 - Curing Concrete

The Contractor shall inform the Engineer or designated representative fully of the methods and procedures proposed for curing, shall provide the proper equipment and material in adequate amounts and shall have the proposed method, equipment and material approved by the Engineer or designated representative prior to placing concrete.

Inadequate curing and/or facilities therefore shall be cause for the Engineer or designated representative to notify the Contractor, in writing, that the work is unsatisfactory and the concrete will have to be removed and replaced.

All concrete shall be cured for a period of 4 curing days except as noted herein. A curing day is a calendar day when the temperature, taken in the shade away from artificial heat is above 50°F (10°C) for at least 19 hours or on colder days if the temperature of all surfaces of the concrete is maintained above 40°F (4°C) for the entire 24 hours. The required curing shall begin when all concrete has attained its initial set. TxDoT's Tex-440-A, "Initial Time-of-Set of Fresh Concrete" may be used to establish when the concrete has attained its initial set.

Table 4: Exceptions to 4-Day Curing

Description	Type of Cement	Required Curing Days
Upper Surfaces of Bridge Slabs, Top Slabs of Direct Traffic Culverts and Concrete Overlays	I or II	8
	II or I/II	10
	All types with supplementary cementing materials	10
Concrete Piling buildups		6

For upper surfaces of bridge slabs, bridge support slabs, median and sidewalk slabs and culvert top slabs constructed using Class S Concrete (Standard Specification Item No. 403S, "Concrete for Structures") interim curing using a Type 1-D curing compound shall be applied as soon as possible after application of the evaporation retardant and after the water sheen has disappeared, but no more than 45 minutes after application of the evaporation retardant. Membrane interim curing shall be applied using a work bridge or other approved apparatus to ensure a uniform application. Final curing with water cure in accordance with this section shall start as soon as possible without damaging the surface finish. Water curing shall be maintained for the duration noted in the table above. Polyethylene sheeting, burlap-polyethylene blankets, laminated mats or insulating curing mats shall be placed in direct contact with the slab when the ambient temperature is expected to drop below 40°F (4°C) during the first 72 hours of the curing period. The curing materials will be weighed down with dry mats to maintain direct contact with the concrete and to provide insulation against cold weather. Supplemental heating or insulation may be required in cold and

wet weather if the insulating cotton mats become wet or if the concrete temperature drops below the specified curing temperature. Application of heat directly to concrete surfaces shall be avoided.

For the top surface of any concrete unit upon which concrete is to be placed and bonded at a later date (i.e. stub walls, risers, etc.), only water-cure in accordance with this Section shall be used.

All other concrete shall be cured as specified in pertinent Items.

The following methods are permitted for curing concrete subject to the restrictions of this Item .

A. Form Curing

When forms are left in intimate contact with the concrete, other curing methods will not be required except for exposed surfaces and for cold weather protection.

When forms are striped before the 4-day minimum curing time has elapsed, curing shall continue by an approved method.

B. Water Curing

All exposed surfaces of the concrete shall be kept wet continuously for the required curing time. The water used for curing shall meet the requirements for concrete mixing water as indicated in Item No. 403S, "Concrete for Structures". Seawater will not be permitted. Water, which stains or leaves an unsightly residue, shall not be used.

1. Wet Mats

Wet cotton mats placed in direct contact with the slab shall be maintained for the required curing time. If needed damp burlap blankets made from 9-ounce (255 gm) stock may be placed on the damp concrete surface for temporary protection prior to the application of the cotton mats, which may be placed dry and wetted down after placement.

The mats shall be weighted down adequately to provide continuous contact with all concrete surfaces where possible. The surfaces of the concrete shall be kept wet for the required curing time. Surfaces, which cannot be cured by contact, shall be enclosed with mats, anchored positively to the forms or to the ground, so that outside air cannot enter the enclosure. Sufficient moisture shall be provided inside the enclosure to keep all surfaces of the concrete wet.

2. Water Spray

This method shall consist of overlapping sprays or sprinklers that keep all unformed surfaces continuously wet.

3. Ponding

This method requires the covering of the surfaces with a minimum of 2 inches (50 mm) of clean granular material, kept wet at all times or a minimum of 1 inch (25 mm) depth of water. Satisfactory provisions shall be made to provide a dam to retain the water or saturated granular material.

C. Membrane Curing

Unless otherwise indicated on the drawings, either Type 1-D or Type 2 membrane curing compound may be used where permitted except that Type 1-D (Resin Base Only) will be permitted for slab concrete in bridge decks and top slabs of direct traffic culverts and all other surfaces that require a higher grade of surface finish. For substructure concrete, only one Type of curing compound will be permitted on any one structure.

TABLE 5

	REQUIRED		PERMITTED	
STRUCTURE UNIT DESCRIPTION	**Water for Complete Curing**	**Membrane for Interim Curing**	**Water for Complete Curing**	**Membrane for Complete Curing**
1. Upper surfaces of Bridge Roadway, Median and Side walk Slabs, Top Slabs of Direct Traffic, and Culverts.	X	X (resin base)		
2.Top Surface of any Concrete Unit upon which Concrete is to be placed and bonded at a later interval (Stub Walls, Risers, etc.). Other Super-structure Concrete (curbs, wing- walls, Parapet Walls, etc.).	X		*X	*X
3. Top Surface of Precast and/or Pre-stressed Piling.	X	X		
4. All Substructure Concrete Culverts. Box Sewers, Inlets, Manholes, Retaining Walls, Riprap.			*X	*X

* Polyethylene Sheeting, Burlap-Polyethylene Mats or Laminated Mats in close intimate contact with the concrete surfaces, will be considered equivalent to water or membrane curing for items under 4.

The membrane curing shall be applied just after free moisture has disappeared in a single, uniform coating at the rate of coverage recommended by the manufacturer and as approved by the Engineer or designated representative, but not less than 1 gallon per 180 square feet (1 liter per 4.4 square meters) of area. Tests for acceptance shall be at this specified rate.

Membrane curing shall not be applied to dry surfaces, but shall be applied just after free moisture has disappeared. Formed surfaces and surfaces which have given a first rub shall be dampened and shall be moist at the time of application of the membrane.

When membrane is used for complete curing, the film shall remain unbroken for the minimum curing period specified. Membrane, which is damaged, shall be corrected immediately by reapplication of membrane. Polyethylene sheeting, burlap-polyethylene mats or laminated mats in close intimate contact with the concrete surfaces, will be considered equivalent to membrane curing. Unless otherwise indicated on the drawing, the choice of membrane type shall be at the option of the Contractor, except that the Engineer or designated representative may require the same curing method for like portions of a single structure.

410S.24 - Removal of Forms and Falsework

Unless otherwise indicated on the drawing, forms for vertical surfaces may be removed when the concrete has aged 12 hours after initial set, provided it can be done without damage to the concrete. Forms for mass concrete placements shall be maintained in place for 4-days following concrete placement. Mass placements are defined as concrete placements with a least dimension greater than equal to 5 ft. (1.575 meters), or those designated as such on the drawings.

Forms for inside curb faces may be removed in approximately 3 hours provided it can be done without damage to the curb.

Unless indicated otherwise on the drawings weight supporting forms and falsework spanning more than 1 ft. (300 mm) for structures, bridge components and culvert slabs shall remain in place until the concrete has attained a minimum compressive strength of 2500 psi (17.25 MPa). Forms for other structural components may be removed as specified by the Engineer or designated representative.

Inside forms (walls and top slabs) for inlets, box culverts and sewers may be removed after the concrete has attained a minimum compressive strength of 1800 psi (12.4 MPa), provided an overhead support system, approved by the Engineer or designated representative, is used to transfer the weight (mass) of the top slab to the walls of the box culvert or sewer before the support provided by the forms is removed.

If all test cylinders made for the purpose of form removal have been broken without attaining the required strength, forms shall remain in place for a total of 14 curing days.

The above provisions relative to form removal shall apply only to forms or parts thereof which are constructed to permit removal without disturbing forms or falsework required to be left in place for a longer period on other portions of the structure.

Remove all metal appliances used inside forms for alignment shall be removed to a depth of at least ½ in. (13 mm) from the concrete surface. The appliances shall be manufactured to allow the removal without undue chipping or spalling of the concrete, and so that it leaves a smooth opening in the concrete surface when removed. Rods, bolts and ties shall not be burned-off.

Backfilling against walls of Type I or Type II cement shall not take place for a minimum of 7 days. Backfilling against walls of Type III cement shall not take place until the cylinder compressive strength has reached 3000 psi (20.7 MPa) or the wall has cured for 5 days.

All forms and falsework shall be removed unless indicated otherwise on the drawings.

410S.25 - Defective Work

Any defective work discovered after the forms have been removed shall be repaired as soon as possible in accordance with "Finishing Exposed Surfaces", below.

If the surface of the concrete is bulged, uneven or shows excess honeycombing or form marks, which in the opinion of the Engineer or designated representative, cannot be repaired satisfactorily, the entire section shall be removed and replaced at the expense of the Contractor.

410S.26 - Finishing Exposed Surfaces

A. Ordinary Surface Finish

An Ordinary Surface Finish shall be applied to all concrete surfaces either as a final finish or preparatory to a higher grade or class of finish. Higher grades and classes of finish shall conform to Item No. 411S, "Surface Finishes for Concrete". Where neither a grade or class of finish is specified, an Ordinary Surface Finish only, will be required.

Ordinary Surface Finish shall be provided as follows:

1. After formal removal, all porous, honeycombed areas and spalled areas shall be corrected by chipping away all loose or broken material to sound concrete.
2. Featheredges shall be eliminated by saw-cutting and chipping spalled areas to a depth at least ½ in. (13 mm) deep perpendicular to the surface. Shallow cavities shall be repaired using a latex adhesive grout, cement mortar or epoxy grout approved by the Engineer or designated representative. If judged repairable by the Engineer or designated representative, large defective areas shall be corrected using concrete or other material approved by the Engineer or designated representative.
3. Holes and spalls caused by removal of form ties, etc., shall be cleaned and filled with latex adhesive grout, cement mortar or epoxy grout approved by the Engineer or designated representative. Only the holes shall be filled. The patch shall not be blended with the surrounding concrete. On surfaces to receive a rub finish in accordance with Standard Specification Item No. 411S, "Surface Finishes for Concrete" the exposed parts of metal chairs shall be chipped out to a depth of ½ inch (13 mm) and the surface repaired.
4. All fins, runs, drips or mortar that will be exposed shall be removed from surfaces. Form marks and chamfer edges shall be smoothed by grinding and/or dry rubbing.
5. Grease, oil, dirt, curing compound, etc., shall be removed from surfaces requiring a higher grade of finish. Discolorations resulting from spillage or splashing of asphalt, paint or other similar material shall be removed.
6. Repairs shall be dense, well bonded and properly cured and when made on surfaces, which remain exposed and do not require a higher finish, shall be finished to blend with the surrounding concrete.

Unless otherwise indicated on the drawings Ordinary Surface Finish shall be the final finish for the following exposed surfaces:

1. inside and top of inlets,
2. inside and top of manholes,
3. inside of sewer appurtenances,
4. inside of culvert barrels,
5. bottom of bridge decks between beams or girders,
6. vertical and bottom surfaces of interior concrete beams or girders.

B. Rubbed Finish

In general, the following areas shall require a rubbed finish and shall receive a first and second rubbing:

1. The top, exterior and roadway facia of curbs and parapet walls.
2. All concrete surfaces of railing.
3. The exterior vertical facia of slab spans, rigid frames, arches and box girders.
4. The outside and bottom surfaces of facia beams or girders (except precast concrete beams).
5. The underside of overhanging slabs to the point of juncture of the supporting beams.
6. All vertical surfaces of piers, columns, bent caps, abutments, wing walls and retaining walls which are exposed to view after all backfill and embankments is placed.
7. Exposed formed surfaces of inlet and outlet structures on culverts, transition structures, headwalls and inlets.

8. Such other surfaces specified elsewhere to receive a rubbed finish and such additional surfaces required by the Engineer or designated representative to receive a rubbed finish.

After removal of forms and as soon as the mortar used in pointing has set sufficiently, surfaces to be rubbed shall be wet with a brush and given a first surface rubbing with a medium coarse carborundum stone. This rubbing shall be done before the concrete has cured more than 48 hours.

The second rubbing shall present a cleaned uniform appearance free from drip marks and discoloration. It shall be given with a No.30 carborundum stone or an abrasive of equal quality.

If the Contractor elects to use epoxy paint in lieu of the second rubbings the Contractor may do so upon approval of the Engineer or designated representative.

C. Special Surface Finishes

Striated, exposed aggregate and other special surface finishes shall conform to Standard Specification Item No. 411S, "Surface Finishes for Concrete" and/or with the requirements indicated on the drawings.

410S.27 - Measurement and Payment

No direct measurement or payment will be made for the work to be done or the equipment to be furnished under this item, but shall be included in the unit price bid for the item of construction in which this item is used.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item 410S, "Concrete Structures"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 360S	Concrete Pavement
Item No. 401S	Structural Excavation and Backfill
Item No. 403S	Concrete for Structures
Item No. 406S	Reinforcing Steel
Item No.	Surface Finishes for Concrete

411S	
Item No. 413S	Cleaning and/or Sealing Joints and Cracks (PC Concrete)
Item No. 425S	Prestressed Concrete Structures

U.S. Department of Commerce Voluntary Product Standard, PS 1 American Concrete Institute

Designation	Description
ACI 347	Guide to Formwork for Concrete

American Society for Testing and Materials (ASTM)

Designation	Description
ASTM D-994	Preformed Expansion Joint Filler for Concrete (bituminous Type)
ASTM D-1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D-1752	Prefprmed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

Texas Department of Transportation: Departmental Material Specifications

Designation	Description
DMS-4640	Chemical Admixtures for Concrete
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants"

DMS-6100	Epoxy and Adhesives
DMS-6160	Waterstops, Nylon Reinforced Neoprene Sheet, and Elastomeric Pads
DMS-6310	Joint Materials and Fillers

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-436-A	Measurement of Texture Depth by the Sand Patch Method
Tex-440-A	Initial Time-of-Set of Fresh Concrete

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 410S, "Concrete Structures"

American Society for Testing and Materials, ASTM

Designation	Description
A 36/A 36M	Carbon Structural Steel
A 82	Steel Wire, Plain, for Concrete Reinforcement
A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
A 496	Steel Wire, Deformed, for Concrete Reinforcement
A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
A 615/A 615M	Deformed and Plain Billet-steel Bars for Concrete Reinforcement
A 675/A 675M	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties

A 706/A 706M	Low- Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
A 775/A 775M	Epoxy-Coated Reinforcing Steel Bars
A 884/A 884M	Epoxy-Coated Steel Wire and Welded Wire Fabric For Reinforcement
A 934/A 934M	Epoxy-Coated Prefabricated Reinforcing Steel Bars
A 996/A 996M	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
D3963/D3963M	Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-739-I	Sampling and Testing Epoxy Coated Reinforcing Steel

City of Austin Standard (Details)

Designation	Description
Standard 406S-1	Reinforced Steel Tolerances

Texas Department of Transportation: Departmental Material Specifications

Designation	Description
DMS 8130	Epoxy Powder Coating for Reinforcing Steel

City of Austin Standard Specification Items

Designation	Description
Item No. 404S	Pneumatically Placed Concrete
Item No. 407S	Fibrous Concrete
Item No. 414S	Concrete Retaining Walls
Item No. 420S	Drilled Shaft Foundations

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 360	Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Hydraulic Cement Concrete
Item No. 422	Reinforced Concrete Slab
Item No. 423	Retaining Walls
Item No. 440	Reinforcing Steels

End

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ITEM NO. 411S - SURFACE FINISHES FOR CONCRETE 11-13-07

411S.1 - Description

This item shall govern the furnishing of all materials and the application by the methods of construction indicated on the Drawings for the application of a surface finish to concrete.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

411S.2 - Submittals

The submittal requirements of this specification item include:

A. Type and manufacturer of cement(s).

B. Type and manufacturer of membrane curing compound.

C. Type and manufacturer of adhesive grout.

D. Type and manufacturer of resin paint.

E. Samples as requested.

F. Locations of proposed grade/class of finishes.

411S.3 - Materials

(1) Masonry Sand

Masonry sand shall conform to ASTM C 144.

(2) White Cement

White cement shall conform to ASTM C 150.

(3) Portland Cement

All cement unless otherwise indicated shall be Portland cement conforming to ASTM C 150.

Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

(4) Membrane Curing

Membrane curing shall conform to Item No. 409S, "Membrane Curing".

(5) Adhesive Grout

This subsection sets forth the requirements for three epoxy adhesives with different viscosities designed to bond fresh Portland Cement concrete to existing Portland

Cement concrete, hardened concrete to hardened concrete and steel to fresh or hardened concrete. These adhesives are as follows:

Type V: Standard (medium viscosity) for applying to horizontal and vertical surfaces. This material is suitable for surface sealing of fine cracks in concrete.

Type VI: Low viscosity for application with spray equipment to horizontal surfaces.

Type VII: Paste consistency for overhead application and where a high buildup is required. This material is suitable for surface sealing of cracks in concrete, which are veed out prior to sealing, and for grouting of dowel bars where clearance is 1/16 inch (1.6 mm) or less.

(a) Mixing Ratio: The ratio of resin and hardener components to be mixed together to form the finished adhesive shall be either 1 to 1 or 2 to 1 by volume.

Any specific coloring of resin and/or hardener components desired will be stated by the Engineer or designated representative.

Fillers, pigments and thixotropic agents. All fillers, pigments and/or thixotropic agents in either the epoxy resin or hardener component must be of sufficiently fine particle size and dispersed so that no appreciable separation or settling will occur during storage.

Any fillers present in the low viscosity version must be of such a nature that they will not interfere with application by spray equipment or abrade or damage such equipment.

The concrete adhesive shall contain no volatile solvents.

(b) Consistency: The adhesives shall comply with the following:

	Type V	**Type VI**	**Type VII**
Viscosity of mixed adhesive 77° ± 1°F, (25° ± -17°C) Poises	400 Maximum	150 Maximum	must be sufficiently fluid to apply by trowel or spatula without difficulty
Pot Life at 77°F (25°C), minutes minimum - 30			
Set Time at 77°F (25°C) (Time required to attain 180 psi (1.3 mPa)), hours maximum - 12			

Thixotropy test shall be performed at both 77° and 120°F (25° and 49°C). Average thickness of cured adhesive remaining on test panel, mils minimum.

Type V	Type VII
30	45

Samples of the individual components in sealed containers shall be maintained at 115° + 3°F (46° + -16°C) for 2 weeks. The mixed adhesive prepared from these samples must still comply with the minimum thixotropy requirements.

The viscosity of the Type V and Type VI versions must not show an increase of more than 20 percent compared with the viscosity prior to the stability test. The Type VII adhesive must still be sufficiently fluid to apply by trowel or spatula without difficulty.

(c) Physical Properties of the Cured Adhesive

Property	Requirements
Adhesive Shear Strength, psi (mPa), minimum	2200 (15)
Water Gain, percent by weight (mass), maximum	0.20
Ability to bond fresh Portland cement concrete to cured Portland cement concrete psi (mPa), minimum (7 days cure time)	400 (2.8)

(6) Synthetic Resin Paint

Type X Epoxy: This is a high solids epoxy coating designed for application by brush or roller. The materials can also be applied by airless spray by addition of a maximum of 5 percent toluene solvent at the direction of the Engineer or designated representative.

Raw Materials: The basic raw materials to be incorporated into this coating are listed below, along with the specific requirements for each material. The final decision as to the quality of materials shall be made by the Engineer or designated representative. After the Engineer or designated representative has approved the brand names of raw materials proposed by the Contractor, no substitution will be allowed during the manufacture without prior approval of the Engineer or designated representative.

Epoxy Resin: The basic epoxy resin used in the formulation shall be an unmodified liquid resin conforming to the following chemical and physical requirements:

Viscosity at 25.0 + 0.1 C, cps	7,000 to 10,000
Weight per epoxy equivalent, gms per gm - mole	175 to 195
Color (Gardner Number), maximum	5
Hydrolyzable chlorine, maximum % by weight	0.2
Specific gravity, 25/25 degrees	1.14 to 1.18

Test methods to be used in determining these qualities are listed below:

(a) Viscosity - Test for Kinematic Viscosity (ASTM Designation: D 445).

(b) Weight per Epoxy Equivalent - Test for Epoxy Content of Epoxy Resins (ASTM Designation: D 1652).

(c) Color - Test for Color of Transparent Liquids (Gardner Color Scale) (ASTM Designation: D 1544).

(d) Hydrolyzable Chlorine - Test for Hydrolyzable Chlorine Content of Liquid Epoxy Resins (ASTM Designation D: 1726).

(e) Specific Gravity - Method of Test for Density of Paint, Varnish, Lacquer and Related Products (ASTM Designation: D 1475).

Pigment

Titanium Dioxide: The titanium dioxide used in this formulation shall be equivalent to DuPont R-900. This shall be a pure, chalk-resistant, rutile titanium dioxide meeting the requirements of ASTM D 476, Type III.

Extender: The extender used in this formulation shall be Nyad 400, manufactured by Interpace Pigments. Specific requirements are as follows:

Particle size distribution	**Minimum**	**Maximum**
Minus 20 microns, percent by weight	95	
Minus 10 microns, percent by weight	70	80
Minus 5 microns, percent by weight	40	50
Minus 3 microns, percent by weight	30	40
Minus 1 micron, percent by weight	14	20
Oil Absorption (rub out, lbs/100 lbs)		25 maximum
Brightness (G.E.)	92.5 minimum	

411S.4 - Grade of Finish

(1) General

The grade and/or class of finish shall be as described herein and as indicated.

"Grade" of finish designates the areas to which a higher finish is to be applied beyond the requirements of an Ordinary Surface Finish. Four grades of finish are included herein.

"Class" of finish designates the materials or the process to be used in providing the grade of finish. Three classes of finish are included herein.

For structures and surfaces not described herein under grade of finish, a class of finish only may be indicated. Where neither a grade nor class is specified, an Ordinary Surface Finish only will be required as specified in Item No. 410S, "Concrete Structures".

Where the plans specify a grade and class of finish, i.e., Grade II, Class C, only that type of finish shall be furnished.

Where the plans specify a grade of finish only, i.e., Grade I Finish, any of the classes of finish may be furnished. Only one class of finish shall be furnished on any individual structure, twin structures or on structures in close proximity to each other, except as specified for prestressed concrete members below.

(2) Grade I

The following areas shall receive a Class A, B or C (two rub) Finish, except that prestressed members shall receive either a Class A or B Finish only.

All concrete surfaces of railing, including the parapet types; exterior vertical faces of slabs, slab spans, arches and box girders; the outside and bottom surfaces of fascia beams or girders (including prestressed members); the underside of overhanging slabs to the point of juncture of the supporting beam; all exposed vertical surfaces of bents and piers and bottom surfaces of bent caps; all exposed surfaces of tie beams, abutments, bridge wingwalls, culvert headwalls and wingwalls and retaining walls exposed to view after all backfill and is placed.

Unless otherwise indicated, the underside of the slab of slab spans shall be finished its entire width.

Unless otherwise indicated, exposed surfaces of pump houses and other miscellaneous concrete surfaces shall receive a Class A, B or C (one rub) Finish.

(3) Grade II

All concrete surfaces of railing, including the parapet types, all exposed surfaces of bridge wingwalls and the exterior vertical faces of slabs and slab spans shall receive a Class A, B or C (two rub) Finish. All other surfaces described under Grade I Finish shall receive a Class A or B finish only. The underside of slab spans shall receive an Ordinary Surface Finish only.

(4) Grade III

All concrete surfaces of railing, including the parapet types, all exposed surfaces of bridge wingwalls and the exterior vertical faces of slabs shall receive a Class A, B or C (two rub) Finish. All other surfaces described under Grade I Finish shall receive an Ordinary Surface Finish.

(5) Grade IV

The top and roadway faces only of all concrete railing, including the parapet types and bridge wingwalls shall receive a Class A, B or C (one rub) Finish. All other surfaces described under Grade I shall receive an Ordinary Surface Finish.

411S.5 - Class of Finish

The Class of Finish designates either an adhesive grout material, a paint-type material or a rubbing process applied to surfaces specified in "Grade of Finish", as required above and/or as indicated.

Unless otherwise indicated the color shall be concrete gray.

(1) Class A

This finish shall consist of an adhesive grout textured coating with a minimum 1/16 inch thickness, composed of 1 part white cement, 1 part natural (gray) cement, 2 parts masonry sand, 1 part (latex) emulsion and enough water to form a viscous slurry of a consistency that may be applied by spray gun, brush or roller without appreciable running or sagging. The proportions of white and gray cement may be varied slightly to obtain the desired color.

Gradation of the masonry sand shall be as required to produce a texture satisfactory to the Engineer or designated representative.

Prepackaged materials meeting these requirements and acceptable to the Engineer or designated representative as to color, texture and appearance will be permitted.

(2) Class B

The finish shall be a paint-type material, consisting of a synthetic resin, containing fibrous as well as texturing pigments, which when applied by a 1 coat spray application at the rate of 45 ± 5 square feet per gallon (15.9 ± 1.9 square meters per liter) yield an acceptable textured coating. Certification by the manufacturer of the above materials will be required.

(3) Class C

This finish shall consist of a one rub or two rub system, as the case may be, meeting the requirements set forth below under "Construction Methods".

411S.6 - Approval of Surface Finishing Materials

The material to be furnished shall meet the requirements of TxDoT Specification DMS-8110, Structural Coatings, latest revision.

In addition to the above, the manufacturer shall furnish the following:

(1) At the time of original request for approval of the surface furnishing material, the manufacturer shall supply a 1-gallon (3.8 L) sample of the material to the Engineer or designated representative, if requested.

(2) Each 6 months after approval of the material, the manufacturer shall furnish a notarized certification indicating that the material originally approved has not been changed or altered in any way. Any change in formulation of a surface finish shall require retesting prior to use.

The Engineer or designated representative may request additional information to be submitted such as infrared spectophotometry scan, solids content, etc., for further identification. A change in formula discovered by any of the tests prescribed herein or by other means and not reported and retested, may be cause to permanently bar the manufacturer from furnishing surface finish materials for City work.

The City reserves the right to perform any or all of the tests required by this specification as a check on the tests reported by the manufacturer. In case of any variance the City tests will govern.

411S.7 - Construction Methods

Prior to application of any of the finishes required herein, concrete surfaces shall be given an Ordinary Surface Finish. For Class A and B materials, concrete surfaces shall be clean and free of dirt, grease, curing compound or any other bond breaking substance. Class A shall be applied on moistened surfaces but Class B requires a dry surface. The temperature of the atmosphere, concrete and compound shall be above 50°F (10°C) for Classes A and B at the time of application. The finished surfaces shall be protected against rain or freezing for a period of 24 hours after application.

Class A materials shall be applied by spraying, by roller or by brush. Class B materials shall be applied by spraying only. All applications shall provide an acceptable texture of the proper coverage.

The Class A and B material shall be applied after all preparation work required by Ordinary Surface Finish has been completed.

The Class C Finish shall be performed with a carborundum stone as follows, after all preparatory work required by Ordinary Surface Finish has been completed:

For a two-rub system, the first rubbing shall bring the wetted concrete face to a paste and produce a smooth dense surface without pits, form marks or other irregularities. The use of cement or grout to form the paste will not be permitted. Striping with a brush and washing after the first rubbing will not be required. Chamfer lines shall be finished during the second rubbing.

The first rubbing shall be done soon after form removal. Membrane curing, if used, shall be applied after the first rub is complete. Prior to the second rubbing, any remaining curing membrane shall be removed from the surface by brushing, buffing or other satisfactory methods.

The second rubbing shall be performed when conditioning the structure for final acceptance. The specified surfaces shall be cleaned of drip marks and discolorations and given a final rubbing. The surface shall be striped neatly with a brush and the paste allowed to take a reset, after which the surfaces shall be washed with clean water leaving them with a neat and uniform appearance and texture.

For a one rub system, the rubbing requirements shall be the same as for the first rub above, except chamfer lines shall be finished and the paste spread uniformly, striped with a brush and allowed to take a reset after which the surfaces shall be washed with clean water leaving them with a neat and uniform appearance and texture.

411S.8 - Special Surfaces Finishes

(1) General

When special surface finishes are required for retaining walls, panels, copings or similar construction, the Contractor shall prepare sample panels for approval of the finish and the method of application. Unless otherwise indicated, panel or pattern arrangement and dimensions may be varied to achieve a more pleasing appearance or to utilize forming material more efficiently when approved by the Engineer or designated representative. Aggregates, materials, variation of panel or pattern arrangement, dimensions and other features affecting the work shall be approved prior to start of the work.

(2) Striated Finish

The striated (grooved) pattern shall be as indicated or as approved by the Engineer or designated representative.

The finish shall be made by lining the forms with striated sheets of plywood, plastic, fiberglass, metal or other material acceptable to the Engineer or designated representative. The striations on the panels shall be of a smooth, wide pattern, not sharp or angular.

A chamfer groove shall be used along all edges of each panel. All ties, bolts or other forming accessories shall be located along the chamfer grooves or panel edges.

(3) Exposed Aggregate Finish

(a) Structural Concrete

Exposed aggregate panels may be either raised, recessed or as indicated with the sides of each panel chamfered as directed by the Engineer or designated representative.

The aggregate used for this finish shall be approved by the Engineer or designated representative. Unless otherwise indicated, aggregate shall conform to the grading requirements of Grade 2 aggregate except that a minimum of 50 percent shall be retained on

the ¾-inch (19 mm) sieve. Gravel of predominately rounded particles shall be used, except that when indicated or approved by the Engineer or designated representative in writing, crushed stone may be used. The aggregate shall be large enough to remain firmly anchored in the face of the final product. The depth shall be ¼-inch (6.4 mm) minimum to ½-inch (12.7 mm) maximum, unless otherwise indicated or directed by the Engineer or designated representative.

A surface retarder that penetrates the concrete approximately ¼ (6.4 mm) inch shall be applied to the forms or concrete surface as an aid in achieving the desired finish. Wood forms may require 2 or 3 coatings to compensate for absorption. Form joints shall be taped or caulked to prevent escape of the retarder during placing operations.

Treated form surfaces shall be protected from sun and rain while exposed to the atmosphere. In case of high humidity or if rain has dampened the forms prior to placing concrete, a reapplication of the surface retarder may be required to provide uniform coverage of the retarder on the forms.

Adjacent areas of fresh concrete not requiring exposed aggregate finish shall be protected when the retarder is applied.

The finish shall be obtained by sandblasting, bush hammering, water blasting or other methods, as approved by the Engineer or designated representative. Horizontal surfaces may be finished by a combination of brushing and washing, but only after the concrete has set sufficiently to prevent loosening of the aggregate.

Unless otherwise directed by the Engineer or designated representative, forms for surface requiring exposed aggregate finish shall be removed 12 to 15 hours after concrete placement. The exposed aggregate operation shall be accomplished immediately after form removal. Except for the time required for obtaining the exposed aggregate finish, curing of all surfaces shall be maintained for the minimum 4 day curing time. All surfaces shall be either water cured or may be cured with an approved clean membrane compound. If water curing is used, it shall be followed by a clear membrane curing compound conforming to Item No. 409S, "Membrane Curing".

Care shall be taken to ensure proper vibration at all points of concrete placement to prevent honeycomb or segregation of the materials. Vibration shall be done in such a manner as to provide adequate penetration of previously placed concrete lifts. Care shall be taken to prevent contact of the vibrator with the face form.

(b) Sidewalks

When exposed aggregate surfaces are required for sidewalks, driveways and/or medians, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable. Grade 5 coarse aggregates shall be used for exposed aggregate finishes for sidewalks, driveways and/or medians.

411S.9 - Measurement and Payment

No direct measurement or payment will be made for the work to be done, the equipment or materials to be furnished under this item, but shall be included in the unit price bid for the item of construction in which this item is used.

SPECIFIC CROSS REFERENCE MATERIALS

Standard Specification Item No. 411S, " Surface Finishes for Concrete"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 410S	Concrete Structures
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
DMS-8110	Coatings for Concrete
American Society for Testing and Materials (ASTM)	
Designation	Description
C 144	Aggregate for Masonry Mortar
C 150	Portland Cement
D 445	Kinematic Viscosity of Transparent and Opaque Liquids
D 476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
D 1475	Standard Test Method for Density of Liquid Coatings, Inks and Related Products
D 1544	Standard Test Method for Color of Transparent Liquids (Gardner Color Scale)
D 1652	Standard Test Method for Epoxy Content of Epoxy Resins
D 1726	Standard Test Method for Hydrolyzable Chloride Content of Liquid Epoxy Resins

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item No. 411S, " Surface Finishes for Concrete"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 403S	Concrete for Structures
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finished for Concrete

End

ITEM NO. 413S - CLEANING AND/OR SEALING JOINTS AND CRACKS (PORTLAND CEMENT CONCRETE) 11-13-07

413S.1 - Description

This item shall govern the cleaning and/or sealing of joints and cracks in either new or existing Portland cement concrete pavements and bridge decks in conformance with the requirements herein and the details indicated on the Drawings or as established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

413S.2 - Submittals

The submittal requirements of this specification item include:

A. Sealant Type (Rubber-Asphalt, Polymer Modified Emulsion, Low Modulus Silicone or Polyurethane), Class and method of application (crack sealing, joint sealing, etc),

B. Manufacturer recommendations concerning the use of primer and backer rod

C. Manufacturer recommended equipment and procedures for preparation, dispensing, application, curing etc of the sealant, and

D. Manufacturer certification that the product to be supplied meets or exceeds the specifications,

E. Listing of the equipment proposed for the Work.

413S.3 - Materials

Joints and/or cracks shall be sealed with the type and/or class of materials indicated on the Drawings. The materials shall conform to the requirements of TxDoT Specification Item No. 433S, "Joint Sealants and Fillers" and TxDoT Departmental Materials Specification No. DMS-6310, "Joint Sealants and Seals".

Primers, if required, shall be as recommended by the manufacturer of the sealant. Backer rods, when required, shall be compatible with the sealant and shall not react with or bond to the sealant.

The sealing compound shall be delivered in the manufacturer's original sealed containers. Each container shall be legibly marked with the name of the manufacturer, the trade name of the sealer, the manufacturer's batch number or lot, the pouring temperature, and the safe heating temperature.

413S.4 - Equipment

All equipment shall be in accordance with the sealant manufacturer's recommendations. Air compressors shall be equipped with appropriate filters for removing oil and water from the air.

Any equipment, that damages dowels, reinforcing steel, Portland cement concrete, base, subbase or subgrade in the process of cleaning the joints and/or cracks, shall be discontinued and the joint and/or crack shall be cleaned by other methods approved by the Engineer or designated representative, which do not cause such damage.

413S.5 - Construction Methods

Equipment, tools and machinery recommended for proper prosecution of the Work shall be on the project and shall be approved by the Engineer or designated representative prior to the initiation of the joint and/or crack cleaning and sealing operations.

A. Joint and Crack Preparation.

The bonding surface of cracks and joints shall be cleaned of infiltrated material, saw cuttings or other foreign material. All material removed from joints and cracks shall be removed from the paved surface of the roadway.

No sealing of any joints or cracks shall be done when the joints or cracks are damp, unless drying of the joints and cracks with compressed air can be demonstrated and meets with the approval of the Engineer or designated representative.

1. Joint Preparation.

The joints shall be cleaned with filtered compressed air or other methods approved by the Engineer or designated representative. Unless noted otherwise on the Drawings, hand tools, air guns, power routers, abrasive equipment or other equipment may be used to clean the joints. Where indicated on the Drawings, the joint sealant space shall be resized by sawing to the width and depth shown on the Drawings to accommodate the type of sealant specified.

2. Crack Preparation.

Unless indicated otherwise on the Drawings, the crack shall be grooved initially at the surface so that a reservoir of rectangular cross section is provided for the sealant. The grooves shall be cut to the dimensions shown on the Drawings. The devices that are used for grooving, such as diamond blade random cut saws, random-crack grinders, etc., shall be capable of following the path of the crack without causing excessive spalling or other damage to the concrete.

B. Joint and Crack Sealing

The sealant shall be installed in accordance with the manufacturer's recommended procedure. The joint and/or crack surfaces shall be surface dry unless recommended otherwise by the manufacturer of the sealant.

The surface temperature at the time of the sealing operation shall not be less than 40°F (4.5°C).

The minimum depth of sealant shall be ½ inch (12.5 mm) or a depth recommended by the sealant manufacturer and the top of the sealant shall be located 1/8 to ¼ inch (3 to 6.5 mm) below the adjacent pavement surface.

1. Primer.

If required, the primer shall be applied as soon as possible after cleaning is accomplished. The primer shall be applied uniformly at the rate recommended by the sealant manufacturer. The primer shall be applied to exposed metal surfaces before new corrosion begins and shall be allowed to cure for a minimum of thirty (30) minutes, but no longer than eight (8) hours prior to the application of the sealant, unless sealant manufacturer recommendations indicate otherwise.

2. Backer Rods.

Backer rods shall be used to pr4event a fluid type sealant from flowing through the joint and crack and to retain the sealant at its required elevation. The application and use of backer rod shall be as recommended by the sealant manufacturer and approved by the Engineer or designated representative.

413S.6 - Measurement

Accepted work performed under this item shall be included in other pay items and will not be measured and paid for unless a separate pay item is provided in the contract bid form documents.

If a pay item is included in the contract documents, acceptable work for "Cleaning and/or Sealing Joints and Cracks" shall be measured by the lineal foot (meter: 1 meter equals 3.281 feet) of sealant in place.

If a pay item is included in the contract documents, acceptable work "Cleaning and/or Sealing Joints and Cracks" shall be measured by the pound (kilograms: 1 kilogram equals 2.205 pounds).

413S.7 - Payment

When included as a pay item in the contract documents, the work performed and materials furnished as provided by this item and measured in accordance with Article 413S.6, "Measurement", will be paid for at the appropriate unit bid price bid. The unit bid prices shall include full compensation for cleaning and, if necessary, grooving and/or sawing the crack/joint; furnishing, hauling and placing primer and backer rod, if necessary; furnishing, heating, hauling, and placing the crack/joint sealer; all freight involved and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 413S-A:	_____ Sealer	Per Lineal Foot.
Pay Item No. 413S-B:	_____ Sealer	Per Pound of Sealer Used.

SPECIFIC CROSS REFERENCE MATERIALS	
Item No. 413S, "Cleaning and/or Sealing Joints and Cracks (Portland Cement Concrete)"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 433S	Joint Sealants and Fillers
Item No. 438S	Cleaning and/or Sealing Joints and Cracks (Portland Cement Concrete)
Texas Department of Transportation: Departmental Materials Specifications	

Designation	Description
DMS 6310	Joint Sealants and Seals

RELATED CROSS REFERENCE MATERIALS	
Item No. 413S, "Cleaning and/or Sealing Joints and Cracks (Portland Cement Concrete)"	
City of Austin Standard Specifications	
Designation	Description
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 313S	Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 300	Asphalts, Oils and Emulsions
Item No. 352	Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)

End

ITEM NO. 430S - P.C. CONCRETE CURB AND GUTTER 11-15-11

430S.1 - Description

This item shall govern Portland Cement (p.c.) concrete curb, p.c. concrete curb and gutter with reinforcing steel or p.c. concrete laydown curb as required, that is constructed in accordance with this specification on an approved subgrade and base in conformity with Standard Detail Series 430S and the lines, grades, section indicated on the Drawings or as established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

430S.2 - Submittals

The submittal requirements of this specification item include:

A. Class A p.c. concrete mix design,

B. Type of Installation (i.e. P.C. Concrete Curb and Gutter or P.C. Concrete Curb or P.C. Concrete Laydown Curb) and construction details (i.e. base, reinforcing steel, joints, curing membrane),

C. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.

430S.3 - Materials

A. Concrete

The Portland cement (p.c.) concrete shall conform to Class A Concrete, Section 403S.7 (Table 4) of Standard Specification Item No. 403S, "Concrete for Structures" or Sections 360S.4 and 360S.6 of Standard Specification Item No. 360S, "Concrete Pavement" when curb and gutter is to be constructed integral with the pavement.

B. Reinforcing Steel

Reinforcing steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel."

C. Expansion Joint Materials

Expansion joint materials shall conform to Standard Specification Item No. 408S, "Expansion Joint Materials."

D. Membrane Curing Compound

Membrane curing compound shall conform to Standard Specification Item No. 409S, "Membrane Curing."

E. Flexible Base

Aggregate shall conform to Standard Specification Item No. 210S, "Flexible Base".

430S.4 - Construction Methods

A. Subgrade and Base Preparation

Subgrade for curb and gutter shall be excavated and prepared to depth and width requirements indicated on the Drawings, including a minimum of 12 inches (300 mm) behind the curb, unless a greater width is indicated on the Drawings. The subgrade shall be shaped to the line, grades, cross section and dimensions indicated on the Drawings. A minimum of 4 inches (100 mm) of flexible base shall be spread, wetted and thoroughly compacted under curb and gutter as specified in Standard

Specification Item No. 210S, "Flexible Base". If dry, the base shall be sprinkled lightly with water before p.c. concrete is deposited thereon.

B. C & G Forms

Forms shall be of metal, well-seasoned wood or other approved material. The length of the forms shall be a minimum of 10 feet (3 meters). Flexible or curved forms shall be used for curves of 100-foot (30 meter) radius or less. Wood forms for straight sections shall be not less than 2 inches (50 mm) in thickness. Forms shall be a section, that is satisfactory to the Engineer or designated representative, of the depth required and clean, straight, free from warp and, if required, oiled with a light form oil. All forms shall be securely staked to line and grade and maintained in a true position during the placement of p.c. concrete.

C. Reinforcing Steel

The reinforcing steel, if required, shall be placed as shown on the typical section of the Drawings. Care shall be exercised to keep all steel in its proper location during p.c. concrete placement.

D. Joints

Joints shall be of the type and spacing shown on the Drawings. Expansion joint material, ¾ inch (19 mm) in thickness, shall be provided at intervals not to exceed 40 feet (12 meters) and shall extend the full width and depth of the p.c. concrete. Weakened plane joints shall be made ¾ inch (19 mm) deep at 10-foot (3 meters) intervals. All joint headers shall be braced perpendicular and at right angles to the curb.

Two round smooth dowel bars, ½ inch (12.5 mm) in diameter and 24 inches (600 mm) in length, shall be installed at each expansion joint. Sixteen inches (400 mm) of one end of each dowel shall be thoroughly coated with hot oil, asphalt or red lead, so that it will not bond to the concrete. The dowels shall be installed with a dowel sleeve on the coated end as indicated on the Drawings or equivalent method as directed by the Engineer or designated representative.

E. P.C. Concrete Placement and Form Removal

Concrete shall be placed in the forms and properly consolidated. Within 1 hour after p.c. concrete placement, a thin coating, that is no more than ½ inch (12.5 mm) nor less than ¼ inch (6.25 mm) thick of finish mortar, composed of 1 part Portland Cement to 2 parts fine aggregate, shall be worked into the exposed faces of the curb and gutter by means of a "mule". After the p.c. concrete has become sufficiently set, the exposed edges shall be rounded by the use of an edging tool to the radii indicated on Standard Detail 430S-1. The entire exposed surface of the curb and gutter shall be floated to a uniform smooth surface, and then finished with a camel hairbrush to a gritty texture. The forms shall remain in place a minimum of 24 hours unless approved otherwise by the Engineer or designated representative.

After removal of the forms, any minor honeycombed surfaces shall be plastered with a mortar mix as described above. Excessively honeycombed curb and gutter, as determined by the Engineer or designated representative, shall be completely removed and replaced when directed.

F. Curing

Immediately after finishing the curb, concrete shall be protected by a membrane curing conforming to Standard Specification Item No. 409S, "Membrane Curing."

After a minimum of 3 days curing and before placement of the final lift of the base course, the curb shall be backfilled to the full height of the p.c. concrete, tamped and sloped as directed by the Engineer or designated representative. The upper 4 inches (100-mm) of backfill shall be of clean topsoil that conforms to Standard Specification Item No. 130S, "Borrow" and is free of stones and debris.

G. Seeding in Turf Areas

When turf is to be established, preparation of the seedbed shall conform to Item No. 604S, "Seeding for Erosion Control".

430S.5 - Measurement

Accepted work as prescribed by this item will be measured by the lineal foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) of p.c. concrete curb and gutter, p.c. concrete curb and/or p.c. concrete laydown curb, complete in place.

430S.6 - Payment

The work performed as prescribed by this item will be paid for at the unit bid price per lineal foot for "P.C. Concrete Curb and Gutter" or P.C. Concrete Curb. The price shall include full compensation for all work as set forth and described under payment Method A and/or B.

A. Method A (Pay Item No. 430S-A)

This payment method shall include all the work performed for "P.C. Concrete Curb and Gutter" complete, at the unit bid price. The unit bid price shall include full compensation for excavation, preparation of the subgrade, furnishing and placing all concrete and base material, reinforcing steel, dowels, expansion joint material, curing material, backfill and for all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

B. Method B (Pay Item No. 430S-B)

This payment method includes all the work performed for "P.C. Concrete Curb and Gutter", complete, at the unit bid price. The unit bid price shall include full compensation for fine grading, furnishing and placing concrete and reinforcing steel, dowels, expansion joint material, curing material, backfill and for all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

C. Method C (Pay Item No. 430S-C)

This payment method includes all the work performed for " P.C. Concrete Curb" complete, at the unit bid price. The unit bid price shall include full compensation for excavation, furnishing and placing all concrete and base material, reinforcing steel, dowels, expansion joint material, curing material, backfill and for all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

D. Method D (Pay Item No. 430S-D)

This payment method includes all the work performed for "P.C. Concrete Curb" complete, at the unit bid price. The unit bid price shall include full compensation for fine grading, furnishing and placing concrete and reinforcing steel, dowels, expansion joint material, curing material, backfill and for other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

E. Method E (Pay Item No. 430S-E)

This payment method shall include all the work performed for "P.C. Concrete Laydown Curb" complete, at the unit bid price. The unit bid price shall include full compensation for excavation, preparation of the subgrade, furnishing and placing all concrete and base material, reinforcing steel, dowels, expansion joint material, curing material, backfill and for all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

F. Method F (Pay Item No. 430S-F)

This payment method includes all the work performed for "P.C. Concrete Laydown Curb" complete, at the unit bid price. The unit bid price shall include full compensation for fine grading, furnishing and placing concrete and reinforcing steel, dowels, expansion joint material, curing material, backfill and for other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 430S-A:	P.C. Concrete Curb and Gutter (Excavation)	Per Lineal Foot.
Pay Item No. 430S-B:	P.C. Concrete Curb and Gutter (Fine Grading)	Per Lineal Foot.
Pay Item No. 430S-C:	P.C. Concrete Curb (Excavation)	Per Lineal Foot.
Pay Item No. 430S-D:	P.C. Concrete Curb (Fine Grading)	Per Lineal Foot.
Pay Item No. 430S-D:	P.C. Concrete Curb (Fine Grading)	Per Lineal Foot.
Pay Item No. 430S-E:	P.C. Concrete Laydown Curb (Excavation)	Per Lineal Foot.
Pay Item No. 430S-F:	P.C. Concrete Laydown Curb (Fine Grading)	Per Lineal Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 430S, "P.C. Concrete Curb and Gutter"	
City of Austin Standard Specifications	
Designation	Description
Item No 130S	Borrow
Item No 210S	Flexible Base
Item No. 360	Concrete Pavement"
Section 360.4 of Item 360	Proportioning of Concrete

Section 360.6 of Item 360	Concrete Mixing and Placing
Item No. 403S	Concrete for Structures
Section 403S.7 of Item No. 403S	(Table 4)
Item No. 406S	Reinforcing Steel
Item No. 408S	Expansion Joint Materials
Item No. 409S	Membrane Curing
Item No. 604S	Seeding for Erosion Control
City of Austin Standard Details	
Designation	Description
430S-1	Curb and Gutter Section
430S-3	Curb Expansion Joint Dowel Detail
430S-4	Concrete Backfill Under Curb & Gutter
430S-5	Reinforcing Bar Detail at Existing Curb and Gutter

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 430S, "P.C. Concrete Curb and Gutter"	
City of Austin Standard Specifications	
Designation	Description

Item No. 301S	Asphalts, Oils and Emulsions
Item No. 302S	Aggregates for Surface Treatments
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 431S	Machine Laid PCC Curb and Gutters
Item No. 433S	P.C. Concrete Driveways
Item No. 434S	P.C. Concrete Medians and Islands
Item No. 436S	P.C. Concrete Valley Gutters
Item No. 606S	Fertilizer

End

ITEM NO. 431S - MACHINE LAID PORTLAND CEMENT CONCRETE CURB AND GUTTER 4-3-09

431S.1 - Description

This item shall govern Portland cement (p.c.) concrete curb and gutter and reinforcing steel dowels, constructed in accordance with this specification on an approved base in conformity with the lines, grades, sections and Standard Detail Series 430S and indicated on the Drawings or as established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

431S.2 - Submittals

The submittal requirements of this specification item include:

A. Class I p.c. concrete mix design,

B. Type of Installation (i.e. P.C. Concrete Curb and Gutter or P.C. Concrete Curb) and construction details (i.e. base, reinforcing steel, joints, curing membrane),

C. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.

431S.3 - Materials

A. Portland Cement Concrete (PCC)

The Portland Cement Concrete shall conform to Class I Concrete, Section 403S.7 (Table 4) of Standard Specification Item No. 403S, "Concrete for Structures."

B. Reinforcing Steel

Reinforcing steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel."

C. Expansion Joint Materials

Preformed expansion joint materials shall conform to Standard Specification Item No. 408S, "Expansion Joint Materials."

D. Membrane Curing Compound

Membrane curing compound shall conform to Standard Specification Item No. 409S, "Membrane Curing."

E. Flexible Base

Flexible base material shall conform to Standard Specification Item No. 210S, "Flexible Base."

F. Stabilized Base

A stabilized base identified as a Type A or B shall conform to the requirements of Standard Specification Item 340S, "Hot Mix Asphaltic Concrete Pavement."

431S.4 - Construction Methods

A. Subgrade and Base Preparation

Subgrade for curb and gutter shall be excavated and prepared to depth and width requirements indicated on the Drawings, including a minimum of 12 inches (300 mm) behind the curb, unless a greater width is indicated on the Drawings. The subgrade shall be shaped to the line, grade, cross section and dimensions indicated on Standard Detail 430S-1 or the Drawings. A minimum thickness of 4 inches (100 mm) of flexible base (Standard Specification Item No. 210S) or stabilized base shall be placed, spread, wetted (flexible base only) and thoroughly compacted. If dry, the flexible base shall be sprinkled lightly with water before p.c. concrete is deposited thereon.

B. Portland Cement Concrete (P.C.C.) Curb and Gutter Extrusion

The pcc curb shall be laid by a curb extrusion machine approved by the Engineer or designated representative. The line for top of curb shall be maintained from a guideline or guide rails, set by the Contractor. Curb outline shall strictly conform to the details indicated on the Drawings. The forming tube of the extrusion machine shall be readily adjustable vertically during the forward motion of the machine, to provide required variable height of curb necessary to conform to the established grade line. If a guideline is used, a pointer or gage shall be attached to the machine in such a manner that a comparison can be made between the curb and the guideline in order to provide a continual check on the curb grade. Other methods may be used if approved in writing by the Engineer or designated representative.

C. Portland Cement (P.C.) Concrete Placement and Finish

The p.c. concrete shall be fed into the machine in such a manner and at such consistency that the finished curb will present a well-compacted mass with a surface free from voids and honeycomb and true to established shape, line and grade.

Any additional surface finishing indicated on the Drawings and/or required by the Engineer or designated representative shall be performed immediately after placement. Weakened plane joints shall be cut to a depth of ¾ inch (19 mm) at 10-foot (3 meters) intervals or as directed by the Engineer or designated representative.

Whenever the curb end abuts a p.c. concrete structure a ¾-inch (19-mm) pre-molded expansion joint conforming to the curb section shall be placed between the 2 concrete surfaces.

Whenever extrusion is suspended long enough to produce a cold joint, ½-inch (12.5 mm) smooth dowel bars, 24 inches (600 mm) long, shall be embedded 12 inches (300 mm) into the completed curb, ¼ curb height from top and bottom. The end of the curb at the point of suspension of extrusion shall be cut back until all remaining p.c. concrete is of a dense, well-compacted nature.

Any addition of concrete to the extruded curb is to be applied and finished before the extruded curb has achieved its initial set. The final finish shall have a gritty surface approved by the Engineer or designated representative.

D. Reinforcing Steel

The reinforcing steel, if required by Standard 430S-1 or shown on approved plans, shall be placed as shown on the typical section of the Drawings. Care shall be exercised to keep all steel in its proper location during p.c. concrete placement.

E. Joints

Joints shall be of the type and spacing shown on the Drawings. Expansion joint material, ¾ inch (19 mm) in thickness, shall be provided at intervals not to exceed 40 feet (12 meters) and shall extend the full width and depth of the p.c. concrete. Weakened plane joints shall be made ¾ inch (19 mm) deep at 10-foot (3 meters) intervals. All joint headers shall be braced perpendicular and at right angles to the curb.

Two round smooth dowel bars, ½ inch (12.5 mm) in diameter and 24 inches (600 mm) in length, shall be installed at each expansion joint. Sixteen inches (400 mm) of one end of each dowel shall

be thoroughly coated with hot oil, asphalt or red lead, so that it will not bond to the concrete. The dowels shall be installed with a dowel sleeve on the coated end as indicated on the Drawings or equivalent method as directed by the Engineer or designated representative.

F. Curing

When finishing operations are completed the curb shall be cured conforming to Standard Specification Item No. 409S, "Membrane Curing."

When the curb has cured a minimum of 3 days and prior to placement of the final lift of base course, it shall be backfilled to the full height of the p.c. concrete, tamped and sloped to drain as directed by the Engineer or designated representative.

In turf areas, the upper 4 inches (100-mm) of backfill shall be of clean topsoil, that conforms to Standard Specification Item No. 130S, "Borrow" and shall be free of stones and debris.

G. Seeding in Turf Areas

When turf is to be established, the preparation of the seedbed shall conform to Standard Specification Item No. 604S, "Seeding for Erosion Control".

431S.5 - Measurement

Machine Laid PCC Curbs will be measured by the lineal foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) of completed and accepted curb, complete in place.

431S.6 - Payment

The work performed as prescribed by this item will be paid for at the unit bid price per lineal foot for "Machine Laid PCC Curb and Gutter". The unit bid price shall include full compensation for all work as set forth and described under payment Method A, B or C below.

A. Method A: With Excavation (Pay Item No. 431S-A)

This payment method includes all the work performed for "Machine Laid PCC Curb and Gutter", complete, at the unit bid price. The unit bid price shall include full compensation for excavation, preparation of the subgrade, furnishing and placing all base material, reinforcing steel, dowels, expansion joint materials, curing material, backfill and all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

B. Method B: With Fine Grading (Pay Item No. 431S-B)

This payment method includes all the work performed for "Machine Laid PCC Curb and Gutter", complete, at the unit bid price. The unit bid price shall include full compensation for fine grading, furnishing and placing reinforcing steel, dowels, expansion joint material, curing material, backfill and for all other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

C. Method C: Included in the unit price bid for this specification Incidental Work (Pay Item No. 431S-C)

This method includes all the work performed as incidental work relating to "Machine Laid PCC Curb and Gutter" as may be detailed and noted on the Drawings or included and described in the "Special Provisions" of the Standard Contract Documents.

Payment will be made under one of the following:

Pay Item No. 431S-A:	Machine Laid Curb and Gutter (Excavation)	Per Lineal Foot.

Pay Item No. 431S-B:	Machine Laid Curb and Gutter (Fine Grading)	Per Lineal Foot.
Pay Item No. 431S-C:	Machine Laid Curb and Gutter (Incidental Work)	Per Lineal Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 431S, "Machine Laid Portland Cement Concrete Curb and Gutter"	
City of Austin Standard Specifications	
Designation	Description
Item No. 130S	Borrow
Item No. 210S	Flexible Base
Item No. 206S	Asphalt Stabilized Base (Plant Mix)
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 403S	Concrete for Structures
Section 403.S7: Item No. 403S	Table 4: Classes of Concrete
Item No. 406S	Reinforcing Steel
Item No. 408S	Expansion Joint Materials
Item No. 409S	Membrane Curing
Item No. 604S	Seeding for Erosion Control

City of Austin Standard Details	
Designation	Description
No. 430S-1	Curb and Gutter Section
No. 430S-3	Curb Expansion Joint Dowel Detail
No. 430S-4	Concrete Backfill Under Curb & Gutter
No. 430S-5	Reinforcing Bar Detail at Existing Curb and Gutter

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 431S, "Machine Laid Portland Cement Concrete Curb and Gutter"	
City of Austin Standard Specifications	
Designation	Description
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 302S	Aggregates for Surface Treatments
Item No. 360	Concrete Pavement
Item No. 430S	P.C. Concrete Curb and Gutter
Item No. 433S	P.C. Concrete Driveways
Item No. 434S	P.C. Concrete Medians and Islands
Item No. 436S	P.C. Concrete Valley Gutters
Item No. 606S	Fertilizer

End

ITEM NO. 433S - P.C. CONCRETE DRIVEWAYS 12-9-08

433S.1 - Description

This item shall govern construction of Portland Cement (p.c.) concrete driveways, as herein specified, on an approved subgrade, in conformity with the lines, grades and cross section indicated on the Drawings, identified in Standard Detail Series 433S, or as established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

433S.2 - Submittals

The submittal requirements of this specification item include:

A. Class A and/or Item 360S p.c. concrete mix design,

B. Type of Installation (i.e. Type I, Flared Type I, Type II, etc.) and construction details (i.e. cushion layer, base, reinforcing steel, joints, curing membrane),

C. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.

433S.3 - Materials

A. Concrete

The Portland Cement Concrete for a Type I driveway (Standards 433S-1 and 433S—A) shall conform to Class A, Section 403S.7 (Table 4) of Standard Specification Item No. 403S, "Concrete for Structures." The Portland Cement Concrete for a Type II driveway (Standard 433S-2) shall conform to a normal concrete mix design for concrete pavement, Section 360S.5(A) of Standard Specification Item No. 360S, "Concrete Pavement".

B. Reinforcing Steel

Reinforcing steel and welded wire fabric shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

C. Expansion Joint Materials

Expansion joint materials shall conform to Standard Specification Item No. 408S, "Expansion Joint Materials."

D. Membrane Curing Compound

Membrane curing compound shall conform to Standard Specification Item No. 409S, "Membrane Curing."

E. Cushion Layer

The Cushion layer shall consist of crusher screenings, gravel or coarse sand.

433S.4 - Construction Methods

All forms and forming, placement of reinforcement, placement of concrete, form removal, finishing and curing shall conform to Standard Specification Item No. 410S, "Concrete Structures".

A. Subgrade Preparation

The subgrade shall be excavated, prepared and shaped to the lines, grades and cross sections indicated on the Drawings or as directed by the Engineer or designated representative. The subgrade shall be thoroughly compacted in accordance with Standard Specification Item No. 201S, "Subgrade Preparation". A 2-inch (50-mm) minimum compacted thickness cushion shall be spread, wetted thoroughly, tamped and leveled. The cushion shall be moist at the time the p.c. concrete is placed.

If the subgrade is undercut or natural ground is located below the top of subgrade, the necessary backfill material shall conform with Standard Specification Item 130S, "Borrow" and shall be compacted with a mechanical tamper. Hand tamping will not be permitted.

Where the subgrade material consists of gravel or includes 70 percent of rock, the 2-inch (50-mm) cushion layer may not be required. The Engineer or designated representative will determine if the subgrade meets the above requirements.

B. Forms

Forms shall be of metal, well-seasoned wood or other approved material of a section satisfactory to the Engineer or designated representative. Wood forms shall not be less than 2 inches (50 mm) nominal thickness for straight runs and 1-inch (25-mm) nominal thickness for curved runs. Forms shall be a section satisfactory to the Engineer or designated representative and clean, straight, free from warp and of a depth equal to the thickness of the finished work.

All forms shall be securely staked to line and grade and maintained in a true position during the placement of p.c. concrete.

C. Joints

Joints shall be of the type and spacing shown on the Drawings. Expansion joint material, ¾ inch (19 mm) thick, shall be provided where the new construction abuts the existing sidewalks or driveways or as directed by the Engineer or designated representative. The expansion joint material shall be placed vertically and shall extend the full depth of the p.c. concrete. Similar expansion material shall be placed around all obstructions protruding through the driveway. Weakened plane joints shall be located on 10-foot (3-meter) centers or as directed by the Engineer or designated representative. Normal dimensions of the weakened plane groove joints shall be ¼-inch (6.25-mm) wide and ¾-inch (19 mm) deep.

D. Reinforcement

Reinforcement for Type I driveways shall consist of 1 layer of 6 x 6 by W 1.4 x W 1.4 (150 x 150 by MW9 x MW9) wire fabric or No. 3 (10 M) bars placed not more than 18 inches (450 mm) on center, both directions. Reinforcement for Type II driveways shall consist of 1 layer of No. 4 (13 M) bars placed no more than 18 inches (450 mm) on center, both directions.

All reinforcements shall be accurately placed equidistant from the top and bottom of the p.c. concrete slab and held firmly in place by means of bar supports of adequate strength and number that will prevent displacement and keep the steel at its proper position. In no instance shall the steel be placed directly on the subgrade or sand cushion layer.

Prior to placement of the concrete, the reinforcement installation shall be inspected by the Engineer or designated representative to ensure conformance with the drawings, specifications and this item. In addition, care shall be exercised to keep all steel in its proper position during the placement of p.c. concrete. If during placement of the concrete, the reinforcement is observed to lose bar support, float upward or move in any direction, the placement shall be stopped until corrective action is taken.

Splices in wire fabric shall overlap sufficiently to allow two pairs of transverse wires to be tied together and no splice of less than 6 inches (150 mm) will be permitted. Splices in the No. 3 (10 M) and No. 4 (13 M) bars shall have a minimum lap of 12 inches (300 mm).

E. P.C. Concrete Placement and Finishing

The p.c. concrete shall be placed in the forms and spaced, tamped and thoroughly compacted until it entirely covers the surface and has a monolithic finish. The top surface shall be floated and troweled to a uniform smooth surface, then finished with a broom or wood float to a gritty texture unless otherwise indicated on the Drawings. The outer edges and joints shall be rounded with approved tools to a ¼-inch (6.3 mm) radius. Care shall be exercised to prevent loss of dummy joints or rounded edges when applying the broom finish.

F. Curing

At the proper time after finishing, the surface shall be protected by a membrane compound curing agent in conformance with Standard Specification Item No. 409S, "Membrane Curing" or by wetting cotton or burlap mats. Either method shall be subject to approval by the Engineer or designated representative.

Traffic shall be barricaded from using the driveway for a minimum of 4 days after initial placing and may be opened to traffic only with approval of the Engineer or designated representative.

G. Incidental Work

All necessary excavation, filling and grading of the slopes, adjacent to the completed pcc driveways, will be considered incidental work pertaining to this item and will not be paid for directly.

The adjacent excavation and grading of the slopes shall be done with topsoil conforming to Standard Specification Item No. 130S, "Borrow". When turf is to be established, the preparation of the seedbed shall conform to Standard Specification Item No. 604S, "Seeding for Erosion Control", in a manner acceptable to the Engineer or designated representative.

433S.5 - Measurement

Accepted work performed as prescribed by this item will be measured by the square foot (square meters: 1 square meter equals 10.764 square feet) of surface area of the specific type of p.c. concrete driveway.

433S.6 - Payment

The work performed as prescribed by this item will be paid for at the unit bid price per square foot for "Concrete Driveways." The unit bid price shall include full compensation for preparation of the subgrade; furnishing and placing all materials, including cushion layer, all reinforcing steel, bar supports and expansion joint materials; and any other materials, manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 433S-A:	Type I P.C. Concrete Driveway	Per Square Foot.
Pay Item No. 433S-B:	Flared Type I P.C. Concrete Driveway	Per Square Foot.
Pay Item No. 433S-C:	Type II P.C. Concrete Driveway	Per Square Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 433S, "P.C. Concrete Driveways"	
City of Austin Standard Specifications	
Designation	Description
Item No. 130S	Borrow
Item No. 201S	Subgrade Preparation
Item No. 360	Concrete Pavement
Item No. 403S	Concrete for Structures
Section 403S.7; Item 403S	Table 4: Classes of Concrete
Item No. 406S	Reinforcing Steel
Item No. 408S	Expansion Joint Materials
Item No. 409S	Membrane Curing
Item No. 410S	Concrete Structures
Item No. 604S	Seeding for Erosion Control
City of Austin Standard Details	
Designation	Description

No. 433S-1	Type I Driveway (1 & 2 Family Residential Use Only)
No. 433S-1A	Flared Type I Driveway (1 & 2 Family Residential Use Only)
No. 433S-2	Type II Driveway

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 433S, "P.C. Concrete Driveways"	
City of Austin Standard Specifications	
Designation	Description
Item No. 430S	P.C. Concrete Curb and Gutter
Item No. 431S	Machine Laid PCC Curb and Gutter
Item No. 432S	Concrete Sidewalks
Item No. 434S	P.C. Concrete Medians and Islands
Item No. 436S	P.C. Concrete Valley Gutters
Item No. 470S	Curb Cuts for Sidewalk Ramps and Driveways
Item No. 606S	Fertilizer

End

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ITEM NO. 434S - P.C. CONCRETE MEDIANS AND ISLANDS 11-13-07

434S.1 - Description

This item shall govern construction of Portland cement concrete traffic islands and medians in accordance with these specifications and in conformity to the lines, grades, sections and details indicated on the Drawings or as established by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

434S.2 - Submittals

The submittal requirements of this specification item include:

A. Class A p.c. concrete mix design,

B. Type of Installation (i.e. Median or Island) and construction details (i.e. cushion layer, base, reinforcing steel, joints, curing membrane).

434S.3 - Materials

A. Portland Cement (p.c.) Concrete

The p.c. concrete shall conform to Class A Concrete, Section 403S.7 (Table 4) of Standard Specification Item No. 403S, "Concrete for Structures".

B. Reinforcing Steel

Reinforcing steel and welded wire fabric shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

C. Expansion Joint Materials

Preformed expansion joint materials shall conform to Standard Specification Item No. 408S, "Expansion Joint Materials".

D. Membrane Curing Compound

Membrane curing compound shall conform to Standard Specification Item No. 409S, "Membrane Curing".

E. Admixtures

Admixtures shall conform to Standard Specification Item No. 405S, "Concrete Admixtures".

F. Aggregate Cushion

Cushion layer shall consist of crusher screening, gravel, sand, crushed stone or "Flexible Base" materials (Standard Specification Item No. 210S) approved by the Engineer or designated representative.

434S.4 - Construction Methods

All forms and forming, placement of reinforcement, placement of concrete, form removal, finishing and curing shall conform to Standard Specification Item No. 410S, "Concrete Structures".

A. PCC Mix Design

The p.c. concrete shall conform to an approved design mix for a Class A p.c. concrete on file with the City or proposed Class A mix designs with the necessary test data may be submitted for approval by the Engineer or designated representative.

High range water reducing admixtures conforming to Standard Specification Item No. 360, "Concrete Pavements" may be used when approved by the Engineer or designated representative.

B. Subgrade and Base Preparation

The subgrade shall be excavated, prepared and shaped to the lines, grades and cross section indicated on the Drawings or as directed by the Engineer or designated representative, and shall be thoroughly compacted conforming to Standard Specification Item No. 201S, "Subgrade Preparation". A cushion layer, 2 inches (50 mm) minimum thickness, shall be spread, wetted thoroughly, tamped and leveled. The cushion shall be moist at the time the p.c. concrete is placed.

C. Forms

Forms shall be of metal, well-seasoned wood or other approved material. The length of the forms shall be a minimum of 10 feet (3 meters). Flexible or curved forms shall be used for curves of 100-foot (30-meter) radius or less. Wood forms for straight sections shall be not less than 2 inches (50 mm) in thickness. Forms shall be a section, that is satisfactory to the Engineer or designated representative, and shall be clean, free from warp, and of a depth equal to the finished work. All forms shall be securely staked to line and grade and maintained in a true position during the placement of the p.c. concrete and, if required, forms shall be thoroughly oiled with a light form oil prior to p.c. concrete placement. If the adjacent existing asphalt pavement is damaged during construction, it shall be restored to its original condition.

D. Reinforcement

Reinforcement shall conform to the details indicated on the Drawings or the directions of the Engineer or designated representative. All reinforcement shall be accurately placed at slab mid-depth, equidistant from the top and bottom of the p.c. concrete, and held firmly in place by means of bar supports of adequate strength and number that will prevent displacement and keep the reinforcement in its proper position during the placement of the p.c. concrete. In no instance shall the steel be placed directly on the subgrade or sand cushion layer.

Prior to placement of the concrete, the reinforcement installation shall be inspected by the Engineer or designated representative to ensure conformance with the drawings, specifications and this item. In addition, care shall be exercised to keep all steel in its proper position during placement of the p.c. concrete. If during placement of the concrete, the reinforcement is observed to loose bar support, float upward or move in any direction, the placement shall be stopped until corrective action is taken.

E. Joints

Joints shall be of the type and spacing shown on the Drawings. Expansion joint material, ¾ inch (19 mm) in thickness, shall be placed as indicated on the Drawings with a maximum spacing of 40 feet (12 meters) or as directed by the Engineer or designated representative. Expansion joints shall be placed on the same alignment when adjacent to a Portland Cement concrete pavement. Weakened plane joints shall be made ¾ inch (19 mm) deep and equally spaced, normally at 5 foot (1.5 meters) on centers or as directed by the Engineer or designated representative. Expansion joints shall be required between the curb and median p.c. concrete.

F. P.C. Concrete Placement and Finishing

The p.c. concrete shall be placed in the forms to the depth indicated on the Drawings, and properly consolidated and until mortar entirely covers the surface and forms a monolithic finish. If a vibrator is used, care shall be taken not to leave it in one location long enough to induce segregation. The top surface shall be floated and troweled to a uniform smooth surface, then finished with a camel

hairbrush or wood float to a gritty texture. The outer edges shall be rounded with approved tools to the radii indicated on the Drawings.

When the ambient air temperature is above 85°F (30°C), an approved retarding agent will be required in all p.c. concrete. The maximum temperature of all p.c. concrete placed shall not exceed 95°F (35°C), unless High Range Water Reducer Admixtures are used.

G. Curing

Immediately after finishing the p.c. concrete median or island, the pcc surface shall be protected by a membrane-compound curing agent conforming with Standard Specification Item No. 409S, "Membrane Curing". The curing procedures shall be acceptable to the Engineer or designated representative.

434S.5 - Measurement

Accepted work as prescribed by this item will be measured by the square foot (square meter: 1 square meter equals 10.764 square feet) of surface area of p.c concrete medians and/or p.c. concrete island, complete in place.

434S.6 - Payment

The work performed as prescribed by this item will be paid for at the unit bid price per square foot for "P.C. Concrete Medians and Islands." The unit bid price shall include full compensation for preparation of the subgrade; finishing and placing all materials, including all reinforcing steel, welded wire fabric; bar supports and any other materials, manipulation, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 434S:	___ Inch P.C. Concrete Medians and Islands	Per Square Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 434S, "P.C. Concrete Medians and Islands"	
City of Austin Standard Specifications	
Designation	Description
Item No. 201S	Subgrade Preparation

Item No. 210S	Flexible Base
Item No. 403S	Concrete for Structures
Section 403S.7: Item No. 403S	Table 4: Classes of Concrete
Item No. 405S	Concrete Admixtures
Item No. 406S	Reinforcing Steel
Item No. 408S	Expansion Joint Materials
Item No. 409S	Membrane Curing
Item No. 410S	Concrete Structures

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 434S, "P.C. Concrete Medians and Islands"	
City of Austin Standard Specifications	
Designation	Description
Item No. 360	Concrete Pavement
Item No. 430S	P.C. Concrete Curb and Gutter
Item No. 431S	Machine Laid PCC Curb and Gutter
Item No. 432S	P.C. Concrete Sidewalks
Item No. 433S	P. C. Concrete Driveways
Item No. 434S	P.C. Concrete Medians and Islands

Item No. 436S	P.C. Concrete Valley Gutters
Item No. 470S	Curb Cuts for Sidewalk Ramps and Driveways

End

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ITEM NO. 439S - PARKING LOT BUMPER CURBS 11-13-07

439S.1 - Description

This item shall govern parking lot bumper curbs, composed of precast concrete and reinforcing steel for placement on gravel, asphalt and concrete surfaces as indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

439S.2 - Submittals

The submittal requirements of this specification item include:

A. Type A Portland cement concrete design mix.

B. Reinforcing steel details.

439S.3 - Materials

A. Concrete. All precast concrete shall be Class A Concrete conforming to Specification Item No. 403S, "Concrete for Structures".

B. Reinforcing Steel. All reinforcing steel shall be #3 (10M) bar conforming to Specification Item No. 406S, "Reinforcing Steel."

439S.4 - Construction Methods

All forms and forming, placement of reinforcement, placement of concrete, form removal, finishing and curing shall conform to Specification Item No. 410S, "Concrete Structures".

Reinforcement shall conform to the details indicated on the Drawings. Care shall be exercised to keep reinforcement in its proper position during the depositing of concrete.

Concrete shall be placed in the forms to the depth indicated and vibrated until thoroughly compacted. Care shall be taken during vibration to insure that a vibrator is not held too long at one location that segregation is produced. The top surface of the concrete shall be floated and troweled to a uniform smooth surface, and then finished with a camel hair brush or wood float to a gritty texture. The outer edges shall be rounded with approved tools to the radii shown on the Drawings.

When the ambient air temperature is above 85°F (30°C), an approved retarding agent will be required in all concrete unless moist curing procedures are employed. The maximum temperature of all concrete placed shall not exceed 95°F (35°C).

439S.5 - Measurement

Parking Lot Bumper Curbs shall be measured per each, complete and in place.

439S.6 - Payment

The work performed as prescribed by this Specification Item will be paid for at the unit bid price per each. The unit bid price shall include full compensation for: all materials, including all reinforcing steel, placing and the concrete curb, and all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 439S:	Parking Lot Bumper Curbs	Per Each.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 439S "Parking Lot Bumper Curbs"	
City of Austin Technical Specifications	
Designation	Description
Item No. 403S	Concrete for Structures
Item No. 406S	Reinforcing Steel
Item No. 410S	Concrete Structures

RELATED CROSS REFERENCE MATERIALS	
Specification Item 439S "Parking Lot Bumper Curbs"	
City of Austin Technical Specifications	
Designation	Description
Item No. 405S	Concrete Admixtures
Item No. 409S	Membrane Curing
Item No. 411S	Surface Finishes for Concrete

City of Austin Standards	
Designation	Description
Item No. 406S-1	Reinforced Steel Tolerances
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 437	Concrete Admixtures
Item 440	Reinforcing Steel
American Society for Testing and Materials	
Designation	Description
A-496	Standard Specification for Steel Wire, Deformed for Concrete Reinforcement
A-615/615M	Standard Specification for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement

End

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ITEM NO. 470S - CURB CUTS FOR SIDEWALK RAMPS AND DRIVEWAYS 3-26-08

470S.1 - Description

This item shall govern horizontal and vertical curb saw cuts, which are undertaken on existing or newly placed Portland cement concrete curb, in order to accommodate the construction of new concrete sidewalk ramps and/or driveways at the locations indicated on the Drawings or as directed by the Engineer or designated representative. The curb cutting operation shall be conducted from the street side of the existing or newly placed curb.

This specification is optional and is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

470S.2 - Submittals

The submittal requirements of this specification item include:

A. Manufacturer and model number of saw to be used for curb cuts.

B. Documentation that the saw that is to be used on the project is designated specifically to curb cuts.

470S.3 - Materials

A diamond-blade-cutting saw shall be utilized for all required curb sawing/cutting. The saw shall be capable of cutting existing or newly placed curb material into the shape of a ramp and/or driveway; leaving a smooth, accurate top face. The saw shall be specifically designed for this purpose and shall be approved by the Engineer or designated representative prior to the start of any curb cut work.

A diamond-grinding wheel shall be used for rounding the sawed concrete edges.

470S.4 - Construction Methods

The curb shall be sawn in accordance with City of Austin Standard Detail 470S-1 or as directed by the Engineer or designated representative. The sawing shall be made along neat lines and shall result in smooth edges and top faces. The length of curb face, which must be removed in order to conform to the proposed sidewalk ramp or driveway, shall be sawn full depth at the bottom of the curb face using a diamond saw blade.

The saw cutting of the curb face shall be initiated at an elevation ½ inch (12.5 millimeters) above the existing gutter and extended at an angle of ¾ inch per foot (63 mm per meter) upwards and away from the gutter pan to conform with the new sidewalk ramp or driveway grade. End cuts shall be sawn full depth on an angle so that the saw cut face provides a dimension of 55 to 60 inches (1.4 to 1.5 meters) for ADA ramps and 30 inches (750 mm) for driveways (Standard Detail No. 470S-1). The corners of the tops of the end cuts shall be ground using a diamond-grinding wheel to a radius of ¼ inch (6 mm).

Special care shall be taken to insure that there is no disturbance or damage to the existing roadway pavement, sidewalk pavement or curbs scheduled to remain. Any damage to remaining pavements, sidewalks and/or curb due to the Contractor's operations shall be repaired at the Contractor's sole cost and expense.

The work under this specification item shall also include the disposal of all concrete curb materials removed during the curb cutting operation. Disposal shall conform to the requirements of City of Austin Standard Specification Item No. 401S, "Structural Excavation and Backfill."

470S.5 - Measurement

Accepted work as prescribed by this item shall include the removal and disposal of all sawn material and shall be measured by the number of lineal feet (lineal meters: 1 meter is equal to 3.281 feet) of sawcutting from top of curb cut at beginning to top of curb cut at ending for each proposed sidewalk ramp location that are completed in accordance with the Drawings, Standard Detail or as directed by the Engineer or designated representative.

470S.6 - Payment

The work performed as prescribed by this item will be paid for at the unit bid price per lineal foot of "Curb Cuts" for sidewalk ramps and driveways. The bid price shall include full compensation for the cost of all labor, materials and equipment necessary to complete the Work, the removal and disposal of the curb cut, and the cost of any repairs necessitated from damage produced during the Contractor's operations.

Pay Item No. 470S-D:	Curb Cuts for Driveways	Per Lineal Foot.
Pay Item No. 470S-R:	Curb Cuts for Sidewalk Ramps	Per Lineal Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 470S, "Curb Cuts for Sidewalk Ramps and Driveways"	
City of Austin Technical Specifications	
Designation	Description
Item No. 401S	Structural Excavation and Backfill
City of Austin Standard Details	
Designation	Description
470S-1	Typical Curb Cuts for Sidewalk Ramps

RELATED CROSS REFERENCE MATERIALS	
Specification 470S, "Curb Cuts for Sidewalk Ramps and Driveways"	
City of Austin Technical Specifications	
Designation	Description
Item No. 104S	Removing Concrete
Item No. 110S	Street Excavation
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 360	Concrete Pavement
Item No. 370S	Concrete Pavers
Item No. 375S	Concrete Pavers for Sidewalk Ramps
Item No. 403S	Concrete for Structures
Item No. 410S	Concrete Structures
Item No. 430S	Concrete Curb and Gutter
Item No. 431S	Machine Laid Curb and Gutter
Item No. 432S	Concrete Sidewalks
Item No. 433S	Concrete Driveways
Item No. 434S	Concrete Median and Islands
Item No. 602S	Sodding for Erosion Control

Item No. 604S	Seeding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation

City of Austin Standard Details

Designation	Description
430S-1	Curb and Gutter Section
430S-3	Curb Expansion Joint Dowel Detail
430S-4	Concrete Backfill Under Curb & Gutter
432S-1	Sidewalk
432S-3	Intersection Curb Ramps
432S-3A	Curb Ramps at T-Type Intersections
432S-3B	Intersection Curb Ramps with Returned Curb
432S-3C	Curb Ramps with Returned Curb at T Intersections
432S-3D	Combined Curb Ramps
432S-3E	Combined Curb Ramp at T type Intersection
432S-3F	Combined Sidewalk Curb Ramp with Pavers
432S-5	Sidewalk Curb Ramp With Pavers (type I)
432S-5A	Sidewalk Curb Ramp With Pavers (type IA)
432S-5B	Sidewalk Curb Ramp With Pavers (type IB)
432S-6	Concrete Stamp

433S-1	Type I Driveway
433S-2	Type II Driveway
610S-1	Tree Protection Fence Locations

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 104	Removing Concrete
Item No. 420	Concrete Structures

End

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ITEM NO. 503S - FRAMES, GRATES, RINGS AND COVERS 2-17-00

503S.1 - Description

This item shall govern furnishing and installation of frames, grates, rings and covers for inlets, manholes and other structures indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

503S.2 - Submittals

The submittal requirements of this specification item include manufacturer, model number, description, painting requirements and characteristics of frames, grates, rings, covers, height adjustment insert and nuts and bolts required for completion of the work.

503S.3 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation in the Work is the kind and quality that satisfies the specified functions and quality. The City of Austin Water and Wastewater Utility Standard Products Lists (SPLs) form a part of these Specifications. Contractors may, when appropriate, elect to use products from the SPLs; however, submittal to the Engineer or designated representative is still required. If the Contractor elects to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal.

The purpose of the SPLs is to expedite the review by the Engineer or designated representative and, if necessary, the City of Austin Water and Wastewater Utility Standard Products Committee of Contractor product submittals. The SPL's should not be interpreted as being a pre-approved list of products necessarily meeting the requirements for a given construction Project. Items contained in the SPL cannot be substituted for items that are shown on the Drawings, called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the Engineer or designated representative in conjunction with the Water and Wastewater Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

A. Welded

Steel Welded steel grates and frames shall conform to the number; size, dimensions and details indicated on the Drawings and shall be welded into an assembly in accordance with those details. Steel shall conform to the requirements of ASTM A 36/A 36M, "Specification for Structural Steel".

B. Castings

Castings, whether Carbon-Steel, Gray Cast Iron or Ductile Iron shall conform to the shape and dimensions indicated on the Drawings and shall be clean substantial castings, free from sand or blowholes or other defects. Surfaces of the castings shall be free from burnt on sand and shall be reasonably smooth. Runners, risers, fins and other cast on pieces shall be removed from the castings and such areas ground smooth. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact. Pairs of machined castings shall be matchmarked to facilitate subsequent identification at installation with the exception of water and wastewater manhole and valve castings. These manhole and valve castings shall be fabricated with such draft, tolerances, bolt hole spacing, etc., that all rings and covers of a particular type or class are interchangeable and match-marking will not be required.

Steel castings shall conform to ASTM A 27/27M, "Specifications for Steel Castings, Carbon, for General Application". Grade 70-36 (480-250) shall be furnished unless otherwise specified on the Drawings.

Cast iron castings shall conform to ASTM A 48, "Specification for Gray Iron Castings", Class 30.

Ductile Iron castings shall conform to ASTM A 536, "Specification for Ductile Iron Castings". Grade 60-40-18 (415-275-125) shall be used unless otherwise indicated on the Drawings.

C. Manhole Cover Riser Rings

Height-adjustment inserts for wastewater manhole rings, which are used for raising standard manhole covers, shall be those models listed in Water and Wastewater Standard Products List item QPL WW-330.

D. Nuts and Bolts

Nuts and bolts shall be hex head 5/8 ″ × 2.5″ (16 mm × 63.5 mm) #11 National Coarse Thread, Type 316 stainless steel. For bolted manhole covers, a thin film of an approved "Anti-freeze" compound, approved by the Engineer or designated representative, shall be applied to all bolts.

E. Mortar

Unless otherwise specified or approved by the Engineer or designated representative, the mortar for bedding castings shall consist of one (1) part Portland cement and three (3) parts sand and sufficient water to provide the desired consistency. The gradation of the fine aggregate shall meet the requirements for Grade No. 1, Item No. 403, "Concrete for Structures".

503S.4 - Construction Methods

Frames, grates, rings and covers shall be constructed of the specified materials in accordance with the details indicated on the Drawings or in the City of Austin Standard Details. The Frames, grates, rings and covers shall be placed carefully to the lines or grades indicated on the Drawings or as directed by the Engineer or designated representative.

All welding shall conform to the requirements of the ANSI/AWS Structural Welding Code D1.1. Welded frames, grates, rings and covers shall be given 1 coat of a commercial grade red lead oil paint and 2 coats of commercial grade aluminum paint. All coats shall be a minimum of 1.5 mils (0.4 mm), dry.

Painting of gray iron castings will not be required, except when used in conjunction with structural steel shapes.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item Number 503S, "Frames, Grates, Rings and Covers"	
City of Austin Standard Specifications	
Designation	Description

Item No. 403S	Concrete for Structures
City of Austin Water and Wastewater Standard Products List	
Designation	Description
QPL-WW-330	Manhole Cover Riser Rings for raising City of Austin Standard Manhole Covers
American Society for Testing Materials (ASTM)	
Designation	Description
A36/A36M	Specification for Structural Steel
A27/A27M	Specification for Steel Castings, Carbon, for General Application
A48	Specification for Gray Iron Castings
A536	Specification for Ductile Iron Castings
ANSI/AWS	
Designation	Description
Code D 1.1	Structural Welding Code

RELATED CROSS REFERENCE MATERIALS
Standard Specification Item Number 503S, "Frames, Grates, Rings and Covers"

City of Austin Standard Specifications	
Designation	Description
Item No. 504S	Adjusting Structures
Item No. 510	Pipe

City of Austin Standard Details	
Designation	Description
No. 503S-1	457mm (18″) Cover and Frame
No. 503S-2S	Storm Sewer Manhole Ring and 610 mm (24″) Cover
No. 503S-2W	Sanitary Sewer Manhole Ring and 610 mm (24″) Cover
No. 503S-3S	Bolted Storm Sewer Manhole Ring and 610 mm (24″) Cover
No. 503S-3W	Bolted Sanitary Sewer Manhole Ring and 610 mm (24″) Cover
No. 503S-4S	Storm Sewer Manhole Ring and 813 mm (32″) Cover
No. 503S-4W	Sanitary Sewer Manhole Ring and 813 mm (32″) Cover
No. 503S-5S	Bolted Storm Sewer Manhole Ring and 813 mm (32″) Cover
No. 503S-5W	Watertight Manhole Ring and 813 mm (32″) Cover
No. 506S-2	Major Manhole Adjustment
No. 506S-11	Storm Sewer Manhole Details

TxDOT Specifications

Designation	Description
Item 421	Portland Cement Concrete

End

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ITEM NO. 504S - ADJUSTING STRUCTURES 2-24-10

504S.1 - Description

This item shall govern the removal and replacement of surfacing, furnishing of materials, adjusting and/or repositioning existing structures, valve boxes, pull boxes, survey monument boxes and water meters in accordance with these specifications to the locations or elevations indicated on the Drawings or as directed by the Engineer or designated representative. This item shall also govern any pumping, bailing and drainage required to complete the Work and Standard Specification Item No. 509S, "Trench Safety Systems" for trench walls when indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses

504S.2 - Submittals

The submittal requirements of this specification item include:

A. Aggregate type, gradations and physical characteristics for the Portland cement concrete mix.

B. Proposed proportioning of materials for the mortar mix.

C. Type structures and proposed adjustment technique (lowering, raising, lateral displacement).

D. Type structure, repair technique and materials to be furnished (new replacement or reuse of existing) Type of mixing plant and associated equipage including chart indicating the calibration of each cold bin

504S.3 - Materials

Precast reinforced concrete rings and castings in good condition, which are removed from the structures to be adjusted, may be reused with the written approval of the Engineer or designated representative. Additional materials required shall conform to the details indicated on the Drawings.

A. Portland Cement Concrete The Portland cement concrete shall be Class A conforming to Standard Specification Item No. 403, "Concrete for Structures".

B. Mortar Unless otherwise specified or approved by the Engineer or designated representative, the mortar for bedding castings shall consist of one (1) part Portland cement and three (3) parts sand, by volume based on dry materials. Sufficient water will be added to provide the desired consistency. The gradation of the fine aggregate shall meet the requirements for "Fine Aggregate" as given in Standard Specification Item No. 403, "Concrete for Structures".

504S.4 - Construction Methods

All adjustments shall be completed prior to the placement of the final surface.

Pull box and valve box components scheduled for reuse shall be carefully removed and the contact areas shall be cleaned of all mortar, concrete, grease and sealing compounds. Any items broken in the process of removal and cleaning shall be replaced in kind by the Contractor at its own expense.

If the adjustment involves slight lowering or raising a valve box or survey monument box, the outside shell of a slip or screw casing shall be excavated to its full length and adjusted to the proposed grade. Pipe castings shall be excavated to the depth required to cut from or weld a section to the casing as may be needed to adjust the ring to the proposed elevation. The ring shall be welded to the casing prior to pouring concrete around the casing.

If the adjustment involves a vertical (lowering or raising) or a horizontal reassignment of a water meter and the property owner's cut off valve, this work shall be completed in accordance with Standard Installation Details included in the City of Austin Standard Details Series (501S-1, 504S-3, 511S-13A, 511S-13B, etc.).

After the adjustments have been completed and cured, structures within the paved area shall be paved as indicated on the Drawings.

504S.5 - Measurement

The work performed and materials furnished as prescribed by this item as indicated shall be measured per each.

504S.6 - Payment

The work performed, materials furnished and measures as provided above, will be paid by the unit bid price per each. The price shall include full compensation for furnishing all materials, handling, placing, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 504S-1WM:	Adjusting Water Meters	Per Each
Pay Item No. 504S-1RM:	Repositioning & Adjusting Water Meters	Per Each
Pay Item No. 504S-3G:	Adjusting Gas Valve Boxes to Grade	Per Each
Pay Item No. 504S-3S:	Adjusting Survey Monument Boxes to Grade	Per Each
Pay Item No. 504S-3W:	Adjusting Water Valve Boxes to Grade	Per Each
Pay Item No. 504S-4PB:	Adjusting Pull Boxes to Grade	Per Each

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 504S, "Adjusting Structures"	
City of Austin Standard Specifications	

Designation	Description
Item No. 403	Concrete for Structures
Item No. 509S	Trench Safety Systems

City of Austin Standard Details

Designation	Description
No. 501S-1	Encasement Detail W/ Casing Spacers
No. 504S-3	Gas Valve Casing Adjustment
No. 511S-13A	Water Valve Box Adjustment to Grade w/ Full Depth Concrete
No. 511S-13B	Water Valve Box Adjustment to Grade w/ Concrete and HMAC

RELATED CROSS REFERENCE MATERIALS

Specification 504S, "Adjusting Structures"

City of Austin Standard Specifications

Designation	Description
Item No. 501S	Jacking or Boring
Item No. 503S	Frames, Grates, Rings and Covers
Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 507S	Bulkheads

Item No. 508S	Miscellaneous Structures and Appurtenances
Item No. 511S	Water Valves

City of Austin Standard Details

Designation	Description
No. 1100S-1	Casting Adjustment
No. 725S-1	Monument, Type A Survey Identification Marker
No. 725S-2	Monument, Type B Survey Identification Marker
No. 725S-3	Monument, Type C Survey Identification Marker
No. 725S-7	Survey Identification Marker Non-Traffic Construction Detail
No. 725S-10	Survey Identification Marker Roadway Construction Detail
No. 725S-11	Adjustable Valve Box For Survey Monument

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No.421	Portland Cement Concrete

End

ITEM NO. 508S - MISCELLANEOUS STRUCTURES AND APPURTENANCES 2-24-10

508S.1 - Description

This item governs the construction of miscellaneous structures and appurtenances, complete in place or to the stage detailed and/or indicated in the Drawings, using the materials specified herein, including the excavation, installation, backfilling, placement of the concrete and when required, the furnishing and installation of frames, grates, rings, covers, safety end treatment and any concrete curb and gutter indicated on the Drawings.

This specification is applicable for projects or work involving either SI or inch-pound units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses

508S.2 - Submittals

The submittal requirements of this specification item include:

A. Type of structure and appurtenances (inlets, headwalls, frames, grates, energy dissipators, etc.), construction methods and sequence (precast, cast in place), materials (bolts, nuts, plates, angles, etc.)

B. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix.

C. Proposed proportioning of materials for the mortar mix.

D. Analysis and thickness calculations for temporary steel covers.

508S.3 - Types

The various types of structures and appurtenances such as inlets, headwalls, energy dissipators, etc., are designated on the Drawings by letter or by number for the particular design of structure to be constructed in accordance with the details indicated on the Drawings. Unless otherwise indicated on the Drawings, the Contractor may have the option of furnishing cast in place or precast structures.

508S.4 - Materials

A. Portland Cement Concrete

The Portland cement concrete shall conform to Item No. 403S, "Concrete For Structures", with the following classes:

Cast in Place Concrete Class A

Precast Concrete Class C

B. Mortar

Mortar shall be composed of 1 part Portland cement and 2 parts clean, sharp mortar sand suitably graded for the purpose by conforming in other respects to the provisions of Standard Specification Item No. 403S, "Concrete for Structures" for fine aggregate. Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight (mass) of the total dry mix.

C. Reinforcement and Steel

Reinforcing Steel shall conform to Standard Specification Item No. 406S,"Reinforcing Steel".

Structural Steel shall conform to Standard Specification Item No. 720S, "Metal for Structures".

D. Frames, Grates, Rings and Covers

Frames, grates, rings and covers shall conform to City of Austin Standard Specification Item No. 503S, "Frames, Grates, Rings and Covers".

E. Safety End Treatment for Structures

The safety end treatment for structures shall conform to TxDOT Specification Item No. 467, "Safety End Treatment".

1. Bolts and Nuts. All bolts, nuts and associated hardware shall meet the specifications of ASTM A 307.
2. Plates and Angles. All plates and similar angles and brackets shall meet the specifications of ASTM A 36.
3. Pipe Runners. Pipe Runners shall conform to the requirements of ASTM A53, Grade B.
4. Galvanizing. All hardware including nuts, bolts and plates listed above shall be galvanized conforming to ASTM A 123 or A 153.

F. Miscellaneous Items

Cast iron for supports, steps and inlet units shall conform to the shape and dimensions indicated on the Drawings. The casting shall be clean and perfect, free from sand or blowholes or other defects. Cast iron castings shall meet the requirements of ASTM A 48, Class 30. Steel for temporary covers when used with stage construction shall be adequate for the loads imposed.

508S.5 - Construction Methods

All concrete work shall be performed in accordance with Standard Specification Item No.410S, "Concrete Structures". Forms will be required for all cast-in-place concrete walls, except where the nature of the surrounding material is such that it can be trimmed to a smooth vertical face (the outside form for concrete bases). Where cast in place concrete is used in wall construction of storm sewers, the steps shall be cast into the wall when the concrete is placed.

The construction inlets shall be completed, as soon as is practicable after installation is complete of the sewer lines in the inlet. All sewer line shall be cut neatly at the inside face of the walls of the inlet and pointed up with mortar.

Bases for cast in place inlets may be placed prior to or at the Contractor's option after the sewer is constructed.

Bases for box sewers shall be cast as an integral part of the sewer. The manholes may be constructed prior to backfilling or if the Contractor so elects, the manhole opening may be covered temporarily with a steel plate to facilitate the compaction of backfill for the sewer as a whole. Thereafter, required excavation for the inlet shall be made and the inlet constructed and backfilled.

The inverts passing out or through an inlet shall be shaped and grouted across the floor of the inlet as indicated on the Drawings. This shaping may be accomplished by adding shaping mortar or concrete after the base is cast or by placing the required additional material with the base.

All miscellaneous structures shall be completed in accordance with the details indicated on the Drawings. Backfilling to original ground elevation shall be in accordance with the provisions of the appropriate items and as directed by the Engineer or designated representative.

Energy dissipators and headwalls shall be constructed in accordance with City of Austin Standard Detail 508S-13.

508S.6 - Measurement

All miscellaneous structures and safety end treatments satisfactorily completed as indicated on the Drawings will be measured as completed units per each.

Concrete removal, excavation and backfill, riprap, pipe, headwalls, wing walls, collars and apron slabs will not be measured under this item but will be included in the unit price bid for the item of construction in which this item is used.

Frames, grates, rings, covers, safety end treatment and any concrete curb and gutter indicated will not be measured and paid for but shall be included in the unit price bid of one of the pay items identified in the contract bid form.

508S.7 - Payment

A. Inlets

Payment for Inlets of the type indicated in place in accordance with these specifications and measured as prescribed above will be made at the unit bid price for each Inlet, of the type specified.

B. Energy Dissipators and Headwalls

Payment for special complete structures will be made at the unit price bid per each.

C. Safety End Treatment

Payment for Safety End Treatment, complete in place, will be made at the unit bid price for each unit of the type indicated on the Drawings.

Payment will be made under one of the following:

Pay Item No. 508S-E:	Energy Dissipators, _____ In. Dia.	Per Each.
Pay Item No. 508S-H:	Headwalls, Type _____, ___ In. Dia. Pipe	Per Each.
Pay Item No. 508S-IG:	Inlet, Grated	Per Each.
Pay Item No. 508S-SET	Safety End Treatment, Type _____ Size ___	Per Each.
Pay Item No. 508S-I5R:	Inlet, Recessed	Per Each.
Pay Item No. 508S-I10R:	Inlet, Recessed	Per Each.
Pay Item No. 508S-I15R:	Inlet, Recessed	Per Each.
Pay Item No. 508S-I20R:	Inlet, Recessed	Per Each.
Pay Item No. 508S-I5S:	Inlet, Standard	Per Each.
Pay Item No. 508S-I10S:	Inlet, Standard	Per Each.

Pay Item No. 508S-I15S:	Inlet, Standard	Per Each.
Pay Item No. 508S-I20S:	Inlet, Standard	Per Each.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item No. 508S, "Miscellaneous Structures and Appurtenances"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 403S	Concrete For Structures
Item No. 406	Reinforcing Steel
Item No. 410	Concrete Structures
Item No. 720	Structural Steel
Item No. 503S	Frames, Grates, Rings and Covers
TxDOT Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges	
Designation	Description
Item 467	Safety End Treatment
American Society for Testing and Materials (ASTM)	

Designation	Description
ASTM A36/36M	Specification for Structural Steel
ASTM A48	Specification for Gray Iron Castings
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	Specifications for Carbon Steel Externally Threaded Standard Fasteners
ASTM C913	Specifications for Precast Concrete Water and Wastewater Structures

RELATED CROSS REFERENCE MATERIALS	
Standard Specification Item No. 508S, "Miscellaneous Structures and Appurtenances"	
City of Austin Drainage Criteria Manual	
Designation	Description
Section 6.6.0	Energy Dissipators
City of Austin Standard Specification Items	
Designation	Description
Item No. 501S	Jacking or Boring Pipe
Item No. 504S	Adjusting Structures

Item No. 506	Manholes
Item No. 507S	Bulkheads
Item No. 510	Pipe

City of Austin Standard Details

Designation	Description
508S-13	Standard Headwall and Energy Dissipators
510S-1	Concrete Trench Cap

TxDOT Specifications

Designation	Description
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Section 421.2(5)	Fine Aggregate
Item 424	Precast Concrete Structures (Fabrication)
Item 440	Reinforcing Steel
Item 466	Headwalls and Wingwalls
Item 467	Safety End Treatment
Item 471	Frames, Grates, Rings and Covers
Item 529	Concrete Curb, Gutter and Combined Curb and Gutter

End

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ITEM NO. 509S - EXCAVATION SAFETY SYSTEMS 9-26-12

509S.1 - Description

This item shall govern the designing, furnishing, installing, maintaining and removing or abandoning of temporary Excavation Safety Systems consisting of trench shields, aluminum hydraulic shoring, timber shoring, trench jacks, tied-back or braced sheeting, tied-back slurry walls, soil nailing, rock bolting, tied-back or braced soldier piles and lagging, and other systems for protecting workers in excavations. This item shall also govern the designing and constructing of sloping and benching systems for protecting workers in excavations.

At a minimum, the Excavation Safety Systems shall conform to United States Department of Labor Rules 29 CFR, Occupational Safety and Health Administration, Part 1926 Safety and Health Regulations for Construction, Subpart P, Excavation (hereinafter called OSHA).

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

509S.2 - Definitions

COMPETENT PERSON shall mean one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The ***COMPETENT PERSON*** shall be capable of interpreting the manufacturer's data sheets and interpreting and implementing the Excavation Safety System Plan.

An ***EXCAVATION*** shall mean any cut, cavity, trench, or depression in an earth surface, formed by earth removed by the Contractor. The Contractor shall provide an Excavation Safety System for all excavations except when 1) the excavation is in stable rock as determined by the Texas-licensed Professional Engineer who prepared the Contractor's Excavation Safety System Plan or 2) the excavation is less than 5 feet (1.52 m) in depth and examination of the ground by the Contractor's competent person provides no indication of a potential cave-in.

TRENCH (TRENCH EXCAVATION) shall mean any narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth shall be greater than the width, but the trench (measured at the bottom) shall not be wider than 15 feet (4.56 m). Excavation Safety Systems for such trenches shall be defined as Trench Excavation Safety Protective Systems.

If the Contractor installs or constructs forms or other structures in an excavation such that the dimension measured from the forms or structures to the sides of the excavation is reduced to 15 feet (4.6 m) or less (measured at the bottom of the excavation), those excavations shall also be defined as a ***TRENCH*** if workers must enter it. Excavation Safety Systems for such ***TRENCHES*** shall also be defined as ***TRENCH EXCAVATION SAFETY PROTECTIVE SYSTEMS*** .

509S.3 - Excavation Safety System Plan Submittal

A. The Notice to Proceed with construction may be issued by the Owner before the Contractor has submitted the necessary Excavation Safety Plan(s); however, excavation shall not proceed until the Owner has received the Contractor's Excavation Safety Plan(s) for the Project.

B. Prior to Starting Excavation

Prior to starting any Excavation, the Contractor shall submit to the Owner:

1. A certificate indicating that the Contractor's Competent Person(s) has completed training in an excavation safety program based on OSHA regulations within the past 5 years.
2. Manufacturer's tabulated data or other tabulated data for Excavation Safety Systems consisting of pre-engineered protective systems such as trench shields, aluminum hydraulic shoring, timber shoring, pneumatic shoring, or trench jacks, or benching or sloping or other protective systems that are not designed specifically for the Project.

Manufacturer's tabulated data shall meet the requirements in OSHA and shall describe the specific equipment to be used on the Project. Tabulated data must bear the seal of the licensed professional engineer who approved the data. Manufacturer's tabulated data shall be an attachment to the Contractor's Excavation Safety System Plan described below.

509S.4 - Excavation Safety System Plan Review

The Contractor shall prepare an Excavation Safety System Plan (hereafter called the "Plan") specifically for the Project. The Contractor shall retain a Texas-licensed Professional Engineer to prepare the Plan. On City-funded projects, the Contractor must follow qualifications-based procedures to procure the required Professional Engineering services, according to Chapter 2254 of the Texas Government Code.

The Contractor shall be responsible for obtaining geotechnical information necessary for design of the Excavation Safety System. If geotechnical information for design of the Project has been acquired by the Owner or designated representative, it shall be provided to the Contractor for information purposes subject to the provisions of City of Austin Standard Contract Section 00220, "Geotechnical Data."

A. The Plan for Excavation Safety Systems consisting of pre-engineered protective systems such as trench shields, aluminum hydraulic shoring, timber shoring, pneumatic shoring, or trench jacks, or benching or sloping or other protective systems that are not designed specifically for the Project shall include:
   1. Detailed Drawings of the Excavation Safety System(s) that will provide worker protection conforming to OSHA. The Drawings shall note the required load carrying capacity, dimensions, materials, and other physical properties or characteristics in sufficient detail to describe thoroughly and completely the Excavation Safety System(s).
   2. Drawings, notes, or tables clearly detailing the specific areas of the Project in which each Excavation Safety System shall be used, the permissible size of the excavation, the length of time that the excavation shall remain open, the means of egress from the excavation, the location of material storage sites in relation to the excavation, the methods for placing/compacting bedding/backfill within the safety of the system, any excavation safety equipment restrictions and subsequent removal of the system.
   3. Recommendations and limitations for using the Excavation Safety Systems.
   4. A Certificate of Insurance of the Excavation Safety System Engineer's Professional Liability Insurance coverage. For City-funded projects, coverage meeting the requirements of Standard Contact Documents Section 00810 shall be provided. For privately funded projects the coverage shall be at least $1,000,000.

B. The Plan for Excavation Safety Systems consisting of tied-back or braced sheeting, tied-back or braced soldier piles and lagging, slurry walls, soil nailing, rock bolting or other protective systems that are designed specifically for the Project shall include:
   1. Detailed Drawings of the Excavation Safety System(s) that will provide worker protection conforming to OSHA. The Drawings shall note the design assumptions, design criteria, factors of safety, applicable codes, dimensions, components, types of materials, and other physical properties or characteristics in sufficient detail to describe thoroughly and completely the Excavation Safety System(s).

2. Detailed technical specifications for the Excavation Safety System addressing the properties of the materials, construction means and methods, quality control and quality assurance testing, performance monitoring, and monitoring of adjacent features, as appropriate.
3. Drawings that clearly detail the specific areas of the Project in which each type of system shall be used and showing the Special Shoring in plan and elevation (vertical profile) views.
4. Drawings, notes or tables clearly detailing the length of time that the excavation shall remain open, the means of egress from the excavation, the location of material storage sites in relation to the excavation, the methods for placing/compacting bedding/backfill within the safety of the system, any excavation safety equipment restrictions and subsequent removal or abandonment of the system or parts thereof.
5. Recommendations and limitations for using the Excavation Safety Systems.
6. A Certificate of Insurance of the Excavation Safety System Engineer's Professional Liability Insurance coverage. For City-funded projects, coverage meeting the requirements of Standard Contract Documents Section 00810 shall be provided. For privately funded projects the coverage shall be at least $1,000,000.

509S.5 - Excavation Safety System Submittal Review

Review of the Excavation Safety System submittal conducted by the Owner or designated representative shall only relate to conformance with the requirements herein. The Owner's failure to note exceptions to the submittal shall not relieve the Contractor of any or all responsibility or liability for the adequacy of the Excavation Safety System. The Contractor shall remain solely and completely responsible for all Excavation Safety Systems and for the associated means, methods, procedures, and materials.

509S.6 - Contractor's Responsibility

The Contractor shall be responsible for implementing the Excavation Safety System Plan and for confirming that the Excavation Safety System(s) used on the Project meets the requirements of the Plan.

The Contractor's Competent Person(s) shall be on the Project whenever workers are in an excavation meeting the definitions of a Trench given in 509S.2.

509S.7 - Construction Methods

The Contractor's Competent Person(s) shall maintain a copy of appropriate OSHA regulations on-site and shall implement OSHA excavation safety regulations at the work site. The Contractor shall perform all excavation in a safe manner and shall maintain the Excavation Safety Systems to prevent death or injury to personnel or damage to structures, utilities or property in or near excavation.

If evidence of possible cave-ins or earthen slides is apparent or an installed Excavation Safety System is damaged, the Contractor shall immediately cease work in the excavation, evacuate personnel from any potentially hazardous areas and notify the Owner. Personnel shall not be allowed to re-enter the excavation until necessary repairs or replacements are completed and are inspected and approved by the Contractor's Competent Person(s). Repair and replacement of damaged Excavation Safety System shall be at the Contractor's sole expense.

509S.8 - Changed Conditions

When changed conditions require modifications to the Excavation Safety System, the Contractor shall provide to the Owner or designated representative a new design or an alternate Excavation Safety System Plan that is proposed by the Contractor's Excavation Safety System Engineer to address the changed conditions. Copies of the new design or alternate system shall be provided to the Owner or designated representative in accordance with the requirements of section 509S.3, "Excavation Safety

System Plan Submittals." A copy of the most current Excavation Safety System Plan shall be maintained on site and made available to inspection and enforcement officials at all times.

Any changes to the Excavation Safety System Plan that are initiated by the Contractor for operational efficiency or as a result of changed conditions, that could be reasonably anticipated, will not be cause for contract time extension or cost adjustment. When changes to the Excavation Safety System Plan are necessitated by severe and uncharacteristic natural conditions or other conditions not reasonably within the control of the Contractor, the Contractor may make a written request to the Owner for a Change Order to address the anticipated work. The Contractor shall notify the Owner in writing within 24 hours of the occurrence of changed conditions that the Contractor anticipates the submittal of a claim for additional compensation. Under "Changed Conditions" the work deemed immediately necessary by the Contractor to protect the safety of workers and public, equipment or materials may only be accomplished until the Owner or designated representative has a reasonable opportunity to investigate the Contractor's written request for a Change Order and respond in writing to the request.

509S.9 - Measurement

Trench Excavation Safety Protective Systems will only be measured and paid for those trenches that workers would reasonably be expected to enter.

Trench Excavation Safety Protective Systems for Trenches excavated to a final width (measured at the bottom of the excavation) not exceeding 15 feet (4.56 m) shall be measured by the linear foot (meter: 1 meter equals 3.281 feet) through manholes, bore pits, receiving pits, and other appurtenances along the centerline of the trench. This method of measurement shall apply to any and all protective systems, including but not limited to tieback or braced sheeting, tieback or braced soldier piles and lagging, slurry walls, soil nails, rock bolts, shoring, trench boxes, and sloping or benching as used to provide a Trench Excavation Safety Protective System in accordance with the Excavation Safety System Plan.

Trench Excavation Safety Protective Systems for Trenches created by installation or construction of forms or other structures in an excavation whose width is greater than 15 feet (4.56 m) such that the dimension measured from the forms or structures to the sides of the excavation is reduced to 15 feet (4.56 m) or less (measured at the bottom of the excavation) shall be measured by the linear foot along the centerline of the Trench. Where forms or structures create multiple Trenches in one excavation, each Trench shall be measured separately. This method of measurement shall apply to any and all protective systems, including but not limited to tieback or braced sheeting, tieback or braced soldier piles and lagging, slurry walls, soil nails, rock bolts, shoring, trench boxes, and sloping or benching as used to provide a Trench Excavation Safety Protective System in accordance with the Excavation Safety System Plan.

509S.10 - Payment

Payment for Trench Excavation Safety Protective Systems, measured as prescribed above, will be made at unit bid price per centerline linear foot of Trench. The unit bid price shall include full compensation for designing, furnishing, installing the system; for dewatering, and for maintaining, replacing, repairing and removing the Trench Excavation Safety Protective System and for sloping, special clearing, and excavation necessary to safely implement the Excavation Safety System Plan. No payment will be made for Trench Excavation Safety Protective Systems made necessary by the Contractor's selection of an optional design or sequence of work that creates the need for the Trench Excavation Safety Protective System

Payment will be made under the following:

Pay Item No. 509S-1:	Trench Excavation Safety Protective Systems (all depths)	Per Linear Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Standard Specification Item No. 509S, "Excavation Safety Systems"	
City of Austin Standard Contract Documents	
Designation	Description
Section 00020	Invitation for Bids
Section 00220	Geotechnical Data
Section 00650	Certificate of Insurance
Section 00700, Article 6.11	Safety and Protection
Section 810	Supplemental General Conditions
29 CFR, Occupational Safety and Health Administration, Part 1926 Safety and Health Regulations for Construction, Subpart P, Excavation	
Texas Health and Safety Code Title 9 Chapter 756 Subchapter C	
Texas Government Code Chapter 2254	

RELATED CROSS REFERENCE MATERIALS	
Standard Specification Item No. 509S, "Excavation Safety Systems"	
Texas Department of Transportation: Standard Specifications For Construction and Maintenance of	

Highways, Streets, and Bridges	
Designation	Description
Item 104	Removing Concrete
Item 110	Excavation
Item 402	Trench Excavation Protection

City of Austin Standard Specification Items	
Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 402S	Controlled Low Strength Material
Item No. 501S	Jacking or Boring Pipe
Item No. 503S	Frames, Grates, Rings and Covers
Item No. 504S	Adjusting Structures
Item No. 505S	Concrete Encasement and Encasement Pipe

Item No. 506	Manholes
Item No. 507S	Bulkheads
Item No. 510	Pipe
Item No. 511S	Water Valves
Item No. 593S	Concrete Retards
Item No. 594S	Gabions and Revet Mattresses

End

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ITEM NO. 510 - PIPE 12-8-18

510.1 - Description

This item governs the furnishing and installing all pipe and/or materials for constructing pipe mains, sewers, laterals, stubs, inlet leads, service connections, culverts, temporary service lines and temporary diversion lines, including all applicable Work such as excavating, bedding, jointing, backfilling materials, tests, concrete trench cap, concrete cap and encasement, etc., prescribed under this item in accordance with the provisions of the Edwards Aquifer Protection Ordinance, when applicable, and City of Austin Utility Criteria Manual, Section 5, "Working in Public Rights-of-Way." The pipe shall be of the sizes, types, class and dimensions indicated or as designated by the E/A and shall include all joints or connections to new or existing mains, pipes, sewers, manholes, inlets, structures, etc., as may be required to complete the Work in accordance with specifications and published standard practices of the trade associations for the material specified and to the lines and grades indicated. This item shall include any pumping, bailing, and drainage when indicated or applicable. Unless otherwise provided, this item shall consist of the removal and disposition of trees, stumps and other obstructions, old structures or portions thereof such as house foundations, old sewers, masonry or concrete walls, the plugging of the ends of abandoned piped utilities cut and left in place and the restoration of existing utilities damaged in the process of excavation, cutting and restoration of pavement and base courses, the furnishing and placing of select bedding, backfilling and cement or lime stabilized backfill, the hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated.

510.2 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work are of the kind and quality that satisfies the specified functions and quality. Austin Water Utility Standard Products Lists (SPL) form a part of the Specifications. Contractors may, when appropriate, elect to use products from the SPL; however, submittal to the E/A is still required. Should the Contractor elect to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal. This will expedite the review process in which the E/A, and, if necessary, the Austin Water Utility Standard Products Committee, decides whether the products meet the Contract requirements and the specific use foreseen by the E/A in the design of this engineered Project. The purpose of the SPL's is to expedite review, by the E/A and, if necessary, the Austin Water Utility Standard Products Committee, of Contractor product submittals. The SPL's shall not be considered as being a pre-approved list of products necessarily meeting the requirements of the Project. Items contained in the SPL cannot be substituted for items shown on the Drawings, or called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the E/A in conjunction with the Austin Water Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

(1) Concrete

Concrete shall conform to Item No. 403S, "Concrete for Structures".

(2) Coarse Aggregate

Coarse aggregate shall conform to Item No. 403S, "Concrete for Structures" or one of the following:

(a) Pipe Bedding Stone

Pipe bedding stone shall be clean gravel, crushed gravel or crushed limestone, free of mud, clay, vegetation or other debris, conforming to ASTM C 33 for stone quality. Size gradation shall conform to ASTM C-33 No. 57 or No. 67 or the following Table:

SIEVE SIZE	% RETAINED BY WEIGHT
1½″	0
1″	0—10
½′	40—85
#4	90—100
#8	95—100

(b) Foundation Rock

Foundation rock shall be well graded coarse aggregate ranging in size from 2 to 8 inches.

(c) Flexible Base

Flexible base shall conform to Item No. 210S, "Flexible Base".

(3) Fine Aggregate

(a) Concrete and Mortar Sand

Fine aggregate shall conform to Item No. 403S, "Concrete for Structures".

(b) Bedding Sand

Sand for use as pipe bedding shall be clean, granular and homogeneous material composed mainly of mineral matter, free of mud, silt, clay lumps or clods, vegetation or debris. The material removed by decantation TxDOT Test Method Tex-406-A, plus the weight of any clay lumps, shall not exceed 4.5 percent by weight.

The resistivity shall not be less than 3000 ohms-cm as determined by TxDOT Test Method Tex-129-E. Size gradation of sand for bedding shall be as follows:

GRADATION TABLE	
SIEVE SIZE	% RETAINED BY WEIGHT
¼″	0
#60	75—100

#100	95—100

(c) Stone Screenings

Stone screenings shall be free of mud, clay, vegetation or other debris, and shall conform to the following Table:

SIEVE SIZE	% PASSING
3/8 ″	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

All screenings shall be the result of a rock crushing operation.

(4) Controlled Low Strength Material

Controlled Low Strength Material (CLSM) shall conform to Item 402S, "Controlled Low Strength Material.

(5) Pea Gravel

Pea gravel bedding shall be clean washed material, hard and insoluble in water, free of mud, clay, silt, vegetation or other debris. Stone quality shall meet ASTM C 33. Size gradation shall be as follows:

SIEVE SIZE	% RETAINED BY WEIGHT
¾″	0

½″	0—25
¼″	90—100

(6) Select Backfill or Borrow

This material shall consist of borrow or suitable material excavated from the trench. It shall be free of stones or rocks over 8 inches and shall have a plasticity index of less than 20. The moisture content at the time of compaction shall be within 2 percent of optimum as determined by TxDOT Test Method Tex-114-E. Sandy loam borrow will not be allowed unless shown on the Drawings or authorized by the E/A.

All suitable materials from excavation operations not required for backfilling the trench may be placed in embankments, if applicable. All unsuitable materials that cannot be made suitable shall be considered surplus excavated materials as described in 510.3(13). The Contractor may, if approved by the engineer, modify unsuitable materials to make them suitable for use. Modification may include drying, removal or crushing of over-size material, and lime or cement treatment.

(7) Cement Stabilized Backfill

When indicated or directed by the E/A, all backfill shall be with cement-stabilized backfill rather than the usual materials. Unless otherwise indicated, cement stabilized backfill material shall consist of a mixture of the dry constituents described for Class J Concrete. The cement and aggregates shall be thoroughly dry mixed with no water added to the mixture except as may be directed by the E/A.

(8) Pipe

General

Fire line leads and fire hydrant leads shall be ductile iron. Domestic water services shall not be supplied from fire service leads, unless the domestic and fire connections are on separately valved branches with an approved backflow prevention device in the fire service branch. All wastewater force mains shall be constructed of ductile iron pipe Pressure Class 250 minimum for pipe greater than 12-inch size and Pressure Class 350 for pipe 12-inch size and smaller. Wastewater pipe shall be in accordance with Austin Water Utility's Standard Products List SPL WW-534 and shall have a corrosion resistant interior lining acceptable to the Owner.

All water pipe within utility easements on private property shall be Ductile Iron Pipe, Pressure Class 350 minimum for pipe 12-inch size and smaller and Pressure Class 250 minimum for pipe greater than 12-inch size wrapped as indicated. For sizes over 24 inches, Concrete Pressure Pipe, steel cylinder type, conforming to the requirements of AWWA C-301 will be acceptable.

There may be no service connections to Concrete Pressure Pipe installed in utility easements on private property. Approved service clamps or saddles shall be used when tapping ductile iron pipe 12 inch size and smaller. All service tubing (¾ inch thru 2 inches) installed in utility easements on private property shall be 150 psi annealed seamless Type K copper tubing with no sweat or soldered joints.

All reclaimed water mains shall be constructed of ductile iron pipe, Pressure Class 350 minimum for pipe 12-inch size and smaller and pressure class 250 for pipe greater than 12-inch size. For mains 12-inch size and smaller, PVC pipe, conforming to the requirements of AWWA

C-900, DR 14 shall be acceptable. Reclaimed water pipe shall be manufactured purple, painted purple, or wrapped in purple polyethylene film wrap.

Manufacturers of concrete pipe and pipe larger than 24-inch diameter shall have a quality control program consisting of one or more of the following: 1) a quality management system certified by the American National Standards Institute (ANSI) or National Sanitation Foundation (NSF) to comply with ISO 9001:2000, 2) a quality management system certified by the QCast Program following the requirements of the ACPA Plant Certification Manual, 3) a quality management system certified by the National Precast Concrete Association 4) a quality control program approved by the OWNER prior to submittal of bids for the PROJECT, or 5) an independent, third party quality control testing and inspection firm for testing and inspecting pipe produced for the PROJECT and approved by the OWNER prior to submittal of bids for the PROJECT. All such quality control programs shall be paid for by the manufacturer. It is the intent of this requirement that the manufacturer will document all appropriate tests and inspections with sampling and inspection criteria, frequency of testing and inspection, date of testing and inspection and date on which every piece was manufactured. Required testing and inspection, including that by an independent, third party, shall be performed full-time during production of pipe for the PROJECT. When requested by the OWNER, the manufacturer will provide copies of test data and results and inspection reports with the shipment of pipe for the PROJECT. Test data and results and inspection reports shall be traceable to specific pipe lots or pieces. Owner approval of the manufacturer's quality control program will expire after three years, at which time the manufacturer must present a current quality control program for approval in order to retain listing on the applicable SPL. Owner approval of the Concrete Pipe manufacturer's quality control program will expire after three years, at which time the manufacturer must present a current quality control program for approval.

The quality of materials, the process of manufacture and the finished pipe shall be subject to inspection and approval by the E/A at the pipe manufacturing plant and at the project site prior to and during installation. Plant inspections shall be conducted at the discretion of the City Representative. Only manufacturers having a quality control program of the type described above will be considered as approved providers of concrete pipe and pipe products as listed in the Standard Products List (SPL).

All water distribution pipe and fittings shall be listed in the Fire Protection Equipment Directory published by the Underwriter's Laboratories, Inc., or shall be Factory Mutual approved for fire service. All water pipe and related products shall be registered by the National Sanitation Foundation as having been certified to meet NSF/ANSI Standard 61.

(a) Reserved

(b) Iron Pipe

Iron pipe shall be ductile iron pipe meeting all requirements of standards as follows:

-For push-on and mechanical joint pipe: AWWA C-151

-For flanged pipe: AWWA C-115

Barrels shall have a nominal thickness required by Table 1 of AWWA C-115, which thickness corresponds to Special Class 53 in sizes through 54 inch, and Class 350 in 60 and 64-inch sizes. Flanges shall be ductile iron (gray iron is not acceptable); they shall be as shown in ANSI/AWWA C115/A21.15 and shall conform to dimensions shown in Table 2 and Figure 1 of AWWA C115. These flanges are the same in all respects as flanges shown in ANSI/AWWA C110/A21.10 for fittings and are standard for all flanges used with pipe, valve, and equipment units in the City of Austin water distribution and wastewater force main systems. Flanges shall be fabricated and attached to the pipe barrels by U.S. fabricators using flanges and pipe barrels of U.S.

manufacture. If fabrication is to be by other than the pipe barrel manufacturer, a complete product submittal and approval by the Austin Water Utility will be required. Additionally, such fabricator shall furnish certification that each fabricated joint has been satisfactorily tested hydrostatically at a minimum pressure of 300 psi.

-Linings and Coating:

Interior surfaces of all iron potable or reclaimed water pipe shall be cement-mortar lined and seal coated as required by AWWA C104. Interior surfaces of all iron wastewater line and force main pipe shall be coated with a non-corrosive lining material as indicated on Austin Water Utility's Standard Products List SPL WW-534. Pipe exteriors shall be coated as required by the applicable pipe specification. The type and brand of interior lining shall be clearly marked on the outside of the pipe and fittings. Except as authorized by the E/A, only one type and brand of pipe lining shall be used on a given project.

Except as described above for flanged pipe (Thickness Class 53) and where not otherwise indicated, ductile iron pipe shall be minimum Class 250 as defined by ANSI/AWWA C150/A21.50-current; all ductile iron pipe and flanges shall meet the following minimum physical requirements:

Grade 60-42-10:

-Minimum tensile strength: 60,000 psi (414 mPa).

-Minimum yield strength: 42,000 psi (290 mPa).

-Minimum elongation: 10 percent.

The flanges for AWWA C115 pipe may be also be made from:

Grade 70-50-05:

-Minimum tensile strength: 70,000 psi (483 mPa).

-Minimum yield strength: 50,000 psi (345 mPa).

-Minimum elongation: 5 percent.

1. Ductile Iron Fittings:

   Fittings shall be push-on, flanged or mechanical joint as indicated or approved and shall meet all requirements of standards as follows:

   -Sizes 4 inch through 24 inch: AWWA C-110 or AWWA C-153

   -Sizes larger than 24 inch: AWWA C-110.

   -Lining and Coating:

   Interior surfaces or all iron potable/reclaimed water pipe fittings shall be lined with cement- mortar and seal coated as required by AWWA C104. Interior surfaces of all iron wastewater and force main fittings shall be coated with a non-corrosive lining material acceptable to Owner. Fitting exteriors shall be coated as required by the applicable pipe specification.

2. Joint Materials

   Gaskets for mechanical joints shall conform to ANSI/AWWA A21.11/C-111.

Joining of slip joint iron pipe shall, without exception, be accomplished with the natural or synthetic rubber gaskets of the manufacturer of that particular pipe being used. A joint lubricant shall be used and applicable recommendations of the manufacturer shall be followed.

Gaskets for flanged joints shall be continuous full face gaskets, of 1/8 inch minimum thickness of natural or synthetic rubber, cloth-reinforced rubber or neoprene material, preferably of deformed cross section design and shall meet all applicable requirements of ANSI/AWWA A21.11/C-111 for gaskets. They shall be manufactured by, or satisfy all recommendations of, the manufacturer of the pipe/fittings being used and be fabricated for use with Class 125 ANSI B16.1 flanges.

Tee-head bolts, nuts and washers for mechanical joints shall be high strength, low alloy, corrosion resistant steel stock equal to "COR-TEN A" having UNC Class 2 rolled threads or alloyed ductile iron conforming to ASTM A 536; either shall be fabricated in accordance with ANSI/AWWA A21.11/C-111.

Hex head bolts and nuts shall satisfy the chemical and mechanical requirements of ASTM A449 SAE Grade 5 plain, and shall be fabricated in accordance with ASTM B 18.2 with UNC Class 2 rolled threads.

Either Tee-Head or Hex-Head bolts, nuts and washers as required, shall be protected with bonded fluoro-polymer corrosion resistant coating where specifically required by the E/A.

All threaded fasteners shall be marked with a readily visible symbol cast, forged or stamped on each nut and bolt, which will identify the fastener material and grade. The producer and the supplier shall provide adequate literature to facilitate such identification; painted markings are not acceptable.

3. Polyethylene Film Wrap

   All iron pipe, fittings and accessories shall be wrapped with standard 8 mil (minimum) low density polyethylene film or 4-mil (minimum) cross laminated high-density polyethylene conforming to AWWA C-105, with all edges overlapped and taped securely with duct tape to provide a continuous wrap to prevent contact between the piping and the surrounding backfill. Repair all punctures of the polyethylene, including those caused in the placement of bedding aggregates, with duct tape to restore the continuous protective wrap before backfilling. Polyethylene film wrap for reclaimed water pipe shall be purple.

4. Marking

   Each pipe joint and fitting shall be marked as required by the applicable AWWA specification. This includes in all cases: Manufacturer's identification, Country where cast, year of casting, and "DUCTILE" or "DI". Barrels of flanged pipe shall show thickness class; others shall show pressure class. The flanges of pipe sections shall be stamped with the fabricators identification; fittings shall show pressure rating, the nominal diameter of openings and the number of degrees for bends. Painted markings are not acceptable.

5. Warning Tape

   Warning tape for identifying restrained joint pipe and fittings shall be yellow and shall have black lettering at least 2inches high that reads "Restrained Joint / Junta de Restriccion" at intervals not exceeding 24 inches. The warning tape shall be polypropylene having a minimum thickness of 2 mils, a minimum width of 3 inches, and adhesive backing on the side opposite the lettering.

(c) Concrete

1. General

Pipe shall conform to ASTM C 76 for Circular Pipe. Concrete pipe smaller than 12 inches in diameter shall conform to ASTM C 14, Extra Strength. All pipe shall be machine made or cast by a process which will provide uniform placement of the concrete in the form and compaction by mechanical devices, which will assure a dense concrete. Concrete shall be mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the concrete can be assured. Transit mixed concrete shall not be acceptable for use in precast pipe. The pipe shall be Class III or the class indicated. Storm sewer pipe shall be of the tongue and groove or 0-ring joint design. Wastewater pipe shall be of the 0-ring joint design; it shall be acceptably lined for corrosion protection.

2. Marking

Each joint of pipe shall be marked with the pipe class, the date of manufacture, the manufacturer's name or trade mark, diameter of pipe and orientation, if required.

Pipe marking shall be waterproof and conform to ASTM C 76.

3. Minimum Age for Shipment

Pipe shall be considered ready for shipment when it conforms to the tests specified in ASTM C 76.

4. Joint Materials

When installing storm sewers (or storm drains), the Contractor shall have the option of using joints with preformed flexible joint sealants or with rubber gaskets. Preformed flexible joint sealants for storm drain joints shall comply with ASTM C990, and rubber gaskets for storm drain joints shall comply with ASTM C 1619. Mortar shall not be used to seal pre-fabricated joints. Pipe manufacturer shall be responsible for submitting to the Owner a detailed design of the joint upon request. The pipe manufacturer shall be responsible for submitting to the Owner a complete list of joint sizes showing the minimum size of material to be used with each size joint, along with complete instructions on recommended installation procedures. Quality control testing at the manufacturing plant shall be in accordance with Texas Department of Transportation (TxDOT) Departmental Materials Specifications (DMS) 7310, "Reinforced Concrete Pipe And Machine-Made Precast Concrete Box Culvert Fabrication And Plant Qualification". The pipe manufacturer shall be verified as compliant with TxDOT DMS 7310 at time of pipe delivery to the jobsite.

a. Mortar

Mortar for joints shall meet the requirements set forth below in "Mortar".

b. Cold Applied Preformed Plastic Gaskets

Cold Applied Plastic Gaskets shall be suitable for sealing joints of tongue and groove concrete pipe. The gasket sealing the joint shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes or obnoxious odors. The gasket joint sealer shall not depend on oxidizing, evaporating or chemical action for its adhesive or cohesive strength and shall be supplied in extruded rope form of suitable cross section. The size of the plastic gasket joint sealer shall be in accordance with the manufacturer's recommendations and sufficient to obtain squeeze-out around the joint. The gasket joint sealer shall be protected

by a suitable removable wrapper that may be removed longitudinally without disturbing the joint sealer to facilitate application.

The chemical composition of the gasket joint sealing compound as shipped shall meet the following requirements:

Composition (% by weight)	Test Method	Typical Analysis
Bitumen (petroleum plastic content)	ASTM D 4	50-70
Ash-inert Mineral Water	Tex-526-C	30-50
Volatile Matter (at 325 F)	Tex-506-C	2.0 Maximum

The gasket joint sealing compound when immersed for 30 days at ambient room temperature separately in 5 percent solution of caustic potash, a mixture of 5 percent hydrochloric acid, a 5 percent solution of sulfuric acid and a saturated H2S solution shall show no visible deterioration.

The physical properties of the gasket joint sealing compound as shipped shall meet the following requirements:

Property	Test Method	Typical Analysis	
		Minimum	Maximum
Specific Gravity at 77 F	ASTM D 71	1.20	1.35
Ductility at 77F (cm) Minimum	Tex-503-C	5.0	
Softening point	Tex-505-C	275 F	
Penetration:			
32 F (300 g) 60 sec	Tex-502-C	75	
77 F (150 g) 5 sec	Tex-502-C	50	120
115 F (150 g) 5 sec	Tex-502-C		150

Flashpoint C.O.C. F	Tex-504-C	600 F	
Fire Point C.O.C. F	Tex-504-C	625 F	

When constructing wastewater lines, the Contractor shall use 0-ring gasket joints conforming to ASTM C 443. Just before making a joint, the ends of the pipe shall be clean, dry, free of blisters or foreign matter and shall be wire brushed. For O-ring joints, the gasket and the inside surface of the bell shall be lubricated with a light film of soft vegetable soap compound to facilitate assembly of the joint. The rubber O-ring gasket shall be stretched uniformly in the joint. Wedge seal type ("Forsheda" pre-lubricated) gaskets may be used if joint details submitted are approved; installation of such gaskets shall be in strict accordance with the manufacturer's recommendations, and shall be the sole element depended upon to make the joint flexible and watertight.

In wastewater lines no horizontal or vertical angles in the alignment of pipes shall be permitted unless indicated. The spigot shall be centered in the bell, the pipe pushed uniformly home and brought into true alignment. Bedding material shall be placed and tamped against pipe to secure the joint.

5. Bends

When horizontal or vertical angles in the alignment of storm sewers are indicated, the bend or angle shall be constructed by cutting on a bias one or both pipes as may be required for the alignment indicated. The pipe cut shall be sufficiently long to allow exposing the reinforcement, which shall be bent, welded and incorporated into the pipe bend and reinforced concrete collar to maintain the structural integrity. The collar shall be 6 inches minimum, reinforced with #4 bars on a 1 foot center both directions. Builder's hardware cloth may be used on the outside of the joint to aid in holding cementing materials in place. Plywood, fiberboard or other materials placed on the inside of the pipe as formwork shall be removed as soon as the joint materials have obtained initial set, after which the inside surface of the pipe joint shall be finished smooth and true to the line and grade established. The Contractor may use prefabricated bends meeting the specification requirements in lieu of field fabricated bends. All bends shall be watertight, have a smooth flow line and be equal or greater in strength to the adjacent pipe.

Horizontal or vertical changes in alignment in wastewater lines shall be accomplished by use of manholes. With the E/A's approval, horizontal changes in alignment may be made by the "Joint Deflection" method. Joint deflection is limited by regulations of the Texas Commission on Environmental Quality (TCEQ) to 80 percent of the maximum recommended by the manufacturer; such deflection may not exceed 5 degrees at any joint. Changes in alignment using pipe flexure shall not be allowed.

6. Sulfide and Corrosion Control

All concrete pipe used for wastewater installations shall be protected from sulfide and corrosion damage by using limestone aggregate.

(d) Concrete Steel Cylinder (CSC) Pipe

1. General Requirements

The Contractor shall submit to the E/A for approval along with other required data a tabulated layout schedule with reference to the stationing and grade lines to be used.

The manufacturer shall furnish all fittings and special pieces required for closures, bends, branches, manholes, air valves, blow offs and connections to main line valves and other fittings as indicated.

Each pipe length, fitting and special joint shall have plainly marked on the bell end of the pipe, the head condition for which it is designed. In addition, marking shall be required to indicate the location of each pipe length or special joint in the line and such markings will be referenced to the layout schedules and drawings and submitted for approval.

Concrete steel cylinder fittings shall be tested as required by the applicable AWWA Standards.

2. Design and Inspection

Where not otherwise indicated, concrete steel cylinder pipe shall be Class 150, designed to withstand a vacuum of not less than 28 feet of water. Valve reducers, tees and outlets from a pipe run shall be designed and fabricated so that all stresses are carried by the steel forming the fitting or outlet.

Concrete steel cylinder pipe shall meet one of the following specifications:

AWWA C-301 - Any Size

AWWA C-303 - 24-inch maximum size

All pipe flanges shall conform to AWWA C-207, requirements for standard steel flanges of pressure classes corresponding to the pipe class.

Pipe to be installed in a tunnel or encasement shall be manufactured with 1 inch thick by 24-inch wide skid bands of mechanically impacted mortar in addition to the normal coating.

All concrete steel cylinder fittings shall be constructed of steel plate of adequate strength to withstand both internal pressure and external loading. Rod reinforcing shall not be used to figure the required steel area. The fittings shall have a concrete lining and 1 inch minimum coating of cement mortar, except that centrifugally spun lining need not be reinforced.

Minimum lining thickness shall be ½ inch for 16-inch pipe and ¾ inch for sizes larger than 16-inch pipe. Where it is impractical to place such concrete protection on interior surfaces of small outlets, 2 coats of "Bitumastic Tank Solution" shall be applied.

No fitting shall be made by cutting of standard pipe, except that outlets of less than 75 percent of the pipe diameter may be placed in a standard pipe. Beveled spigots may be placed on standard pipe.

3. Joint Materials

Joints shall be of the rubber gasket type conforming to the applicable standards. The inside and outside recesses between the bell and spigot shall be completely filled with Cement Grout in accordance with the pipe manufacturer's recommendations. Grout materials for jointing such pipe, unless otherwise indicated, shall be as described herein.

(e) Reserved

(f) Polyethylene Tubing

1. General

All polyethylene (PE) tubing shall be high density, high molecular weight plastic tubing meeting ASTM D2737; it shall be pressure rated at 200 psi working pressure and must bear the National Sanitation Foundation seal of approval for potable water service. Pipe manufacturers shall be listed on SPL WW-65.

2. Materials

Polyethylene plastics shall be Designation PE3408 (Grade P34 with hydrostatic design stress of 800 psi).

3. Markings

Permanent marking on the tubing shall include the following at intervals of not more than 5 feet:

Nominal tubing size.

Type of plastic material, i.e., PE 3408.

Dimension Ratio (SDR) and pressure rating in psi for water at 73.4 F (e.g., SDR-9, 200 psi).

ASTM D 2737 designation.

Manufacturer's name or trademark, code and seal of approval (NSF mark) of the National Sanitation Foundation.

Polyethylene tubing for reclaimed service lines shall be purple.

4. Tube Size

PE tubing shall be standard copper tube size outside diameter, with Standard Dimension Ratio (SDR) of 9.

(g) Copper Tubing

All copper service tubing shall be annealed seamless Type K water tube meeting ASTM B88 and rated at 150 psi working pressure. The tubing shall be homogenous throughout and free from cracks, holes, crimping, foreign inclusions or other defects. It shall be uniform in density and other physical properties. Copper tubing for reclaimed water shall be wrapped in purple polyethylene film wrap. Pipe manufacturers shall be listed on SPL WW-613.

(h) Service Connection Fittings

All fittings used in customer service connection - tapping mains, connecting meters, etc. - must be currently listed on the applicable Water and Wastewater Standard Products List (SPL WW-68), or called for in the City of Austin Standard Details (520 - series).

(i) Brass Goods

All brass valves, couplings, bends, connections, nipples and miscellaneous brass pipe fittings and accessories used in meter connections, service lines, air release piping assemblies, and wherever needed in the water distribution system, shall conform to the

City of Austin Standards, Austin Water Utility Standard Products Lists, and AWWA C-800, except as herein modified or supplemented.

Unless otherwise noted, the goods described herein shall be fabricated of standard Red Brass (Waterworks Brass) meeting ASTM B62 or B584, alloy 83600, consisting of 85 percent copper and 5 percent each of tin, lead and zinc.

Exposed threads shall be covered with plastic caps or sheeting to protect the threads.

Brass goods of each type and class shall be compatible with other fittings in common usage for similar purposes. Where not otherwise indicated, all such materials shall meet the following requirements:

Inlet threads of corporation valves shall be AWWA iron pipe (IP) thread (male); outlets of service saddles shall be tapped with AWWA IP thread (female). AWWA IP threads shall conform to ANSI/ASME B1.20.1 as required by AWWA C800 for "General Purpose (Inch) Pipe Threads". For ¾" and 1″ sizes only, corporation valve inlet threads, and the internal threads of saddles may be the AWWA taper thread conforming to AWWA C800 Figure 1 and Table 6. External threads of corporation valve inlet must be compatible with internal threads of the service saddle.

Connections of all new tubing, and of tubing repairs wherever possible, shall be by compression fittings. Compression connections shall be designed to provide a seal and to retain the tubing, without slippage, at a working water pressure of 150 psig.

Flanges shall conform to ANSI B16.1, Class 125, as to dimensions, drillings, etc. Copper tubing, when used, shall be Type K tubing having dimensions and weights given in Table A.1 of AWWA C800.

Brass pipe shall conform to the weights and dimensions for Extra Strong pipe given in Table A.2 of AWWA C800.

All fittings shall be suitable for use at hydrostatic working pressures up to 150 psig (hydrostatic testing of installed systems is at 200 psig).

(j) Reserved

(k) Polyvinyl Chloride Potable/Reclaimed Water Pipe

1. General

All polyvinyl chloride (PVC) potable/reclaimed water pipe shall be of the rigid (UNPLASTICIZED) type and must bear the National Sanitation Foundation seal of approval for potable water pipe. Each joint of pipe shall consist of single continuous extrusion; bells or other components attached by solvent welding are not acceptable. Pipe shall be pressure rated at 200 psi (SDR-14).

Pipe shall have push-on, rubber gasket joints of the bell and spigot type with thickened integral bells with rubber gasket joints. The wall thickness of each pipe bell and joint coupling must be greater than the standard pipe barrel thickness. Clearance must be provided in every gasket joint for both lateral pipe deflection and for linear expansion and contraction. Concrete thrust blocking shall be placed behind bends and tees. Concrete support cradles or blocking shall be required for support of all fire hydrants, valves and AWWA C110 fittings; such support shall be provided for AWWA C153 fittings when required by the E/A.

2. Applicable Specifications

Except as modified or supplemented herein, PVC pipe shall meet the following standards:

AWWA C-900, or SDR 14 for PVC Pressure Pipe, in 4, 6, 8 and 12 inch nominal sizes, having Cast Iron Pipe size outside diameters.

Fittings used with PVC Pressure pipe shall be AWWA C-110 or AWWA C-153 compact ductile iron fittings.

All pipe 4 inches and larger must be approved Underwriter's Laboratories for use in buried water supply and fire protection systems.

3. Material Requirements

All pipe and fittings shall be made from clean, virgin, NSF certified, Class 12454B PVC. Clean reworked materials generated from the manufacturers own production may be used within the current limits of the referenced AWWA C-900.

4. Marking

PVC for reclaimed piping shall be purple or wrapped in purple polyethylene film wrap.

Permanent marking on each joint of pipe shall include the following at intervals of not more than 5 feet:

Nominal pipe size and OD base (e.g., 4 CIPS).

Type of plastic material (e.g., PVC 12454B).

Standard Dimension Ratio and the pressure rating in psi for water at 73 F (e.g., SDR 18, 150 psi).

AWWA designation with which the pipe complies (e.g., AWWA C-900).

Manufacturer's name or code and the National Sanitation Foundation (NSF) mark.

5. Tracer Tape

Inductive Tracer Detection Tape shall be placed directly above the centerline of all non-metallic pipe a minimum of 12 inches below subgrade or, in areas outside the limits of pavement, a minimum of 18 inches below finished grade. The tracer tape shall be encased in a protective, inert, plastic jacket and color coded according to American Public Works Association Uniform Color Code. Except for minimum depth of cover, the tracer tape shall be placed according to manufacturer's recommendations. Manufacturers must be listed on SPL WW-597.

(l) Polyvinyl Chloride (PVC) Pipe (Nonpressure) and Fittings

1. General

PVC sewer and wastewater pipe and fittings 6 through 15 inch diameter shall conform to ASTM D 3034. Pipe shall have minimum cell classification of 12364 or 12454. Fittings shall have cell classification of 12454 or 13343. Pipe stiffness shall be at least 115 psi as determined by ASTM D 2412. Pipe manufacturers shall be on SPL WW-227, and fitting manufacturers shall be on SPL WW-227B.

PVC sewer and wastewater pipe and fittings 18 through 27 inch diameter shall conform to ASTM F 679. Pipe shall have minimum cell classification of 12364 or 12454. Pipe stiffness shall be at least 72 psi as determined by ASTM D 2412. Pipe

manufacturers shall be on SPL WW-227A, and fitting manufacturers shall be on SPL WW-227B.

2. Joints

PVC pipe and fitting shall have elastomeric gasket joints conforming to ASTM D 3212. Gaskets shall conform to ASTM F 477.

3. Pipe Markings

Pipe meeting ASTM D 3034 shall have permanent marking on the pipe that includes the following at intervals of not more than 5 feet:

Manufacturer's name and/or trademark and code.

Nominal pipe size.

PVC cell classification per ASTM D 1784.

The legend "SDR-_ _ PVC Sewer Pipe" (SDR 26, 23.5. or less is required)

The designation "ASTM D 3034"

Pipe meeting ASTM F 679 shall have permanent marking that includes the following at intervals of not more than 5 feet:

Manufacturer's name or trademark and code

Nominal pipe size

PVC cell classification per ASTM D 1784

Pipe stiffness designation "PS _ _ PVC Sewer Pipe" (PS of at least 72 is required

The designation "ASTM F 679"

4. Fitting Markings

Fittings meeting ASTM D 3034 shall have permanent marking that includes the following:

Manufacturer's name or trademark

Nominal size

The material designation "PVC"

The designation, "ASTM F 679"

Fittings meeting ASTM F 679 shall have permanent marking that includes the following:

Manufacturer's name or trademark and code

Nominal size

The material designation "PVC"

The designation "ASTM F 679"

5. Tracer Tape

   Inductive Tracer Detection Tape shall be placed directly above the centerline of all non-metallic pipe a minimum of 12 inches below subgrade or, in areas outside the limits of pavement, a minimum of 18 inches below finished grade. The tracer tape shall be encased in a protective, inert, plastic jacket and color coded according to American Public Works Association Uniform Color Code. Except for minimum depth of cover, the tracer tape shall be placed according to manufacturer's recommendations. Manufacturers must be listed on SPL WW-597.

(m) Steel Pipe

1. Standard Weight

   ASTM A 53, Schedule 40.

2. Extra Heavy Weight

   Seamless ASTM A 53, Schedule 80.

3. Encasement Pipe

   a. For direct-bury installations, pipe shall conform to ASTM A134 with minimum thickness of 3/8 inch (9.5 mm).

   b. For jacked installations, pipe shall conform to requirements on drawings.

4. Fittings

   Nipples and fittings extra strong Federal Specification WW-N 351 or WW-P 521.

5. Coatings

   Black or galvanized as indicated.

(n) Welded Steel Pipe and Fittings for Water-Pipe

1. General Reference Standards Specification.

   Specifications of the American Water Works Association (AWWA) listed below shall apply to this Section.

   C-200 Steel Water Pipe 6 inches and larger.

   C-205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 inches and larger, Shop Applied.

   C-206 Field Welding of Steel Water Pipe.

   C-207 Steel Pipe Flanges for Waterworks Services, Sizes 4 inches through 144 inches.

   C-208 Dimensions for Steel Water Pipe Fittings.

   C-602 Cement-Mortar Lining of Water Pipelines, 4 inches and larger in Place.

2. Submittals

   Furnish Shop Drawings, product data, design calculations and test reports as described below:

a. Certified copies of mill tests confirming the type of materials used in steel plates, mill pipe flanges and bolts and nuts to show compliance with the requirements of the applicable standards.

b. Complete and dimensional working drawings of all pipe layouts. Shop Drawings shall include the grade of material, size, wall thickness of the pipe and fittings, type and location of fittings and the type and limits of the lining and coating systems of the pipe and fittings.

c. Product data to show compliance of all couplings, supports, fittings, coatings and related items.

3. Job Conditions

a. The internal design pressure of all steel pipe and fittings shall be as indicated.

b. The interior of all steel pipe for potable water, 4 inches and larger, shall be cement-mortar lined.

4. Manufacturing

a. Description

Pipe shall comply with AWWA C-200.

(1) Circumferential deflection of all pipe in-place shall not exceed 2.0 percent of pipe diameter.

(2) Diameter

Nominal pipe diameter shall be the inside diameter of lining or pipe barrel, unless otherwise designated in Job Conditions.

b. Wall Thickness

(1) Steel pipe wall thickness shall be designed for the internal and external loads specified in this section. The cylinder thickness needed to resist internal pressure shall be based on an allowable stress in the steel equal to ½ the minimum yield stress of the material used.

5. Fittings

a. Welded

Fabricated steel fittings shall be of the same material as pipe and shall comply with AWWA C-208.

6. Flanges

a. Flanges shall comply with the requirements of AWWA C-207, Class D or Class E. The class shall be based on operating conditions and mating flanges of valves and equipment.

b. Gaskets shall be cloth-inserted rubber, 1/8 inch thick.

c. Flanges shall be flat faced with a serrated finish.

7. Pipe Joints

a. Lap Joints for Field Welding

(1) Lap joints for field welding shall conform to AWWA C-206. This item applies only to pipes 72 inches in diameter and larger.

(2) The bell ends shall be formed by pressing on a hydraulic expander or a plug die. After forming, the minimum radius of curvature of the bell end at

any point shall not be less than 15 times the thickness of the steel shell. Bell ends shall be formed in a manner to avoid impairment of the physical properties of the steel shell. Joints shall permit a lap at least 1 ½ inches when assembled. The longitudinal or spiral weld on the inside of the bell end and the outside of the spigot end on each section of pipe shall be ground flush with the plate surface. The inside edge of the bell and the outside edge of the spigot shall be scarfed or lightly ground to remove the sharp edges or burrs.

b. Bell and Spigot Joints with O-Ring Gasket

(1) Bell and spigot joints with rubber gasket shall conform to AWWA C-200.

(2) The bell and spigot ends shall be so designed that when the joint is assembled, it will be self-centered and the gasket will be confined to an annular space in such manner that movement of the pipe or hydrostatic pressure cannot displace it. Compression of the gasket when the joint is completed shall not be dependent upon water pressure in the pipe and shall be adequate to ensure a watertight seal when subjected to the specified conditions of service. Bell and spigot ends shall be welded on preformed shapes. The bell and spigot ends shall conform to the reviewed Shop Drawings.

8. Interior and Exterior Protective Surface Coatings

a. Exterior Surface to be mortar coated shall conform to AWWA C-205 for shop application and AWWA C-602 for field application. Pipe materials shall be the product of an organization, which has had not less than 5 years successful experience manufacturing pipe materials, and the design and manufacture of the pipe, including all materials, shall be the product of one company.

b. All surfaces except as noted in c and d below shall receive shop application of mortar lining and coating.

c. Field Welded Joints. After installation, clean, line and coat unlined or uncoated ends adjacent to welded field joints, including the weld proper, as specified for pipe adjacent to the weld. Potable water only shall be used in the preparation of any cement, mortar, or grout lining.

d. Machined Surfaces. Shop coat machined surfaces with a rust preventative compound. After jointing surfaces, remaining exposed surfaces shall be coated per a) and b) above.

(o) Corrugated Metal Pipe

1. General

Pipe shall be corrugated continuous lock or welded seam helically corrugated pipe. Corrugated metal pipe may be galvanized steel, aluminized steel or aluminum conforming to the following:

Galvanized Steel AASHTO M 218

Aluminized Steel AASHTO M 274

Aluminum AASHTO M 197

Where reference is made herein to gage of metal, the reference is to U.S. Standard Gage for uncoated sheets. Tables in AASHTO M 218 and AASHTO M 274 list thickness for coated sheets in inches. The Tables in AASHTO M 197 list thickness in inches for clad aluminum sheets.

Sampling and testing of metal sheets and coils used for corrugated metal pipe shall be in accordance with TXDOT Test Method Tex-708-I.

Damaged spelter coating shall be repaired by thoroughly wire brushing the damaged area and removing all loose, cracked or weld-burned spelter coating. The cleaned area shall be painted with a zinc dust-zinc oxide paint conforming to Federal Specifications TT-P 641b. Damaged pipe shall be rejected and removed from the project.

Damaged aluminized coating shall be repaired in accordance with the manufacturer's recommendations.

The following information shall be clearly marked on each section of pipe:

Thickness and corrugations

Trade Mark of the manufacturer

Specification compliance

2. Fabrication

a. Steel Pipe

Galvanized or aluminized steel pipe shall be full circle or arch pipe conforming to AASHTO M 36, Type I or Type II as indicated.

It may be fabricated with circumferential corrugations; lap joint construction with riveted or spot welded seams or it may be fabricated with helical corrugations with continuous helical lock seam or ultra high frequency resistance butt-welded seams.

b. Aluminum Pipe

Pipe shall conform to AASHTO M 196, Type I, circular pipe or Type II, pipe arch as indicated. It may be fabricated with circumferential corrugations; lap joint construction with riveted or spot welded seams or it may be fabricated with helical corrugations with a continuous helical lock seam.

Portions of aluminum pipe that are to be in contact with high chloride concrete or metal other than aluminum, shall be insulated from these materials by a coating of bituminous material. The coating applied to the pipe or pipe arch to provide insulation between the aluminum and other material shall extend a minimum distance of 1 foot beyond the area of contact.

3. Selection of Gages

The pipe diameter, permissible corrugations and required gauges for circular pipe shall be as indicated on the drawings.

For pipe arch, the span, rise, gage, corrugation size and coating thickness shall be as shown on the drawings. A tolerance of plus or minus 1 inch or 2 percent of equivalent circular diameter, whichever is greater, will be permissible in span and rise, with all dimensions measured from the inside crests of the corrugations.

4. Joint Material

Except as otherwise indicated, coupling bands and other hardware for galvanized or aluminized steel pipe shall conform to AASHTO M 36 for steel pipe and AASHTO M 196 for aluminum pipe. Field joints for each type of corrugated metal pipe shall

maintain pipe alignment during construction and prevent infiltration of soil material during the life of the installation.

Coupling bands shall be not more than 3 nominal sheet thickness lighter than the thickness of the pipe to be connected and in no case lighter than 0.052 inch for steel or 0.048 inch for aluminum.

Coupling bands shall be made of the same base metal and coating (metallic or otherwise) as the pipe.

Coupling bands shall lap equally on each of the pipes being connected to form a tightly closed joint after installation.

Pipes furnished with circumferential corrugations shall be field jointed with corrugated locking bands. This includes pipe with helical corrugations, which has reformed circumferential corrugations on the ends. The locking bands shall securely fit into at least one full circumferential corrugation on each of the pipe ends being coupled. The minimum width of the corrugated locking bands shall be as shown below for the corrugation which corresponds to the end circumferential corrugations on the pipes being joined:

10½ inches wide for 2 2/3 inches × ½-inch corrugations.

12 inches wide for 3 inches × 1 inch or 5 inches × 1-inch corrugations.

Helical pipe without circumferential end corrugations will be permitted only when it is necessary to join a new pipe to an existing pipe, which was installed with no circumferential end corrugations. In this event pipe furnished with helical corrugations at the ends shall be field jointed with either helically corrugated bands or with bands with projections or dimples. The minimum width of helically corrugated bands shall conform to the following:

12 inches wide for pipe diameters up to and including 72 inches.

14 inches wide for 1 inch deep helical end corrugations.

Bands with projections shall have circumferential rows of projections with one projection for each corrugation. The width of bands with projections shall be not less than the following:

12 inches wide for pipe diameters up to and including 72 inches.

The bands shall have 2 circumferential rows of projections.

16¼ inches wide for pipe diameters of 78 inches and greater.

The bands shall have 4 circumferential rows of projections.

Unless otherwise indicated, all bolts for coupling bands shall be ½-inch diameter. Bands 12 inches wide or less shall have a minimum of 2 bolts and bands greater than 12 inches wide shall have a minimum of 3 bolts.

Galvanized bolts may be hot dip galvanized conforming to AASHTO M 232, mechanically galvanized to provide the same requirements as AASHTO M 232 or electro-galvanized per ASTM A 164 Type RS.

5. Additional Coatings or Linings

a. Bituminous Coated

Bituminous Coated pipe or pipe arch shall be as indicated both as to base metal and fabrication and in addition shall be coated inside and out with a bituminous coating which shall meet the performance requirements set forth herein. The bituminous coating shall be 99.5 percent soluble in carbon bisulphide. The pipe shall be uniformly coated inside and out to a minimum thickness of 0.05 inch, measured on the crests of the corrugations.

The bituminous coating shall adhere to the metal tenaciously, shall not chip off in handling and shall protect the pipe from deterioration as evidenced by samples prepared from the coating material successfully meeting the Shock Test and Flow Test in accordance with Test Method Tex-522-C.

b. Paved Invert

Where a Paved Invert is indicated, the pipe or pipe arch, in addition to the fully coated treatment described above, shall receive additional bituminous material of the same specification as above, applied to the bottom quarter of the circumference to form a smooth pavement with a minimum thickness of 1/8 inch above the crests of the corrugations.

c. Cement Lined

(1) General

Except as modified herein, pipe shall conform to AASHTO M 36 for lock seam or welded helically corrugated steel pipe. Pipe shall be of full circle and shall be fabricated with two annular corrugations for purposes of joining pipes together with band couplers. Lock seams shall develop the seam strength as required in Table 3 of AASHTO M 36. Concrete lining shall conform to the following:

Composition

Concrete for the lining shall be composed of cement, fine aggregate and water that are well mixed and of such consistency as to produce a dense, homogeneous, non-segregated lining.

Cement

Portland Cement shall conform to AASHTO M 85.

Aggregate

Aggregates shall conform to AASHTO M 6 except that the requirements for gradation and uniformity of gradation shall not apply.

Mixture

The aggregates shall be sized, graded, proportioned and thoroughly mixed with such proportions of cement and water as will produce a homogenous concrete mixture of such quality that the pipe will conform to the design requirements indicated. In no case, however, shall the proportions of Portland Cement, blended cement or Portland Cement plus pozzolanic admixture be less than 470 lb/cu. yd of concrete.

Thickness

The lining shall have a minimum thickness of 1/8 inch above the crest of the corrugations.

Lining Procedures

The lining shall be plant applied by a machine traveling through a stationary pipe. The rate of travel of the machine and the rate of concrete placement shall be mechanically regulated so as to produce a homogenous nonsegregated lining throughout.

Surface Finish

The lining machine shall also mechanically trowel the concrete lining as the unit moves through the pipe.

Certification

Furnish manufacturer's standard certification of compliance upon request of the purchaser.

Joints

Pipe shall be joined together with coupling bands made from steel sheets to an indicated thickness of 0.064 inch (12 ga.). Coupling bands shall be formed with two corrugations that are spaced to provide seating in the third corrugation of each pipe end without creating more than ½ inch ± annular space between pipe ends when joined together.

Bands shall be drawn together by two ½ inch galvanized bolts through the use of a bar and strap suitably welded to the band.

When O-ring gaskets are indicated they shall be placed in the first corrugation of each pipe and shall be compressed by tightening the coupling band. Rubber O-ring gaskets shall conform to Section 5.9, ASTM C 361.

(2) Causes for Rejection

Pipe shall be subject to rejection on account of failure to conform to any of the indications. Individual sections of pipe may be rejected because of any of the following:

Damaged ends, where such damage would prevent making satisfactory joint.

Defects that indicate poor quality of work and could not be easily repaired in the field.

Severe dents or bends in the metal itself.

If concrete lining is broken out, pipe may be rejected or at the discretion of the E/A, repaired in the field in accordance with the manufacturer's recommendation.

Hairline cracks or contraction cracks in the concrete lining are to be expected and does not constitute cause for rejection.

d. Fiber Bonded

Where fiber bonded pipe is indicated, the pipe or pipe arch shall be formed from sheets whose base metal shall be as indicated. In addition, the sheets shall have been coated with a layer of fibers, applied in sheet form by pressing them into a molten metallic bonding. If a paved invert is indicated it shall be in accordance with the procedure outlined above. The test for spelter coating above is waived for fiber bonded pipe.

6. Slotted Drain Storm Sewers

The pipes for the slotted drain and slotted drain outfall shall be helically corrugated, lock seam or welded seam pipe. Materials and fabrication shall be in accordance with the above. The metal thickness shall be a minimum 16 gage.

The chimney assemblies shall be constructed of 3/16 inch welded plate or machine formed 14 gage galvanized steel sheets. The height of the chimney required shall be as indicated. Metal for the welded plate slot shall meet the requirements of ASTM A 36 and the completed plate slot shall be galvanized after fabrication in accordance with ASTM A 123.

Weld areas and the heat affected zones where the slot is welded to the corrugated pipe shall be thoroughly cleaned and painted with a good quality asphalt base aluminum paint.

7. Mortar

Mortar shall be composed of 1 part Type I Portland Cement and 2 parts clean, sharp mortar sand suitably graded for the purpose and conforming in other respects to the provisions for fine aggregate of Item No. 403, "Concrete for Structures". Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight of the total dry mix.

(9) Geotextile Filter Fabric for Pipe Bedding Material

Geotextile filter fabric for pipe bedding material shall be Hanes Geo Components - TerraTex NO4.5 (AOS US Standard Sieve 70) geotextile fabric or approved equal.

510.3 - Construction Methods

(1) General

Prior to commencing this Work, all erosion control and tree protection measures required shall be in place and all utilities located and protected as set forth in "General Conditions". Clearing the site shall conform to Item No. 102S, "Clearing and Grubbing". Maintenance of environmental quality protection shall comply with all requirements of "General Conditions" and Item No. 601S, "Salvaging and Placing Topsoil".

The Contractor shall Work such that a reasonable minimum of disturbance to existing utilities will result. Particular care shall be exercised to avoid the cutting or breakage of all existing utilities. If at any time the Contractor's operations damage the utilities in place, the Contractor shall immediately notify the owner of the utility to make the necessary repairs. When active wastewater sewer lines are cut in the trenching operations, temporary flumes shall be provided across the trench while open and the lines shall be restored when the backfilling has progressed to the original bedding lines of the sewer so cut.

The Contractor shall inform utility owners sufficiently in advance of the Contractor's operations to enable such utility owners to reroute, provide temporary detours or to make other adjustments to utility lines in order that the Contractor may Work with a minimum of delay and expense. The Contractor shall cooperate with all utility owners concerned in effecting any utility

adjustments necessary and shall not hold the City liable for any expense due to delay or additional Work because of conflicts arising from existing utilities.

The Contractor shall do all trenching in accordance with the provisions and the directions of the E/A as to the amount of trench left unfilled at any time. All excavation and backfilling shall be accomplished as indicated and in compliance with State Statutes.

Where excavation for a pipe line is required in an existing City street, a street cut permit is required and control of traffic shall be as indicated in accordance with the Texas Manual on Uniform Traffic Control Devices.

Wherever existing utility branch connections, sewers, drains, conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed by the Contractor through cooperation with the owner of the utility, structure or obstruction involved. In those instances where their relocation or reconstruction is impractical, a deviation from line and grade will be ordered by the E/A and the change shall be made in the manner directed.

Adequate temporary support, protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the Work shall be furnished by, and at the expense of, the Contractor and as approved by the E/A.

Where traffic must cross open trenches, the Contractor shall provide suitable bridges in conformance with Standard 804S-4. Adequate provisions shall be made for the flow of sewers; drains and watercourses encountered during construction and any structures, which may have been disturbed, shall be satisfactorily restored upon completion of Work.

When rainfall or runoff is occurring or is forecast by the U.S. Weather Service, the Contractor shall not perform or attempt any excavation or other earth moving Work in or near the flood plain of any stream or watercourse or on slopes subject to erosion or runoff, unless given specific approval by the E/A. When such conditions delay the Work, an extension of time for working day contracts will be allowed in accordance with "General Conditions".

(2) Water Line/New Wastewater Line Separation

Separation between water, reclaimed water, and wastewater lines shall be provided as shown in the Drawings.

Crossings of water, reclaimed water, and wastewater lines shall conform to details in the Drawings.

Wastewater manholes within 9 feet of water and reclaimed water lines shall be made watertight according to details in the Drawings.

(3) Utility and Storm Sewer Crossings

When the Contractor installs a pipe that crosses under a utility or storm sewer structure and the top of the pipe is within 18 inches of the bottom of the structure, the pipe shall be backfilled as shown in the Drawings. When the Contractor installs a pipe that crosses under a utility or storm sewer structure that is not shown in the Drawings, the pipe shall be backfilled as directed by the Engineer. Payment for backfilling pipe at utility or storm sewer structures not shown in the Drawings shall be by Change Order.

(4) Trench Excavation

Excavation in a paved street shall be preceded by saw cutting completely through any asphaltic cement concrete or Portland cement concrete surface, base, or subbase to the underlying

subgrade. This requirement shall not apply to excavations made with trenching machines that use a rotating continuous belt or chain for cutting and removing of material.

Underground piped utilities shall be constructed in an open cut in accordance with Federal regulations, applicable State Statutes conforming to Item No. 509S, "Excavation Safety Systems" and with a trench width and depth described below. When pipe is to be constructed in fill above the natural ground, Contractor shall construct embankment to an elevation not less than one foot above the top of the pipe, after which trench is excavated. Required vertical sides shall be sheeted and braced as indicated to maintain the sides of the required vertical excavation throughout the construction period. Adequacy of the design of sheeting and bracing shall be the responsibility of the Contractor's design professional. The Contractor shall be responsible for installation as indicated. After the pipe has been laid and the backfill placed and compacted to 12 inches above the top of the pipe, any sheeting, shoring and bracing required may be removed with special care to insure that the pipe is not disturbed. As each piece of sheeting is removed, the space left by its removal must be thoroughly filled and compacted with suitable material and provisions made to prevent the sides of the trench from caving until the backfill has been completed. Any sheeting left in place will not be paid for and shall be included in the unit price bid for pipe.

(5) Trench Width

Trenches for water, reclaimed, and wastewater lines shall have a clear width on each side beyond the outside surfaces of the pipe bell or coupling of not less than 6 inches nor more than 12 inches.

Trenches for Storm Sewers up to 42 inches shall have a width of 1 foot on each side beyond the outside surfaces of the pipe. Pipes more than 42 inches shall have a trench width not to exceed 18 inches on each side beyond the outside surfaces of the pipe.

If the trench width within the pipe zone exceeds this maximum, the entire pipe zone shall be refilled with approved backfill material, thoroughly compacted to a minimum of 95 percent of maximum density as determined by TxDOT Test Method Tex-114-E and then re-excavated to the proper grade and dimensions. Excavation along curves and bends shall be so oriented that the trench and pipe are approximately centered on the centerline of the curve, using short lengths of pipe and/or bend fittings if necessary.

For all utilities to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than 1 foot above the top of the utility after which excavation for the utility shall be made.

(6) Trench Depth and Depth of Cover

All pipe and in-line appurtenances shall be laid to the grades indicated. The depth of cover shall be measured from the established finish grade, natural ground surface, subgrade for staged construction, street or other permanent surface to the top or uppermost projection of the pipe.

(a) Where not otherwise indicated, all potable/reclaimed water piping shall be laid to the following minimum depths:

1. Potable/reclaimed water piping installed in undisturbed ground in easements of undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 36 inches of cover.

2. Potable/reclaimed water piping installed in existing streets, roads or other traffic areas shall be laid with at least 48 inches of cover below finish grade.

3. Unless approved by the E/A, installation of potable/reclaimed water piping in proposed new streets will not be permitted until paving and drainage plans have been approved and the roadway traffic areas excavated to the specified or standard paving subgrade,

with all parkways and sidewalk areas graded according to any applicable provisions of the drainage plans or sloped upward from the curb line to the right-of-way line at a minimum slope of ¼ inch per foot. Piping and appurtenances installed in such proposed streets shall be laid with at least 36 inches of cover below the actual subgrade.

(b) Where not otherwise indicated, all wastewater piping shall be laid to the following minimum depths:

1. Wastewater piping installed in natural ground in easements or other undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 42 inches of cover.

2. Wastewater piping installed in existing streets, roads or other traffic areas shall be laid with at least 66 inches of cover.

3. Wastewater piping installed in such proposed streets shall be laid with at least 48 inches of cover below the actual subgrade.

(7) Classification of Excavation

Excavation will not be considered or paid for as a separate item of Work, so excavated material will not be classified as to type or measured as to quantity. Full payment for all excavation required for the construction shall be included in the various unit or lump sum Contract prices for the various items of Work installed, complete in place. No extra compensation, special treatment or other consideration will be allowed due to rock, pavement, caving, sheeting and bracing, falling or rising water, working under and in the proximity of trees or any other handicaps to excavation.

(8) Dewatering Excavation

Underground piped utilities shall not be constructed or the pipe laid in the presence of water. All water shall be removed from the excavation prior to the pipe placing operation to insure a dry firm granular bed on which to place the underground piped utilities and shall be maintained in such unwatered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point installation as conditions warrant.

In the event that the excavation cannot be dewatered to the point where the pipe bedding is free of mud, a seal shall be used in the bottom of the excavation. Such seal shall consist of Class B concrete, conforming to Item No. 403, "Concrete for Structures", with a minimum depth of 3 inches.

(9) Trench Conditions

Before attempting to lay pipe, all water, slush, debris, loose material, etc., encountered in the trench must be pumped or bailed out and the trench must be kept clean and dry while the pipe is laid and backfilled. Where needed, sump pits shall be dug adjoining the trench and pumped as necessary to keep the excavation dewatered.

Backfilling shall closely follow pipe laying so that no pipe is left exposed and unattended after initial assembly. All open ends, outlets or other openings in the pipe shall be protected from damage and shall be properly plugged and blocked watertight to prevent the entrance of trench water, dirt, etc. The interior of the pipeline shall at all times be kept clean, dry and unobstructed.

Where the soil encountered at established footing grade is a quicksand, saturated or unstable material, the following procedure shall be used unless other methods are indicated:

All unstable soils shall be removed to a depth of a minimum 2 feet below bottom of piped utility or as required to stabilize the trench foundation. Such excavation shall be carried out for the entire trench width.

All unstable soil so removed shall be replaced with a concrete seal, foundation rock or coarse aggregate materials placed across the entire trench width in uniform layers not to exceed 6 inches, loose measure and compacted by mechanical tamping or other means which shall provide a stable foundation for the utility.

Forms, sheathing and bracing, pumping, additional excavation and backfill required in unstable trench conditions shall be included in the unit price bid for pipe.

(10) Blasting

All blasting shall conform to the provisions of the "General Conditions" and/or "Public Safety and Convenience".

(11) Removing Old Structures

When out of service masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1 foot below the bottom of the trench. When abandoned inlets or manholes are encountered and no plan provision is made for adjustment or connection to the new sewers, such manholes and inlets within the construction limits shall be removed completely to a depth 1 foot below the bottom of the trench. In each instance, the bottom of the trench shall be restored to grade by backfilling and compacting by the methods provided above. Where the trench cuts through storm or wastewater sewers which are known to be abandoned, these sewers shall be cut flush with the sides of the trench and blocked with a concrete plug in a manner satisfactory to the E/A. When old structures are encountered, which are not visible from the existing surface and are still in service, they shall be protected and adjusted as required to the finished grade.

(12) Lines and Grades

Grades, lines and levels shall conform to the General Conditions and/or "Grades, Lines and Levels". Any damage to the above by the Contractor shall be re-established at the Contractor's expense. The Contractor shall furnish copies of all field notes and "cut sheets" to the City.

The location of the lines and grades indicated may be changed only by direction of the E/A. It is understood that the Contractor will be paid for Work actually performed on the basis of the unit Contract prices and that the Contractor shall make no claim for damages or loss of anticipated profits due to the change of location or grade.

All necessary batter boards or electronic devices for controlling the Work shall be furnished by, and at the expense of, the Contactor. Batter boards shall be of adequate size material and shall be supported substantially. The boards and all location stakes must be protected from possible damage or change of location. The Contractor shall furnish good, sound twilled lines for use in achieving lines and grades and the necessary plummets and graduated poles.

The Contractor shall submit to the E/A at least 6 copies of any layout Drawings from the pipe manufacturer for review and approval. The Contractor shall submit the layout Drawings at least 30 days in advance of any actual construction of the project. The E/A will forward all comments of the review to the Contractor for revision. Revisions shall be made and forwarded to the E/A for his acceptance. Prior to commencement of the Project, reviewed layout Drawings will be sent to the Contractor marked for construction.

Should the Contractor's procedures not produce a finished pipe placed to grade and alignment, the pipe shall be removed and relayed and the Contractors procedures modified to the satisfaction of the E/A. No additional compensation shall be paid for the removal and relaying of pipe required above.

(13) Surplus Excavated Materials

Excess material or material which cannot be made suitable for use in embankments will be declared surplus by the E/A and shall become the property of the Contractor to dispose of off site at a permitted fill site, without liability to the City or any individual. Such surplus material shall be removed from the Work site promptly following the completion of the portion of the utility involved.

(14) Pipe Bedding Envelope

Pipe shall be installed in a continuous bedding envelope of the type shown on the drawings or as described herein. The envelope shall extend the full trench width, to a depth of at least 6 inches (150 mm) below the pipe and to a depth of the springline of storm water pipe and at least 12 inches (300 mm) above water, reclaimed, and wastewater pipe.

(a) Standard Bedding Materials

USE/PIPE MATERIAL	Cement Stabilized Backfill	Natural or Mf'd Sand	Pea Gravel	PIPE BEDDING STONE			
				Uncrushed Gravel	Crushed Gravel	Crushed Stone	Stone Screenings
WATER and RECLAIMED WATER							
Welded Steel	X					X	
Service Tubing ¾″ to 2½″		X	X				X
WATER and RECLAIMED WATER (Ductile Iron)							
Up to 15 Inch ID		X	X	X			X
Larger Than 15 Inch ID			X	X			
WATER and RECLAIMED WATER (PVC only) and WASTEWATER							
Up to 15 Inch ID		X	X	X	X	X	X
Larger Than 15 Inch ID			X	X	X	X	
STORMWATER							

Concrete		X	X	X	X	X	X
Metal		X	X	X			X

(b) General requirements and limitations governing bedding selection.

(1) Crushed gravel or crushed stone shall not be used with polyethylene tubing or polyethylene film wrap.

(2) Uncrushed gravel may be used with polyethylene film wrap in trenches up to 6 feet deep and in deeper trenches where ample trench width, a tremmie, or conditions will allow controlled placement of the gravel without damaging the polyethylene wrap.

(3) Bedding shall be placed in lifts not exceeding 8 inches loose thickness and compacted thoroughly to provide uniform support for the pipe barrel and to fill all voids around the pipe.

(4) Pea Gravel or bedding stone shall be used in blasted trenches.

(c) Requirements to prevent particle migration.

Bedding material shall be compatible with the materials in the trench bottom, walls and backfill so that particle migration from, into or through the bedding is minimized. The E/A may require one or more of the following measures to minimize particle migration: use of impervious cut-off collars; selected bedding materials, such as pea gravel or bedding stone mixed with sand; filter fabric envelopment of the bedding; cement stabilized backfill; or other approved materials or methods. Measures to minimize particle migration will be shown on the Drawings or designated by the E/A, and, unless provisions for payment are provided in the contract documents, the cost of these measures shall be agreed by change order. The following limitations shall apply.

(1) Sand, alone, shall not be used in watercourses, in trenches where groundwater is present, or in trenches with grades greater than 5 percent.

(2) Pea gravel or bedding stone, alone, shall not be used in the street right-of-way within 5 feet of subgrade elevation in trenches that are 3 feet or wider.

(3) Each gravel or bedding stone, alone, shall not be used where the trench bottom, sides, or backfill is composed of non-cementitious, silty or sandy soils having plasticity indices less than 20, as determined by the E/A.

(4) Sand, alone, shall not be used for installation of concrete storm water pipe unless the bedding envelope is wrapped with a geotextile membrane and the joints of the stormdrain conduit are wrapped to prevent the migration of fines into the bedding envelope and into the stormdrain conduit.

(5) For concrete storm water pipe, if pea gravel, uncrushed gravel, crushed gravel, crushed stone, or combination thereof is used for pipe bedding material, a geotextile filter fabric shall be placed around the perimeter of the joint.

(15) Laying Pipe

No pipe shall be installed in the trench until excavation has been completed, the bottom of the trench graded and the trench completed as indicated.

Laying of corrugated metal pipes on the prepared foundation shall be started at the outlet end with the separate sections firmly joined together, with outside laps of circumferential joints pointing upstream and with longitudinal laps on the sides. Any metal in joints, which is not protected by galvanizing, shall be coated with suitable asphaltum paint. Proper facilities shall be provided for hoisting and lowering the sections of pipe into the trench without damaging the pipe or disturbing the prepared foundation and the sides of the trench. Any pipe which is not in alignment or which shows any undue settlement after laying or damage, shall be taken up and re-laid without extra compensation.

Multiple installations of corrugated pipe or arches shall be laid with the centerlines of individual barrels parallel. When not otherwise indicated, clear distances of 2 feet between outer surfaces of adjacent pipes shall be maintained.

No debris shall remain in the drainways or drainage structures.

All recommendations of the manufacturer shall be carefully observed during handling and installation of each material. Unless otherwise indicated, all materials shall be delivered to the project by the manufacturer or agent and unloaded as directed by the Contractor. Each piece shall be placed facing the proper direction near to where it will be installed.

The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times and stored in a manner that will protect them from damage. Stockpiled materials shall be stacked so as to minimize entrance of foreign matter.

The interior of all pipeline components shall be clean, dry and unobstructed when installed.

Piping materials shall not be skidded or rolled against other pipe, etc. and under no circumstances shall pipe, fittings or other accessories be dropped or jolted.

During handling and placement, materials shall be carefully observed and inspected and any damaged, defective or unsound materials shall be marked, rejected and removed from the job site. Minor damage shall be marked and repaired in a manner satisfactory to the E/A. Joints, which have been placed, but not joined, backfilled, etc., shall be protected in a manner satisfactory to the E/A.

(16) Assembling of Pipe

Angular spacing of all joints shall meet the manufacturer's recommendations for the pipe and accessories being used. Side outlets shall be rotated so that the operating stems of valves shall be vertical when the valves are installed. Pressure pipe shall be laid with bell ends facing the direction of pipe installation. Pipe end bells shall be placed upgrade for all wastewater lines.

Orientation marks, when applicable, shall be in their proper position before pipe is seated.

Before joining any pipe, all foreign matter, lumps, blisters, excess coal tar coating, oil or grease shall be removed from the ends of each pipe and the pipe ends shall then be wire brushed and wiped clean and dry. Pipe ends shall be kept clean until joints are made.

Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing or other materials shall be placed in the pipe.

(17) Joints

(a) Mortar (Storm Drain joints only)

Pipe ends shall be clean, free of asphalt or other contaminants, which will inhibit the bond of the mortar to the pipe. The pipe ends shall be moistened immediately prior to placing the mortar in the joint.

(b) Cold Applied Preformed Plastic Gaskets (Storm Drain joints only)

The pipe ends shall be clean and the joint material applied to the dry pipe. In cold weather, the joint material shall be heated to facilitate the seal of the joint.

(c) O-Ring and Push-on Joints

Just before making a joint the ends of the pipe shall be clean, dry, free of any foreign matter, lump blisters, excessive coal tar coating and grease or oil and shall be wire brushed. The gasket and the inside surface of the bell shall be lubricated with a light film of soft vegetable soap compound (Flax Soap) to facilitate telescoping the joints. The rubber gasket if not factory installed shall be stretched uniformly as it is placed in the spigot groove to insure a uniform volume of rubber around the circumference of the groove. The spigot shall be centered in the bell, the pipe pushed home uniformly and brought into true alignment. Bedding material shall be placed and tamped against pipe to secure the joint. Care should be taken to prevent dirt or foreign matter from entering the joint space.

(d) Bolted Joints

All flanged, mechanical or other bolted joints shall be joined with nuts and bolts and be coated as indicated above in Iron Pipe.

(e) Storm Drain Joints

Storm drain joints sealed with preformed flexible joint sealants shall be provided and installed in compliance with ASTM C990. Storm drain joints sealed with rubber gaskets shall comply with ASTM C443 Install joint sealants in accordance with the pipe and joint sealant manufacturers' recommendations. Place the joint sealer so that no dirt or other deleterious materials come in contact with the joint sealing material. Pull or push home the pipe with enough force to properly seal the joint with the final joint opening (gap) on the inside of the installed pipe being less than or equal to the pipe manufacturer's recommended dimensions. Protrusion of joint material greater than 1/8 " into the interior of the pipe will not be accepted. Excess joint material will be removed to within 1/8 ''of pipe surface. Observe joint sealant manufacturer's recommendations for installation temperature of the joint sealant. Apply joint sealant to pipe joint immediately before placing pipe in trench, and then connect pipe to previously laid pipe.

If inspection (video or other means) reveal C-990 joints that show signs of backfill infiltration, or where joints or conduits exhibit excessive joint gap or are otherwise defective, then the contractor has the following options:

1. Conduits less than 36-inches in any dimension: pour a concrete collar around the joint or wrap joint with a wrap meeting requirements of ASTM C-877 or approved equal.
2. Conduits greater than or equal to 36-inches in all dimensions: repair joints using joint repair techniques recommended by the manufacturer to achieve a completed system that meets all Contract requirements.

(18) Pressure Pipe Laying

(a) Grout for Concrete Steel Cylinder Pipe (CSC) and Welded Steel Pipe

Aggregate, cement, etc., shall be as indicated in "Mortar" herein. Potable water shall be used in the preparation of any cement, mortar, or grout lining.

Grout shall be poured into the recess between the bell and spigot on the outside of the pipe and contained by a joint wrapper ("diaper") recommended by the pipe manufacturer. The wrapper shall have a minimum width of 7 inches for 30 inch and smaller and 9 inches for larger pipe, secured to the pipe by "Band Iron" steel straps. The grout shall be poured in

one continuous operation in such manner that after shrinkage and curing the joint recess shall be completely filled.

Mortar for the inside recess shall be of the consistency of plaster. The inside recess between the bell and spigot shall be filled with mortar after the pipe joint on either side of the recess has been backfilled and well tamped with no less than one pipe joint installed ahead of the pipe forming the recess. The mortar shall completely fill the recess and shall be trowelled and packed into place and finished off smooth with the inside of the pipe.

The Contractor shall inspect the joint after the mortar has set and make repairs of any pockets, cracks or other defects caused by shrinkage to the satisfaction of the E/A. The inside surface shall be cleared of any mortar droppings, cement, water, slurry, etc., before they have become set and shall be cleared of any other foreign matter. The inside surface of the pipe shall be left clean and smooth.

Pipe shall be handled at all times with wide non abrasive slings, belts or other equipment designed to prevent damage to the coating and all such equipment shall be kept in such repair that its continued use is not injurious to the coating. The use of tongs, bare pinch-bars, chain slings, rope slings without canvas covers, canvas or composition belt slings with protruding rivets, pipe hooks without proper padding or any other handling equipment, which the E/A deems to be injurious to the coating, shall not be permitted. The spacing of pipe supports required to handle the pipe shall be adequate to prevent cracking or damage to the cement mortar lining.

(19) Placing Pipe in Tunnels

Piping installed as a carrier pipe in a tunnel, encasement pipe, etc., shall have uniform alignment, grade, bearing and conform to the reviewed Shop Drawings. All necessary casing spacers, bedding material, grout cradle or paving, bracing, blocking, etc., as stipulated by the Contract or as may be required to provide and maintain the required pipe alignment and grade, shall be provided by the Contractor at no cost except as provided by the Bid Items. This shall include casing spacers acceptable to the Owner attached to the carrier pipe in accordance with the manufacturer's recommendations. The insertion pushing forces shall not exceed the pipe manufacturer's recommendation. Such carrier piping shall have flexible bolted or gasketed push-on joints or Concrete Steel Cylinder pipe installed as follows:

(a) 21 Inch Pipe and Smaller

Prior to placing the pipe in the tunnel, the inside joint recess at the bell shall be buttered with cement mortar.

After the joint is engaged, the excess mortar shall be smoothed by pulling a tight fitting swab through the joint. Cement mortar protection shall then be placed in the normal manner to the exterior of the joint and allowed to harden sufficiently to avoid dislodgment during installation. If time is of the essence, a quick setting compound may be used.

(b) 24 Inch Pipe and Larger

Each length of pipe shall be pushed into the tunnel as single units. A flexible mastic sealer shall be applied to the exterior of the joint prior to joint engagement. The surfaces receiving the mastic sealer shall be cleaned and primed in accordance with the manufacturer's recommendation. Sufficient quantities of the mastic sealer shall be applied to assure complete protection of all steel in the joint area. The interior of the joint shall be filled with cement mortar in the normal manner after the pipe is in its final position within the tunnel.

(20) Temporary Pipe Plugs, Caps, Bulkheads and Trench Caps

Temporary plugs, caps or plywood bulkheads shall be installed to close all openings of the pipe and fittings when pipeline construction is not in progress.

All temporary end plugs or caps shall be secured to the pipe as provided under Item No. 507, "Bulkheads".

Trench caps shall be reinforced Class D concrete as indicated.

(21) Corrosion Control

(a) Protective Covering

Unless otherwise indicated, all flanges, nuts, bolts, threaded outlets and all other iron or steel components buried and in contact with earth or backfill shall be wrapped with 8-mil (minimum) polyethylene film meeting ANSI/AWWA C-105 to provide a continuous wrap.

(22) Pipe Anchorage, Support and Protection

Pressure pipeline tees, plugs, caps and bends exceeding 22½ degrees; other bends as directed shall be securely anchored by suitable concrete thrust blocking or by approved metal harness. Unless otherwise indicated, on 24 inch or larger piping, all bends greater than 11 ¼ degrees shall be anchored as described herein.

Storm sewers on steep grades shall be lugged as indicated.

(a) Concrete Thrust Blocking

Concrete for use as reaction or thrust blocking shall be Class B conforming to Item No. 403, "Concrete for Structures".

Concrete blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as indicated or directed by the E/A. The blocking shall, unless otherwise indicated, be so placed that the pipe, fittings and joints will be accessible for repair.

The trench shall be excavated at least 6 inches outside the outermost projections of the pipe or appurtenance and the trench walls shaped or undercut according to the detail Drawings or as required to provide adequate space and bearing area for the concrete.

The pipe and fittings shall be adequately weighted and laterally braced to prevent floating, shifting or straining of the pipeline while the concrete is being placed and taking initial set. The Contractor shall be solely responsible for the sufficiency of such restraints.

(b) Metal Thrust Restraint

Fabricated thrust restraint systems such as those described below may be approved for use instead of concrete blocking. To obtain approval, the project Drawings must include sufficient drawings, notes, schedules, etc., to assure that the proposed restraints as installed will be adequate to prevent undesirable movement of the piping components. Such restraint systems may only be used where and as specifically detailed and scheduled on approved Project Drawings.

1. Thrust Harness

A metal thrust harness of tie rods, pipe clamps or lugs, turnbuckles, etc., may be approved. All carbon steel components of such systems, including nuts and washers, shall be hot-dip galvanized; all other members shall be cast ductile iron. After installation, the entire assembly shall be wrapped with 8-mil polyethylene film, overlapped and taped in place with duct tape to form a continuous protective wrap.

2. Restrained Joints

Piping or fitting systems utilizing integral mechanically restrained joints may be approved. All components of such systems shall be standard manufactured products fabricated from cast ductile iron, hot-dip galvanized steel, brass or other corrosion resistant materials and the entire assembly shall be protected with a continuous film wrap as described for 1. above. Manufacturers of pipe with restrained joints integral to the pipe shall be listed on SPL WW-27F. All pipe and fitting systems with restrained joints shall be identified by applying an adhesive-backed warning tape to the top of the pipe and for the full length of the pipe, regardless of the type of pipe. For plastic pipes the warning tape shall be applied directly to the top of the pipe. For metal pipes and fittings the warning tape shall be applied to the top of the polyethylene film wrap. The warning tape shall conform to 510.2(8)(b)5.

Location, configuration and description of such products shall be specifically detailed on the Drawings. (Add-on attachments such as retainer glands, all-thread rods, etc., are not acceptable.)

(c) Concrete Encasement, Cradles, Caps and Seals

When trench foundation is excessively wet or unstable or installation of water or wastewater pipe will result in less than 30 inches of cover, Contractor shall notify E/A. E/A may require Contractor to install a concrete seal, cradle, cap, encasement or other appropriate action.

All concrete cap, etc., shall be continuous and begin and end within 6 inches of pipe joints. Concrete cap, cradle and encasement shall conform to City of Austin Standard No. 510S-1, "Concrete Trench Cap". The pipe shall be well secured to prevent shifting or flotation while the concrete is being placed.

(d) Anchorage Bulkheads

Concrete bulkheads keyed into the undisturbed earth shall be placed as indicated to support and anchor the pipe and/or backfill against end thrust, slippage on slopes, etc. Concrete material and placement shall be Class A, Item No. 403, "Concrete for Structures".

(e) Trench Caps, Concrete Rip-Rap and Shaped Retards

Where called for by the Contract or as directed by the E/A, concrete trench caps, concrete rip-rap and/or shaped retards shall be placed as detailed by the Drawings as protection against erosion. Concrete material and placement shall be Class B, Item No. 403, "Concrete for Structures".

(23) Wastewater Connections

(a) Connections to Mains 12 Inches and Smaller

All branch connections of new main lines shall be made by use of manholes.

Service stubs shall be installed as indicated. Minimum grade shall be 1 percent downward to main and minimum cover shall be 4½ feet at the curb. Standard plugs shall be installed in the dead end before backfilling.

Where a service connection to a main 12 inches or smaller is indicated, a wye, tee or double wye shall be installed.

Where a service connection to a main 15 inches or larger is indicated, a field tap may be made with the pipes installed crown to crown. The tap should be made conforming to the pipe manufacturer's recommendations with the E/A's approval.

Where not otherwise indicated, (wastewater) service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.

(b) Connections to the Existing System

Unless otherwise specified by the E/A, all connections made to existing mains shall be made at manholes with the crown of the inlet pipe installed at the same elevation as the crown of the existing pipe. Service stubs installed on the existing system shall be installed by use of tapping saddles unless otherwise approved by the E/A. Extreme care shall be exercised to prevent material from depositing in the existing pipe as the taps are being made.

When connections to existing mains are made, a temporary plug approved by the E/A must be installed downstream in the manhole to prevent water and debris from entering the existing system before Final Completion. These plugs shall be removed after the castings are adjusted to finish grade or prior to Final Completion.

(c) Connecting Existing Services to New Mains

Where wastewater services currently exist and are being replaced from the main to the property line, those services shall be physically located at the property line prior to installing any new mains into which the services will be connected. Where wastewater services currently exist but are not being replaced to the property line, those services shall be physically located at the point of connection between the new and existing pipes prior to installing any new mains into which the services will be connected.

(24) Potable or Reclaimed Water System Connections

All necessary connections of new piping or accessories to the existing potable or reclaimed water system shall be made by, and at the expense of, the Contractor. To minimize any inconvenience from outages, the Contractor shall schedule all such connections in advance and such schedule must be approved by the E/A before beginning any Work.

(a) Shutoffs

The City will make all shutoffs on existing potable or reclaimed water mains. The Contractor shall be required to notify the Owner's Representative in writing a least twenty five (25) Calendar Days prior to the anticipated date for a wet-connection. The Owner's Representative is defined as the City Inspector. The Owner's Representative will notify any affected utility customers at least 48 hours prior to the shutoff. Austin Water (AW) will make the shutoff after ensuring that all appropriate measures have been taken to protect the potable or reclaimed water system, customers and employees.

The City will operate all valves to fill existing mains. Where a newly constructed main has not been placed in service and has only one connection to the potable or reclaimed system, the Contractor may operate one valve to fill the main after approval has been obtained from AW. The operation of the valve is to be conducted under the immediate supervision of the Owner's Representative.

Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

(b) Wet Connections to Existing Potable or Reclaimed Water System

The Contractor shall make all wet connections called for by the Contract or required to complete the Work. Two connections to an existing line performed during the same shutout, at the same time and at a distance less than 50 linear feet apart, will be considered one wet connection. Two connections to an existing line performed during the same shutout, at the same time and at a distance equal to, or greater than 50 linear feet

will be considered two wet connections. A wet connection shall include draining and cutting into existing piping and connecting a new pipeline or other extension into the existing pressure piping, forming an addition to the potable or reclaimed water transmission and distribution network.

The Contract price for wet connections shall be full payment for all necessary shutoffs, excavation, removing plugs and fittings, pumping water to drain the lines, cutting in new fittings, blocking and anchoring piping, bedding and backfilling, placing the lines and service and all site cleanup.

No water containing detectable amounts of chlorine may be drained, released or discharged until specific planning and appropriate preparations to handle, dilute and dispose of such chlorinated water are approved in advance by the City and the disposal operations will be witnessed by an authorized representative from the City.

(c) Pressure Taps to Existing Potable or Reclaimed Water System

The Contractor shall make all pressure taps called for by the Contract Documents or required to complete the Work. A pressure tap shall consist of connecting new piping to the existing potable or reclaimed water system by drilling into the existing pipe while it is carrying water under normal pressure without taking the existing piping out of service.

Unless otherwise provided by the Contract, the Contractor shall, at the Contractor's expense, perform all necessary excavation, furnish and install the tapping sleeve, valve and accessories, provide the tapping machine, drill the tap and shall block, anchor and backfill the piping, valve and all accessories, place the new piping in service and perform all site cleanup. When the City makes the tap, City forces are not obligated or expected to perform any Work except to provide tapping machine and drill the actual hole. If City crews are to make the tap, fiscal arrangements must be made in advance at the Taps Office, Waller Creek Center, 625 East 10th Street.

If a private Contractor makes the tap, an AW Inspector must be present. "Size on size" taps will not be permitted, unless made by use of an approved full bodied mechanical joint tapping sleeve. Concrete blocking shall be placed behind and under all tap sleeves 24 hours prior to making the wet tap.

(d) Service Connections

Service connection taps into PVC or AC pipe or into CI or DI pipe 12 inches or smaller shall be made using either a service clamp or saddle or a tapping sleeve as recommended by the pipe manufacturer and as approved by the E/A. Direct tapping of these pipes will not be permitted.

All potable or reclaimed water service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.

Precautions should be taken to ensure that the tapping saddle or sleeve is placed on the pipe straight to prevent any binding or deformation of the PVC pipe. The mounting chain or U-bolt strap must be tight.

Tapping shall be performed with a sharp shell type cutter so designed that it will smoothly penetrate heavy walled PVC DR14 and 200 psi AC and will retain and extract the coupon from the pipe.

(25) Backfilling

(a) General

Special emphasis is placed upon the need to obtain uniform density throughout the backfill material. The maximum lift of backfill shall be determined by the compaction equipment selected and in no case shall it exceed 18 inches, loose measurement.

No heavy equipment, which might damage pipe, will be allowed over the pipe until sufficient cover has been placed and compacted. All internal pipe bracing installed or recommended by the manufacturer shall be kept in place until the pipe bedding and trench backfill have been completed over the braced pipe section. Testing of the completed backfill in streets and under and around structures shall meet the specified density requirements. Initial testing shall not be at Contractor's expense and shall conform to the "General Conditions."

(b) General Corrugated Metal Pipe

After the corrugated metal pipe structure has been completely assembled on the proper line and grade and headwalls constructed where indicated; selected material free from rocks over 8 inches in size from excavation or borrow, as approved by the E/A, shall be placed along both sides of the completed structures equally, in uniform layers not exceeding 6 inches in depth (loose measurement), sprinkled if required and thoroughly compacted between adjacent structures and between the structures and the sides of the trench.

Backfill material shall be compacted to the same density requirements as indicated for the adjoining sections of embankment in accordance with the governing specifications thereof. Above the ¾ point of the structure, the fill shall be placed uniformly on each side of the pipe in layers not to exceed 12 inches, loose measure.

Prior to adding each new layer of loose backfill material, until a minimum of 12 inches of cover is obtained over the crown of the pipe, an inspection will be made of the inside periphery of the corrugated metal structure to determine if any floating, local or unequal deformation has occurred as a result of improper construction methods.

(c) Backfill Materials

The Engineer or designated representative may approve any of the following well graded materials as backfill:

1. Select trench material
2. Sand
3. Crushed rock cuttings
4. Rock cuttings
5. Foundation Rock
6. Blasted material with fines and rock
7. Cement stabilized material
8. Borrow

Within the 100-year flood plain, sand will not be permitted for backfilling. The Engineer or designated representative will approve the topsoil for areas to be seeded or sodded.

(d) Backfill in Street Right-of-Way

Placement of backfill under existing or future pavement structures and within 2 feet of any structures shall be compacted to the specified density using any method, type and size of equipment, which will produce the specified compaction without damaging the pipe or

bedding. Placement of backfill greater than 2 feet beyond structures in right-of-way shall conform to (g) below.

The thickness of lifts, prior to compaction, shall depend upon the type of sprinkling and compacting equipment used and the test results thereby obtained. Prior to and in conjunction with the compaction operation, each lift shall be brought to the moisture content necessary to obtain the specified density and shall be placed in a uniform thickness to ensure uniform compaction over the entire lift. Testing for density shall be in accordance with Test Method Tex-114-E and Test Method Tex-115-E.

It is highly desirable that the backfill lifts be placed in a flat (or level) configuration; however when approved by the Engineer or designated representative, the backfill lifts may be placed at gradients (percent of vertical rise or fall to horizontal run) that do not exceed 30%.

The proposed gradient for each lift or series of lifts shall be established based on the capabilities of the equipment proposed to attain the required compaction.

Each lift of backfill must provide the density as specified herein. Swelling soils (soils with a minimum Liquid Limit of 50, more than 50% passing a #200 sieve and a plasticity index greater than 22) shall be sprinkled as required to provide not less than optimum moisture nor more than 2 percent over optimum moisture content and compacted to the extent necessary to provide not less than 95 percent nor more than 102 percent of the density as determined in accordance with Test Method Tex-114-E. Non-swelling soils shall be sprinkled as specified and compacted to the extent necessary to provide not less than 95 percent of the density as determined in accordance with Test Method Tex-114-E.

After each lift of backfill is complete, tests may be made by the Engineer or designated representative. If the material fails to meet the density indicated, the course shall be reworked as necessary to obtain the indicated compaction and the compaction method shall be altered on subsequent Work to obtain indicated density.

At any time, the Engineer or designated representative may order proof rolling to test the uniformity of compaction of the backfill lifts. All irregularities, depressions, weak or soft spots that develop shall be corrected immediately by the Contractor.

If the backfill, due to any reason, loses the specified stability, density or finish before the pavement structure is placed, it shall be recompacted and refinished at the sole expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent backfill layer or granular material. Excessive loss of moisture shall be construed to exist when the subgrade soil moisture content is more than 4 percent below the optimum of compaction ratio density. Backfill shall be placed from the top of the bedding material to the existing grade, base course, subgrade or as specified. The remainder of the street backfill shall either be Flexible Base, Concrete or Hot Mix Asphalt Concrete as specified on the drawings or replacement "in kind" to the surface of the materials originally removed for placement of the pipe.

(e) Backfill in County Street or State Highway Right-of-Way

All Work within the right-of-way shall meet the requirements of (d) above, as a minimum and shall meet the requirements of the permit issued by the County when their requirements are more stringent. Prior to the start of construction, the Contractor shall be responsible for contacting the appropriate TxDOT office or County Commissioner's Precinct Office and following the operating procedures in effect for utility cut permits and pavement repair under their jurisdiction. Approval for all completed Work in the State or County right-of-way shall be obtained from the appropriate Official prior to final payment by the Owner.

(f) Backfill in Railroad Right-of-Way

All Work within the railroad right-of-way shall meet the requirements of (d) above, as a minimum and shall meet the requirements of the permit issued by the Railroad Owner when their requirements are more stringent. Approval for all completed Work in the railroad right of way shall be obtained from the Railroad prior to Final Completion.

(g) Backfill in Easements

Where not otherwise indicated, Contractor may select whatever methods and procedures may be necessary to restore entire Work area to a safe, useful and geologically stable condition with a minimum density of 85 percent or a density superior to that prior to construction.

In and near flood plain of all streams and watercourses, under or adjacent to utilities, structures, etc. all backfill shall be compacted to a density of not less than 95 percent conforming to TxDOT Test Method Tex-114-E, unless otherwise directed by E/A.

All soil areas disturbed by construction shall be covered with top soil and seeded conforming to Item No. 604, "Seeding for Erosion Control". All turf, drainways and drainage structures shall be constructed or replaced to their original condition or better. No debris shall remain in the drainways or drainage structures.

(h) Temporary Trench Repair/Surfacing

If details of temporary trench repair/surfacing are not provided in the contract documents, the Contractor shall submit for approval of the E/A (1) a plan for temporary trench repair for areas that will be open to traffic but will be excavated later for full depth repair, and (2) a proposed method for covering trenches to maintain access to properties. The temporary surfacing shall afford a smooth riding surface and shall be maintained by the Contractor the entire time the temporary surface is in place.

(i) Permanent Trench Repair

The Contractor shall install permanent trench repairs conforming to details in the drawings.

(26) Quality Testing for Installed Pipe

(a) Wastewater Pipe Acceptance Testing

After wastewater pipe has been backfilled, the Contractor shall perform infiltration tests, exfiltration tests, or low pressure air tests as determined by the E/A. In addition, the Contractor shall perform deflection tests and shall assist OWNER'S personnel, as directed, in performing pipeline settlement tests. The Contractor shall be responsible for making appropriate repairs to those elements that do not pass any of these tests.

(b) Exfiltration Test

Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

Exfiltration testing shall be performed by the Contractor when determined by the E/A to be the appropriate test method. Exfiltration testing shall conform to requirements of the Texas Commission on Environmental Quality given in the Texas Administrative Code Title 30 Part 1 Chapter 317 Rule §317.2.

(c) Infiltration Test

Infiltration testing shall be performed by the Contractor when determined by the E/A to be the appropriate test method. Infiltration testing shall conform to requirements of the Texas

Commission on Environmental Quality given in the Texas Administrative Code Title 30 Part 1 Chapter 317 Rule §317.2.

(d) Pipeline Settlement Test

During the infiltration test or after the exfiltration test, the pipe will be TV inspected for possible settlement. When air testing has been used, water shall be flowed into the pipe to permit meaningful observations. Any pipe settlement which causes excessive ponding of water in the pipe shall be cause for rejection. Excessive ponding shall be defined as a golf ball (1 5/8 ″ dia.) submerged at any point along the line.

(e) Low Pressure Air Test of Gravity Flow Wastewater Lines

(1) General

Wastewater lines up to 33-inch diameter shall be air tested between manholes. Wastewater lines 36-inch in diameter and larger shall be either air tested between manholes or at pipe joints. Backfilling to grade shall be completed before the test and all laterals and stubs shall be capped or plugged by the Contractor so as not to allow air losses, which could cause an erroneous, test result. Manholes shall be plugged so they are isolated from the pipe and cannot be included in the test.

All plugs used to close the sewer for the air test shall be capable of resisting the internal pressures and must be securely braced. Place all air testing equipment above ground and allow no one to enter a manhole or trench where a plugged sewer is under pressure. Release all pressure before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the sewer under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. Use care to avoid the flooding of the air inlet by infiltrated ground water. (Inject the air at the upper plug if possible.) Use only qualified personnel to conduct the test.

(2) Ground Water

Since the presence of ground water will affect the test results, test holes shall be dug to the pipe zone at intervals of not more than 100 feet and the average height of ground water above the pipe (if any) shall be determined before starting the test.

(3) Test Procedure

The E/A may, at any time, require a calibration check of the instrumentation used. Use a pressure gauge having minimum divisions of 0.10 psi and an accuracy of 0.0625 psi. (One ounce per square inch.) All air used shall pass through a single control panel. Clean the sewer to be tested and remove all debris where indicated. Wet the sewer prior to testing. The average back pressure of any groundwater shall be determined (0.433 psi) for each foot of average water depth (if any) above the sewer.

Add air slowly to the section of sewer being tested until the internal air pressure is raised to 3.5 psig greater than the average back pressure of any ground water that may submerge the pipe. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure. After the temperature stabilization period, disconnect the air supply. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average backpressure of any ground water that may submerge the pipe.

For pipe less than 36-inch diameter, compare the time recorded with the time computed using the following equation:

T = (0.0850 × D × K) ÷ Q, where

T = time for pressure to drop 1.0 pounds per square inch gauge in seconds;

K = 0.000419 × D × L, but not less than 1.0

D = nominal inside diameter, in inches, as marked on the pipe;

L = length of line of same pipe size in feet; and

Q = rate of loss, 0.0015 cubic feet per minute per square foot of internal surface area (ft3/min/ft sq) shall be used.

Because a K value of less than 1.0 shall not be used, there are minimum test times for each pipe diameter as shown in the following table:

Table For Low Pressure Air Testing of Pipe

Pipe Diameter (inches)	Minimum Time (seconds)	Minimum Time Applies to All Pipes Shorter than (feet)	Time for Longer Pipes (seconds)
8	454	298	1.520 × L
10 (See Note 1)	567	239	2.374 × L
12	680	199	3.419 × L
15	850	159	5.342 × L
18	1020	133	7.693 × L
21	1190	114	10.471 × L
24	1360	100	13.676 × L
30	1700	80	21.369 × L

Note 1. 10-inch diameter pipe to be used only by AW maintenance personnel.

Note 2. The test parameter for pipes larger than 30-inch diameter shall be shown on the construction plans.

Any drop in pressure, from 3.5 psig to 2.5 psig (adjusted for groundwater level), in a time less than that required by the above equation or table shall be cause for rejection. When the line tested includes more than one size pipe, the minimum time shall be that given for the largest size pipe included.

When joint testing, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch gauge during a joint test, regardless of pipe size, shall be twenty (20) seconds. A drop in pressure from 3.5 psig to 2.5 psig (adjusted for groundwater level) in less than twenty seconds shall be cause for rejection.

Manholes must be tested separately and independently. All manholes must be hydrostatically tested with a maximum loss allowance of 0.025 gallon per foot diameter per foot of head per hour.

When lines are air tested, manholes are to be tested separately by exfiltration or vacuum method (see Standard Specification Item No. 506S, "Manholes").

(f) Deflection Test

Deflection tests shall be performed by the Contractor on all flexible and semi-rigid wastewater pipes. The tests shall be conducted after the final backfill has been in place at least 30 days. Testing for in-place deflection shall be with a pipe mandrel at 95% of the inside diameter of the pipe. A second test of flexible and semi-rigid wastewater pipes 18 inch size and larger, also with a pipe mandrel sized at 95% of the inside diameter of the pipe, shall be conducted by the Contractor 30 days before the warranty expires on the Contractor's Work.

Contractor shall submit proposed pipe mandrels to the E/A or the E/A's designated representative for concurrence prior to testing the line.

Test(s) must be performed without mechanical pulling devices and must be witnessed by the E/A or the E/A's designated representative.

Any deficiencies noted shall be corrected by the Contractor and the test(s) shall be redone.

(g) Inspection of Installed Storm Drain Conduits

(1) General

All storm drain conduits (pipe and box culvert) shall be inspected for conformance to the requirements of this specification. Smart Housing, low/moderate income housing, and projects that are 100-percent privately funded are exempt from the cost of the initial video inspection. All deficiencies revealed by inspection shall be corrected. Video re-inspection meeting the requirements of this specification shall be provided at the Contractor's expense to show that deficiencies have been corrected satisfactorily. Further, the contractor shall provide video in complete segments (manhole to manhole) versus specific deficiency locations.

Projects that are not exempt from the cost of the initial video inspection are also subject to the following constraints:

• All inspectors utilized by the Contractor for video inspection shall be NASSCO-PACP certified for a minimum of 3 years.

• The Contractor will be required to inspect, assess, and record the condition of the storm drain pipe using National Association of Sewer Service Companies (NASSCOs) Pipeline Assessment Certification Program (PACP) coding standards.

(2) Video Inspection of Installed Storm Drain Conduits

Contractor shall provide all labor, equipment, material and supplies and perform all operations required to conduct internal closed-circuit television and video recording of all storm drain conduits. Video recording of each storm drain conduit section shall be conducted after the trench has been backfilled and prior to placement of permanent pavement repairs or permanent pavement reconstruction. The video recording shall be provided to the Owner for review. Contractor shall not place permanent pavement repairs or permanent pavement reconstruction over the storm drain conduit until Owner has reviewed the video and agrees that there are no defects in the storm drain conduit installation shown in the video submitted by the Contractor or shown in any video acquired by the Owner through other means. Placement of permanent pavement repair or permanent pavement reconstruction over the installed storm drain conduit before the Owner acknowledges no defects shall be at the Contractor's risk. Any defects revealed by the video inspection shall be corrected at the Contractor's expense and a new video submitted to the Owner for review prior to acceptance of the conduit.

All video work shall be conducted under the direct full-time supervision of a NASSCO-PACP certified operator.

The conduit inspection camera shall have the capability of panning plus/minus 275 degrees and rotating 360 degrees. The television camera shall be specifically designed and constructed for such use. The camera shall be operative in 100% humidity conditions. Camera shall have an accurate footage counter that displays on the monitor the exact distance of the camera (to the nearest tenth of a foot) from the centerline of the starting manhole or access point. Camera shall have height adjustment so that the camera lens is always centered within plus/minus 10% of the center axis of the conduit being videoed. Camera shall provide a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. Camera shall be equipped with a remote iris to control the illumination range for an acceptable picture. Geometrical distortion of the image shall not exceed one percent (1%). The video image produced by each camera shall be calibrated using a Marconi Resolution Chart No. 1 or equivalent.

Lighting for the camera shall be sufficient to allow a clear picture of the entire periphery of the conduit without loss of contrast, flare out of picture or shadowing. A reflector in front of the camera may be required to enhance lighting in dark or large sized conduit. The video camera shall be capable of showing on the digital display the Owner's name, Project name, Contractor name, date, line size and material, conduit identification, and ongoing footage counter. The camera, television monitor, and other components of the video system shall be capable of producing a picture quality satisfactory to the satisfaction of the Owner. The recording of the internal condition of the storm drain conduit shall be clear, accurate, focused and in color. If the recording fails to meet these requirements, the, equipment shall be removed and replaced with equipment that is suitable. No payment will be made for an unsatisfactory recording.

If during video inspection, water is encountered inside the conduit, the conduit shall be dewatered by the Contractor. The storm drain section must be dry. Video recording conducted while the camera is floating is not acceptable unless approved by the Owner.

If during video inspection, debris is encountered that prohibits a proper inspection of the conduit, the Contractor shall remove the debris before proceeding.

All video shall be documented using a data logger and reporting system that are PACP compliant and which use codes as established by the National Association of Sewer Service Companies (NASSCO)s - Pipeline Assessment and Certification Program (PACP).

Computer printed location records shall be kept by the Contractor and shall clearly show the location and orientation of all points of significance such as joints, conduit connections, connections at manholes and inlets, and defects. Copy of all records shall be supplied to the Owner. Noted defects shall be documented as color digital files and color hard copy print-outs. Photo logs shall accompany each photo submitted.

The video recording shall supply a visual and audio record of the storm drain conduits that may be replayed. Video recordings shall include an audio track recorded by the video technician during the actual video work describing the parameters of the storm drain conduit being videoed (i.e. location, depth, diameter, pipe material), as well as describing connections, defects and unusual conditions observed during the video work. Video recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Once videoed, the CDs/DVDs shall be labeled and become the property of the Owner. The Contractor shall have all video and necessary playback equipment readily accessible for review by the Owner while the project is under construction.

Post-installation video shall not be completed until all work is completed on a section of storm drain conduit. Post-installation video work shall be completed by the Contractor in the presence of the Owner. The post-installation video work shall be completed to confirm that the storm drain conduits are free of defects. Provide a color video showing the completed work. Prepare and submit video logs providing location of storm drain conduit along with location of any defects. Manhole and inlet work shall be complete prior to post-installation video work.

For post-installation video, exercise the full capabilities of the camera equipment to document the completion and conformance of the storm drain installation work with the Contract Documents. Provide a full 360-degree view of conduit, all joints, and all connections. The camera shall be moved through the storm drain conduit in either direction at a moderate rate, stopping and slowly panning when necessary to permit proper documentation of the conduit condition at each pipe connection, joint, and defect. In no case shall the camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the storm drain conditions shall be used to move the camera through the storm drain conduit. When manually operated winches are used to pull the camera through the conduit, telephones or other suitable means of communication shall be set up between the two access points of the conduit being videoed to insure good communication between members of the video crew.

Distance measurements shall be provided to an accuracy of one tenth of a foot.

Video shall be continuous for each storm drain conduit segment. Do not show a single segment on more than one CD/DVD, unless specifically allowed by the Owner.

Contractor shall submit to Owner the following:

A. National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) certification of operators who will be performing video work.

B. Compact Disc (CD) or Digital Video Disc (DVD) of recording of storm drain conduits (concrete storm water pipe or box culvert).

a. The color CD or DVD shall include a digital color key map in a format acceptable to the Owner with each segment of storm drain conduit labeled with the appropriate inspection ID on the map.

b. The file folder for each segment of the storm drain conduit shall have a unique name based on the Owner's approved inspection naming convention and shall contain the following:

i. Video files

ii. Video inspection logs with information coded in accordance with the PACP

iii. Photo logs

iv. A report summarizing the results of the video inspection

v. A proposed method of repair for any defects discovered.

(3) Time commitments from City for projects that are exempt from the cost of the initial video inspection

Projects that are exempt from the cost of the initial video inspection are afforded the following time commitments from the City.

A. Initial inspection - contractor must inform the City of Austin construction inspector assigned to the project in writing that all stormdrain infrastructure for the project has been completed according to the permit and is ready for inspection. The inspector will then notify the Watershed Protection Department (WPD) in writing that the all of the stormdrain infrastructure for the project has been completed and is ready for inspection. The WPD is allowed 15-days to complete inspection from written notification by the inspector. The outcome of this item does not impact the one-year warranty requirements.

B. Video re-inspection by the contractor for deficient installed stormdrain infrastructure. The contractor must submit the video inspection data as defined in this specification to the City of Austin construction inspector assigned to the project along with a written letter of transmittal certified by a professional engineer stating that all identified stormdrain infrastructure installation deficiencies for the project have been corrected. The inspector will then notify the Watershed Protection Department (WPD) in writing and convey the video inspection data to the WPD. The WPD is allowed 15-days to complete review of the data from the date of delivery by the inspector.

(27) Pressure Pipe Hydrostatic Testing

After the pipe has been installed and backfilled and all service laterals, fire hydrants and other appurtenances installed and connected, a pressure test, followed by a leakage test, will be conducted by the City. The City will furnish the pump and gauges for the tests. The Contractor shall be present and shall furnish all necessary assistance for conducting the tests. The specified test pressures will be based on the elevation of the lowest point of the line or section under test. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points.

All drain hydrant and fire hydrant leads, with the main 6-inch gate valve open, the hydrant valve seats closed and no nozzle caps removed, shall be included in the test.

(a) Pressure Test

The entire project or each valved section shall be tested, at a constant pressure of 200 psi for a sufficient period (approximately 10 minutes) to discover defective materials or substandard work. The Contractor assumes all risks associated with testing against valves. Repairs shall be made by the Contractor to correct any defective materials or substandard work. The Contractor shall pre-test new lines before requesting pressure tests by City Forces. The Contractor shall have new lines pressurized to a minimum of 100 psi, on the date of testing, prior to arrival of City Forces.

(b) Leakage Test

A leakage test will follow the pressure test and will be conducted on the entire project or each valved section. The Contractor assumes all risks associated with testing against valves. The leakage test shall be conducted at 150 psi for at least 2 hours. The test pressure shall not vary by more than ±5 psi for the duration of the test.

(1) Allowable Leakage

Leakage shall be defined as the quantity of water that must be supplied into any test section of pipe to maintain the specified leakage test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

No pipe installation will be accepted if leakage exceeds the amount given by the following formula:

$$\text{Allowable leakage (gal/hr)} = [L \times D] \div 10{,}875$$

Where L = length of pipe tested, in feet
D= nominal pipe diameter, in inches, as marked on the pipe

(2) Location and Correction of Leakage

If such testing discloses leakage in excess of this specified allowable, the Contractor, at the Contractor's expense, shall locate and correct all defects in the pipeline until the leakage is within the indicated allowance.

All visible leakage in pipe shall also be corrected by Contractor at the Contractor's expense.

(28) Service Charges for Testing

Initial testing performed by City forces for the Contractor will be at the City's expense. Retesting, by City forces, of Contractor's work that fails initial testing will be at the Contractor's expense. The City's charge for retests will be a base fee plus an hourly rate published in the current AW Fee Schedule. On City-funded projects, the charges incurred by the City for retesting will be deducted from funds due the Contractor. On non-City-funded projects, the charges incurred by the City for retesting will be billed to the Contractor. The City will withhold acceptance of the Contractor's work until the Contractor has paid the City for the retesting costs.

(29) Disinfection of Potable Water Lines

Prior to performing any disinfection of potable water lines, the Contractor shall submit a Disinfection Plan (Plan) and obtain approval in accordance with COA specification 01300, Submittals. The Plan shall comply with AWWA C651 (Disinfecting Water Mains) and AWWA C655 (Field Dechlorination), latest editions, and shall be developed using one of the following

templates, unless otherwise approved by the Engineer and/or AW: Disinfection Plan for Tablet/Granule Method, or Disinfection Plan for Continuous-Feed Method. Templates for these two methods are located at http://www.austintexas.gov/department/construction-standards . The Contractor shall decide which disinfection method to use for a given project. The Slug Method and Spray Method are also acceptable if better suited for disinfection. The initial plan shall be submitted for review a minimum of 60 calendar days prior to when the water main is scheduled to be placed into service, or at the preconstruction conference if the project requires that the waterline be placed in service in less than 60 days, as indicated in the Contractor's Construction Schedule. If any appurtenances are required for injection, sampling, or flushing purposes that are not shown in the original plan/profile sheets, then the Contractor shall include the appurtenances in the project Record Drawings. The Contractor shall disinfect potable water lines only in accordance with an approved Plan.

(a) Preventing Contamination

The Contractor shall protect all piping materials from contamination during storage, handling and installation. Prior to disinfection, the pipeline interior shall be clean, dry and unobstructed. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work.

(b) Cleaning

Prior to disinfection the Contractor shall clean the pipeline to remove foreign matter. For pipelines 16″ in diameter or smaller, cleaning shall consist of flushing the pipeline. For pipelines greater than 16″ in diameter, cleaning shall be performed by operating hydrants and blow-offs located at low points in the pipeline, or by mechanical means (sweeping or pigging. Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

(c) Procedure and Dosage

For pipelines 16" or smaller in diameter, the Contractor may use either the AWWA C-651 "Tablet/Granular Method" or the "Continuous Feed Method" for disinfecting the pipeline. The Contractor, at its expense, will supply the test gauges and the Sodium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 5 percent to fifteen percent available chlorine, and will submit for approval a written plan for the disinfection process. Calcium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 65 percent available chlorine by weight, may be used in granular form or in 5 g tablets for 16″ diameter or smaller lines, if it is included as part of the written plan of disinfection that is approved by the City of Austin. The Contractor, at its expense, shall provide all other equipment, supplies and the necessary labor to perform the disinfection under the general supervision of the City.

One connection to the existing system will be allowed with a valve arranged to prevent the strong disinfecting dosage from flowing back into the existing water supply piping. The valve shall be kept closed and locked in a valve box with the lid painted red. No other connection shall be made until the disinfection of the new line is complete and the water samples have met the established criteria. The valve shall remain closed at all times except when filling or flushing the line and must be staffed during these operations. As an option, backflow prevention in the form of a reduced pressure backflow assembly may be provided if the valve is left unattended. The new pipeline shall be filled completely with disinfecting solution by feeding the concentrated chlorine and approved water from the existing system uniformly into the new piping in such proportions that every part of the line has a minimum concentration of 25 mg/liter available chlorine.

The disinfecting solution shall be retained in the piping for at least 16 hours and all valves, hydrants, services, stubs, etc. shall be operated so as to disinfect all their parts. After this

retention period, the water shall contain no less than 10 mg/liter chlorine throughout the treated section of the pipeline.

For pipelines larger than 16″ in diameter, the Contractor may use the AWWA C-651 "Slug Method" for disinfecting the pipeline. Chlorine shall be fed at a constant rate and at a sufficient concentration at one end of the pipeline to develop a slug of chlorinated water having not less than 100 mg/liter of free chlorine. The Contractor shall move the slug through the main so that all interior surfaces are exposed to the slug for at least three (3) hours. The chlorine concentration in the slug shall be measured as it moves through the pipeline. If the chlorine concentration drops below 50 mg/liter, the Contractor shall stop the slug and feed additional chlorine to the head of the slug to restore the chlorine concentration to at least 100 mg/liter before proceeding. As the slug flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

Unless otherwise indicated, all quantities specified herein refer to measurements required by the testing procedures included in the current edition of "Standard Methods". The chlorine concentration at each step in the disinfection procedure shall be verified by chlorine residual determinations.

(d) Final Flushing

The heavily chlorinated water shall then be carefully flushed from the potable water line by a dechlorination process until the chlorine concentration is no higher than the residual generally prevailing in the existing distribution system. This is necessary to insure that there is no injury or damage to the public, the water system or the environment. The plans and preparations of the Contractor must be approved by the City before flushing of the line may begin. The Contractor will supply the Dechlorination chemical conforming to ANSI/AWWA C655. Additionally the flushing must be witnessed by an authorized representative of the City.

Approval for discharge of the diluted chlorine water or heavily chlorinated water into the wastewater system must be obtained from AW. The line flushing operations shall be regulated by the Contractor so as not to overload the wastewater system or cause damage to the odor feed systems at the lift stations. The City shall designate its own representative to oversee the work.

Daily notice of line discharging must be reported to the AW Dispatch office.

(e) Bacteriological Testing

After disinfection and final flushing, samples shall be collected per one of the two options. Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hours. Both sets of samples must pass for the main to be approved for release. Option B: Before approving a main for release, let it sit for a minimum of 16 hours without any water use. Then collect two sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release. The two (2) sets of water samples from the line will be tested for bacteriological quality by the City and must be found free of coliform organisms before the pipeline may be placed in service. Each set shall consist of one (1) sample that is drawn from the end of the main, at least one from each branch greater than one pipe length, and additional samples that are collected at intervals of not more than 1,200 feet along the pipeline. All stubs shall be tested before connections are made to existing systems.

The Contractor, at its expense, shall install sufficient sampling taps at proper locations along the pipeline. Each sampling tap shall consist of a standard corporation cock installed

in the line and extended with a copper tubing gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

Samples for bacteriological analysis will only be collected from suitable sampling taps in sterile bottles treated with sodium thiosulfate. Samples shall not be drawn from hoses or unregulated sources. The City, at its expense, will furnish the sterile sample bottles and may, at its discretion, collect the test samples with City personnel.

If the initial disinfection fails to produce acceptable sample test results, the disinfection procedure shall be repeated at the Contractor's expense. Before the piping may be placed in service, two (2) consecutive sets of acceptable test results must be obtained.

An acceptable test sample is one in which: (1) the chlorine level is similar to the level of the existing distribution system; (2) there is no free chlorine and (3) total coliform organisms are absent. An invalid sample is one, which has excessive free chlorine, silt or non-coliform growth as defined in the current issue of the "Standards Methods." If unacceptable sample results are obtained for any pipe, the Contractor may, with the concurrence of the Inspector, for one time only flush the lines and then collect a second series of test samples for testing by the City. After this flushing sequence is completed, any pipe with one or more failed samples must be disinfected again in accordance with the approved disinfection procedure followed by appropriate sampling and testing of the water.

The City of Austin Water Quality Laboratory will notify the assigned City of Austin Inspector in writing of all test results. The Inspector will subsequently notify the Contractor of all test results. The Water Quality Laboratory will not release test results directly to the Contractor.

(30) Cleanup and Restoration

It shall be the Contractor's responsibility to keep the construction site neat, clean and orderly at all times. Cleanup shall be vigorous and continuous to minimize traffic hazards or obstructions along the streets and to driveways. Trenching, backfill, pavement repair (as necessary), and cleanup shall be coordinated as directed by the City. The E/A will regulate the amount of open ditch and may halt additional trenching if cleanup is not adequate to allow for orderly traffic flow and access.

Materials at the site shall be stored in a neat and orderly manner so as not to obstruct pedestrian or vehicular traffic. All damaged material shall be removed from the construction site immediately and disposed of in a proper manner. All surplus excavated materials shall become the property of the Contractor for disposal at the Contractor's expense. After trenching, the Contractor shall immediately remove all excavated materials unsuitable for or in excess of, backfill requirements. Immediately following the pipe laying Work as it progresses, the Contractor shall backfill, grade and compact all excavations as provided elsewhere. The backfill placed at that time shall meet all compaction test requirements. The Contractor shall immediately clean up and remove all unused soil, waste and debris and restore all surfaces and improvements to a condition equal or superior to that before construction began and to an appearance which complements the surroundings. The Contractor shall grade and dress the top 6 inches of earth surfaces with soil or other material similar and equal to the surrounding, fill and smooth any visible tracks or ruts, replace and re-establish all damaged or disturbed turf or other vegetation and otherwise make every effort to encourage the return of the entire surface and all improvements to a pleasant appearance and useful condition appropriate and complementary to the surroundings and equal or similar to that before construction began.

Placement of the final lift of permanent pavement, if a pavement is required, shall begin immediately after all testing of each segment of piping is satisfactorily completed.

(31) Valve Turn Walk-though

As part of the acceptance of Water or Reclaimed Water pressure pipe, an AW Valve Walk-through will be performed after an initial inspection by the Owner's Representative to identify any deficient items. If deficient items are present during the AW Valve Walk-Through and the project fails acceptance, a re-inspection fee will apply and must be paid before a re-inspection is scheduled to confirm correction of deficient items. See AW Fee Schedule for the current Distribution Walk-Through Re-inspection Fee.

(32) 2-inch Jumper Hose

During connections to the water distribution system, the Contractor may be required to install a temporary jumper hose between the unpressurized water segment and an adjacent pressurized water segment for the purpose of maintaining water service to customers who can't operate without water service during the connection. The jumper shall include an approved backflow preventer and be of adequate size and pressure rating to maintain service to the customer. It shall be polyethylene tubing meeting the requirements of COA SPL WW-65. The jumper hose and other components in the temporary service shall be disinfected, and bacteriological samples will be taken and pass before the temporary service is provided to the customer. Contractor shall provide adequate protection for the jumper hose in vehicular traffic areas at all times during use.

Source: Rule No. R161-17.05 , 5-31-2017; Rule No. R161-17.19 , 11-28-2017; Rule No. R161-18.23 , 12-8-2018.

510.4 - Measurement

Pipe will be measured by the linear foot for the various types, sizes and classes. Parallel lines will be measured individually.

Where a line ties into an existing system, the length of the new line will be measured from the visible end of the existing system at the completed joint. Unless otherwise indicated, the length of water, reclaimed, and wastewater lines will be measured along pipe horizontal centerline stationing through fittings, valves, manholes, and other appurtenances.

Ductile iron fittings, whether standard mechanical joint or integral factory restrained joint type, will be measured by the ton and paid for in accordance with the schedule in Standard Products List WW-27C. Bolts, glands and gaskets will not be measured for payment. Steel cylinder concrete pipe fittings and welded steel pipe fittings will not be measured separately and are included in the unit price for the respective pipe bid items.

Factory restrained joint pipe meeting the requirements of Standard Products List WW-27F will be measured by the linear foot. The estimated quantity on the bid form is only for restrained joint pipe having integral mechanically restrained joints.

Connecting a new water, wastewater, or reclaimed water service to an existing, comparable type of private service will be measured by each connection. Service pipe from the main to the service connection will be measured by the linear foot.

The Contractor shall be responsible for removing and treating ground water flowing into a trench up to a baseline flow rate of 350 gpm of sustained flow for each mainline open trench (no more that 300 linear feet open trench per work zone segment is allowed at one time). This baseline flow rate is not a prediction of ground water conditions to be expected on the Project. Rather, it establishes contract terms regarding the quantity of ground water for which the contractor is responsible without extra or separate compensation. The flow rate must exceed 350 gpm continuously for at least 4 consecutive hours to be considered sustained flow. It is expected that trench dewatering for this baseline rate may be accomplished with a single 3-inch trash-type pump per open trench; however, measured flow rate, not pump size, type or characteristics shall be used to determine if the baseline rate has been exceeded.

Flow rate shall be determined by measurements made at the discharge point of the water treatment facilities. Surface storm water flowing into a trench shall be the Contractor's responsibility to remove and treat without compensation, regardless of inflow rate or volume.

Adjustment of elevations during construction resulting in changes in flow line elevations of plus or minus two feet or less will not be considered for credit or additional compensation and no measurement for payment will be made.

Stormwater pipe will be measured along the slope of the pipe. Where drainage pipe ties into inlets, headwalls, catch basins, manholes, junction boxes or other structures that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included.

Excavation and backfill, when included as pipe installation will not be measured as such but shall be included in the unit price bid for constructing pipe and measured as pipe complete in place including excavation and backfill.

When pay items are provided for the other components of the system, measurement will be made as addressed hereunder.

Video inspection of newly installed box culverts and storm drain pipe will be measured per linear foot of pipe videoed.

Jumper hose will be measured per linear foot of hose installed, including all depths, excavation and backfill, complete, and in place.

Source: Rule No. R161-17.05 , 5-31-2017.

510.5 - Payment

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot for the various sizes of pipe, of the materials and type indicated, unless unstable material is encountered or trench excavation and backfill is bid as a separate item.

The concrete seal, foundation rock or coarse aggregate when used as directed in unstable material will be paid for at the unit price bid per cubic yard, which shall be full payment for all excavation and removal of unsuitable material and furnishing, placing and compacting the foundation rock, coarse aggregate or other approved material all complete in place.

Excavation and backfill, when included as a separate pay item, will be paid for by Pay Item No. 510-E or 510-F.

No separate payment will be made for dewatering a trench with ground water inflow of less than the baseline rate of 350 gpm of sustained flow as described above. Dewatering of those trenches shall be included in the contract unit price of the Pipe pay item. Payment for dewatering a trench with ground water inflow exceeding 350 gpm of sustained flow shall be agreed by change order. Dewatering of bore pits shall be included in the contract unit price for Bore Entry Pit or Exit Pit regardless of inflow rate or volume unless specified otherwise in the bid item for Bore Entry Pit or Exit Pit.

(1) Pipe

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot complete-in-place as designed and represented in the Drawings and other Contract documents. Restrained joint pipe meeting the requirements of Standard Products List WW-27F will be paid for separately at the unit price bid per linear foot. Unless otherwise provided herein, as separate pay item(s), the bid price per linear foot of pipe shall include the following:

a. clearing

b. constructing any necessary embankment

c. excavation

d. disposal of surplus or unusable excavated material

e. furnishing, hauling and placing pipe

f. field constructed joints, collars, temporary plugs, caps or bulkheads

g. all necessary lugs, rods or braces

h. pipe coatings and protection

i. connections to existing systems or structures, concrete blocking and thrust blocks and restrained joints

j. preparing, shaping, pumping for dewatering, and shoring of trenches

k. bedding materials

l. backfill materials

m. hauling, placing and preparing bedding materials

n. particle migration measures

o. hauling, moving, placing and compacting backfill materials

p. temporary and permanent pavement repairs and maintenance

q. temporary removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction

r. cleanup

s. vertical stack on deep wastewater services

t. all other incidentals necessary to complete the pipe installation as indicated.

u. pipe joint restraint devices, where specified or allowed, meeting Standard Products List WW-27A or WW-27G.

No separate payment will be made for thrust restraint measures.

Steel cylinder concrete pipe fittings and welded steel pipe fittings will not be paid for separately. These will be included in the unit price bid for the bid item Pipe.

(2) Concrete Cradles and Seals

When called for in the Bid, concrete cradles and seals will be paid for at the unit Contract price bid per linear foot for the size of pipe specified, complete in place.

(3) Concrete Retards

When called for in the Bid, Concrete retards will be paid under Item No. 593S, Concrete Retards."

(4) Boring or Jacking.

When called for in the Bid, boring or jacking will be paid under Item 501S, "Jacking or Boring Pipe.

(5) Wet Connections to Potable or Reclaimed Water Mains

When called for in the bid, wet connections will be paid at the unit price bid per each, complete in place, according to the size of the main that is in service and shall be full compensation for all Work required to make the connection and place the pipe in service. (See subsection 510.3 'Construction Methods' part (24) (b) 'Wet Connections to Existing Water System').

(6) Fittings

Ductile iron fittings, furnished in accordance with these specifications, will be paid for at the unit price bid per ton, complete in place, according to the schedule of weights in Standard Products List WW-27C. Bolts, glands, and gaskets will not be paid for separately and shall be included in the contract unit price for fittings.

(7) Concrete Trench Cap and Encasement

Where the distance between the top of the concrete encasement and the top of the trench cap is less than 36 inches, the concrete cap and encasement shall be poured as one unit and paid for under this bid item at the Contract price bid per linear foot. When the distance above is greater than 36 inches or when the trench cap is placed separately, the trench cap shall be paid for as a separate item, per linear foot, complete in place.

(8) Cement-Stabilized Backfill

Cement-stabilized backfill will be paid for at the unit price bid per linear foot and shall be full payment to the Contractor for furnishing and installing the required material, mixed, placed and cured complete in place.

(9) Concrete Encasement

When called for in the Bid, Concrete Pipe Encasement will be paid under Item No. 505S, "Encasement and Encasement Pipe".

(10) Pressure Taps

Pressure taps will be paid for at the unit price bid, complete in place, according to the size tap made and the size main tapped and shall be full payment for furnishing all necessary materials, including tapping sleeve and valve, making the tap, testing and placing the connection in service.

(11) Excavation Safety Systems

When called for in Bid, Trench Safety Systems shall conform to Item No. 509S, "Excavation Safety Systems."

(12) Connecting a New Water, Wastewater, or Reclaimed Water Service to an existing, comparable type of private service will be paid for at the unit price bid, complete in place, according to the size of new service and size of existing private service, and shall be full payment for furnishing and installing all necessary materials, such as cleanouts, pipe, couplings, and fittings, and including excavation and backfill.

(13) Video Inspection

Video Inspection of Newly Installed Box Culverts and Storm Drain Pipe will be paid for at the unit price bid per linear foot and shall be full payment for all labor, equipment, and materials required for video inspection per this specification, including all submittals of CD/DVD as required.

(14) Jumper Hose

Jumper Hose will be paid at the unit bid price, complete and in place, including installation and removal of all materials necessary to provide a fully functional jumper hose. This item shall also include adequate protection for the jumper hose within vehicular traffic areas.

Source: Rule No. R161-17.05 , 5-31-2017.

Payment, when included as a Contract pay item, will be made under one of the following:

Pay Item No. 510-AR___Dia.:	Pipe, ___ Dia. ___ Type (all depths), including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-ARRJ___Dia.:	Factory Restrained Joint Pipe, ___ Dia., Class ___ Ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-BR___×___Dia.:	Connecting New ___ Service to Existing Private Service (___ Dia. New Service to ___ Dia. Private Service)	Per Each.
Pay Item No. 510-CR:	Pipe Excavation, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-DR:	Pipe Trench Backfill, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-ER:	Concrete Seal or Cradle, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-FR:	Concrete Trench Cap, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-GR:	Concrete Cap and Encasement, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-HR:	Cement Stabilized Backfill, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-IR: ___ × ___ Dia.:	Pressure Taps, ___ Dia. × ___ Dia.	Per Each.
Pay Item No. 510-JR: ___ × ___ Dia.:	Wet Connections, ___ Dia. × ___ Dia.	Per Each.
Pay Item No. 510-KR:	Ductile Iron Fittings	Per Ton.
Pay Item No. 510-ASD___Dia.:	Pipe, ___ Dia. (all depths), including excavation and backfill	Per Linear Foot.

Pay Item No. 510-CSD:	Pipe Excavation, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-DSD:	Pipe Trench Backfill, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-ESD:	Concrete Seal or Cradle, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-FSD:	Concrete Trench Cap, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-GSD:	Concrete Cap and Encasement, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-HSD:	Cement Stabilized Backfill, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-AW___ Dia.:	Pipe, ___ Dia. ___ Type (all depths), including excavation and backfill	Per Linear Foot
Pay Item No. 510-AWRJ___ Dia.:	Factory Restrained Joint Pipe, ___ Dia., Class Ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-BW___ × ___ Dia.:	Connecting New ___ Service to Existing Private Service (___ Dia. New Service to ___ Dia. Private Service)	Per Each.
Pay Item No. 510-CW:	Pipe Excavation, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-DW:	Pipe Trench Backfill, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-EW:	Concrete Seal or Cradle, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-FW:	Concrete Trench Cap, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-GW:	Concrete Cap and Encasement, ___ Dia. Pipe	Per Linear

		Foot.
Pay Item No. 510-HW:	Cement Stabilized Backfill, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-IW:___ × ___ Dia.:	Pressure Taps, ___ Dia. × ___ Dia.	Per Each.
Pay Item No. 510-JW: ___ × ___ Dia.:	Wet Connections, ___ Dia. × ___ Dia.	Per Each.
Pay Item No. 510-KW:	Ductile Iron Fittings	Per Ton.
Pay Item No. 510-AWW: ___ Dia.:	Pipe, ___ Dia. ___ Type (all depths), including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-AWWRJ___ Dia.:	Factory Restrained Joint Pipe, ___ Dia., Class ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-BWW___ × ___ Dia.:	Connecting New ___ Service to Existing Private Service (___ Dia. New Service to ___ Dia. Private Service)	Per Each.
Pay Item No. 510-CWW:	Pipe Excavation, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-DWW:	Pipe Trench Backfill, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-EWW:	Concrete Seal or Cradle, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-FWW:	Concrete Trench Cap, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-GWW:	Concrete Cap and Encasement, ___ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-HWW:	Cement Stabilized Backfill, ___ Dia. Pipe	Per Linear Foot.

Pay Item No. 510-KWW:	Ductile Iron Fittings	Per Ton.
Pay Item No. 510-VIDEO	Video Inspection of Newly Installed Box Culverts and Storm Drain Pipe	Per Linear Foot.
Pay Item No. 510-JH	2-inch Jumper Hose	Per Linear Foot.

An "R" after the pay item indicates the use for reclaimed water.

An "SD" after the pay item indicates the use for storm drain.

A "W" after the pay item indicates the use for water.

A "WW" after the pay item indicates the use for wastewater.

Source: Rule No. R161-17.05 , 5-31-2017.

Applicable References:

Standard Specifications Manual: Item Nos. Ref: 102S, 210S, 402S, 403, 501S, 505S, 506, 507S, 509S, 593S, 601S, 604S

Standards Manual: Standard Detail Nos. 510S-1, (520 - series).

Design Criteria Manuals: Utilities Criteria Manual, Section 5.

End

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ITEM NO. 700S - MOBILIZATION 9-26-12

700S.1 - Description

This item shall govern the mobilization of personnel, equipment and materials at the work site for other contract items that will be performed by the Contractor. Mobilization shall include, but not be limited to the movement of equipment, personnel, material, supplies, etc. to the Work site; the installation of temporary facilities (when not paid for separately) and the establishment of office and other necessary facilities prior to the initiation of the Work. The cost of the Payment Bond and Performance Bond on the Work that is delayed due to circumstances beyond Contractor's control, a closed construction season or for the convenience of the City of Austin will be considered part of the mobilization item under this Contract.

700S.2 - Measurement.

Measurement of the Specification Item, "Mobilization", as specified herein as "Total Mobilization Payment", will be by the "Lump Sum", as the Work progresses.

RELATED CROSS REFERENCE MATERIALS	
Specification 700S, "MOBILIZATION"	
City of Austin Standard Contract Documents	
Designation	Description
00020	Invitation for Bids
00100	Instructions To Bidders
00300	Bid Form
00425	Insurance Cost Form
00500	Agreement
00610	Performance Bond
00620	Bid Bond

00650	Certificate of Insurance
00700	General Conditions
00810	Supplemental General Conditions
00820	Modifications to Bidding Requirements & Contract Forms
01010	Summary of Work
01300	Submittals
01500	Temporary Facilities
01550	Public Safety and Convenience
01700	Contract Closeout
01710	Final Cleaning

End

ITEM NO. 701S - FENCING 9-26-12

701S.1 - Description

This item shall govern furnishing and installing fencing and gates at locations shown on the Drawings or directed by the Engineer or designated representative, including all posts, bracing and accessories as specified in this Item and as indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

701S.2 - Submittals

Prior to installation of the fencing the Contractor shall furnish the Engineer or designated representative with certification from the manufacturer that all fencing materials comply with the requirements specified in this Item.

701S.3 - Materials

A. Chain Link Fabric

1. Wire fabric for fencing shall be 9 gauge (3.76 mm) steel with a minimum breaking strength of 1,290 pounds per foot (1 750 Newtons per square meter). The overall height of the fence when erected shall be the height above grade as indicated on the Drawings. The fabric shall be woven into an approximately 2-inch ± 1/8 -inch (50 mm ± 3 mm) mesh such that in a vertical dimension of 23 inches (585 mm) along the diagonals of the openings there shall be at least 7 meshes. Unless indicated otherwise on the Drawings the fabric shall have a knuckled (K) and twisted (T) finish for the top and bottom selvages respectively. The wire in the fabric shall withstand a minimum tensile strength test of 75,000 psi (517 kPa) after galvanizing. Except as provided herein, the chain link fence fabric shall conform to ASTM A392, Class I or ASTM A491.
2. The fabric shall be hot dip galvanized after weaving and shall have a minimum coating of 1.2 ounces per square foot (0.4 kilograms per square meter) of uncoated surface conforming to ASTM A392, Class I.
3. Between posts the fabric shall be fastened at 12-inch (300-mm) intervals to a top and bottom tension wire. When a top rail is shown on the Drawings, the fabric shall also be fashioned in the same manner. On gate frames, the fabric shall be fastened to top and bottom of the gate frame at all 12-inch (300-mm) intervals. Steel or aluminum wire fabric ties with a minimum 9 gauge (3.76 mm) diameter shall be used.

B. Woven Wire Fencing

Woven wire fencing shall be either galvanized steel wire fencing or aluminum-coated steel wire fencing conforming to the following requirements:

1. Galvanized steel wire fencing shall conform to ASTM A116, Class 1.
2. Aluminum-coated steel wire fencing shall consist of aluminum-coated steel wire conforming to the requirement for galvanized steel wire fencing, except the wire shall be aluminum coated. The wire shall not have less than 0.40 ounce (11 grams) coating of aluminum alloy per square foot of uncoated surface in accordance with ASTM A491

C. Wire Fencing

Wire shall be either galvanized or aluminum alloy coated 9 gage (3.76 mm) steel wire conforming to the specifications for galvanized steel or aluminum alloy coated woven wire fencing above.

D. Wood Fencing

Wood for wood fencing shall be Wolmanized pine, cedar or as indicated on the Drawings. The timber shall be sound and free from all decay, shakes, splits or any other defects, which would make it structurally unsuitable for the intended purpose.

E. Metal Posts, Top Rails, Braces and Gates

Steel pipe used for posts, top rails, braces and gate frames shall conform to the specifications of ASTM A 53. Steel sections used for posts, top rails, frames and braces shall be a good commercial quality weldable steel. All material shall be new and no used, re-rolled or open seam material will be acceptable. All posts shall meet the weight and length requirements indicated. The fabric bands and steel wire ties shall conform to the gauge and spacing indicated and shall be of suitable design to fasten fabric to the posts. Wire ties of the gauge shown may be used in lieu of fabric bands. All fittings required for posts shall be pressed or rolled steel, forge steel, malleable iron or wrought iron of good commercial quality and spaced as indicated on the Drawings.

1. Line Posts

Line posts may be either C-section or tubular. Tubular line posts shall be fitted with watertight malleable iron caps. Line posts shall be furnished in sufficient quantity to provide a maximum spacing of 10 feet (3 meters)

2. Terminal Posts

All end, corner and pull posts shall be known as terminal posts and shall be of either round or square sections. All terminal posts shall be furnished with watertight malleable iron caps. Fabric shall be fastened to terminal posts by steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing indicated on the Drawings.

3. Gate Posts

Gateposts shall be either round or square. All gateposts shall be furnished with watertight malleable iron caps. The fabric shall be attached to the gateposts by means of steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing indicated on the Drawings.

4. Post Caps

Post caps for pipe sections shall be designed to exclude all moisture. Where a top rail is shown on the Drawings, post caps shall have an opening for the top rail. All post caps shall have a 2-inch (50-mm) skirt for rigidity. When barbed wire is allowed for topping a six-foot (1.82 meter) or higher fence (LDC Section 10-1-9) the barbed wire support arms shall be integral with post caps.

5. Gates

a. Single Swing Gate

The gate frames shall be fabricated from sections either round or square of the size and weight indicated on the Drawings and shall be filled out with the same type fabric specified for the chain link fence. All gates shall be equipped with approved malleable iron or steel latches, stops and center rest. A satisfactory locking device suitable for padlocking shall be provided. The gates shall be hung by at least 2 steel or malleable iron hinges securely fastened to the posts. Hinges shall not twist or turn under the action of the gate, shall be capable of allowing a full 180 degree opening turn, shall be so arranged that a closed gate cannot be lifted off the hinges to obtain entry and shall be easily operated by one person.

b. Double Swing Gate

Double swing gates shall be furnished and installed as indicated on the drawings. Gates shall be of the same height as the fence and shall have a single vertical mat of barbed wire. The gates shall be hinged to swing 180 degrees from closed to open. The gates shall be complete with frames, latches, stops, keepers, hinges, fabric, braces, padlocks and three strands of barbed wire. Gates shall have intermediate members and diagonal truss rods as required for rigid construction and shall be free from sag and twist. Gates shall be fitted with vertical extension arms or shall have frame end members intended to carry barbed wire.

Hinges shall be pinned type, heavy pattern with large bearing surface and shall not twist or turn under the action of gate. Latches for double swing gates shall be plunger bar type, full gate height, and arranged to engage the gate stop. Stops shall consist of a roadway plate with anchor set in Portland Cement concrete and arranged to engage the plunger. Keepers shall consist of mechanical devices for securing and supporting the free end when in the full open position. Latches shall be arranged for padlocking with padlock accessible from sides of the gate. Gates shall be installed so that they cannot be removed without disassembly of the hardware. Hardware attachment bolt shall be penned to prevent easy removal.

6. Top Rail

The top rail shall be of size and weight indicated on the Drawings and shall be furnished in random lengths, not less than 18 feet (5.5 meters) per section with outside sleeve type couplings at least 6 inches (150 mm) long and having a wall thickness of not less than 0.70-inch (18-mm). One coupling in five shall have a heavy spring to take up expansion and contraction of the rail. The top rail shall be installed before installing chain link fabric and shall pass through post tops.

7. Braces

All braces shall be of the size, weight and length indicated on the Drawings. All braces shall be trussed with rods and turnbuckles of the dimensions indicated on the Drawings. Braces shall be installed on all terminal posts and shall extend to the adjacent line posts. All corner and pull posts shall have braces on each side of terminal.

8. Fittings, Bolts and Other Miscellaneous Hardware

All fittings, bolts and miscellaneous hardware shall be hot dip galvanized in conformance with TxDoT Standard Specification Item No. 445, "Galvanizing.

9. Tension Wire

Between posts, the fabric shall be fastened to a top and bottom tension wire or to the top rail and bottom tension wire by steel wire ties of the gauge and spacing indicated on the Drawings. The tension wire shall be at least 7 gauge (4.5 mm) galvanized coil spring steel of good commercial quality.

Tension wire shall have a minimum coating of 0.8 ounce per square foot (0.2 kilogram per square meter) of uncoated surface when tested in conformance with ASTM A116.

10. Security Fence

The security fence shall be 8 feet (2.44 meters) high with brackets and 3 strands barbed wire.

Barbed wire, when specified on the Drawings, shall be 12-½ gauge wire (2.51 mm), twisted with two-point 14 gauge (2.03 mm) barbs spaced approximately 5 inches (125 mm) apart and shall conform to ASTM A121 or ASTM A585. Three strands of barbed wire will be required when a barbed wire top is specified on the Drawings.

Barbed wire support arms shall be at an angle or 45o from vertical and shall have clips for attaching three (3) strands of barbed wire to each support arm. Each support arm shall be of sufficient strength to support a 200-pound (90 kilograms) weight (mass) applied at the outer strand of barbed wire.

11. Galvanizing

Thin-wall, high-strength pipe posts shall be externally hot-dip galvanized with a minimum weight of coating of 0.9 ounce per square foot (0.3 kilogram per square meter). After galvanizing, thin-wall, high-strength pipe posts shall be externally chromated by total immersion followed by application of clear polyurethane finish.

Interior surfaces shall have a hot-dip galvanized coating, a zinc base coating with thickness 0.5 mil ± 0.2 mil (13 micrometer ± 5 micrometer). The coating shall be 94 percent zinc powder by weight (mass).

All tubular posts, rails and braces shall comply with the following salt spray performance requirements when tested in accordance with ASTM B117.

Exterior - 1250 hours to maximum 5 % red rust

Interior - 650 hours to maximum 5 % red rust

The uniformity of the zinc coating shall be determined by visual inspection. If, in the opinion of the Engineer or designated representative, visual examination is not conclusive, he may use the Preece Test as described in ASTM A239. When so tested, all items shall withstand a minimum of 6 one-minute dips except for those items designated in ASTM A153 as Class B-2, B-3, C and D, which shall withstand a minimum of 4 one-minute dips.

Careful visual inspection shall be made to determine the quality of the zinc coating. Excessive roughness, blisters, salammoniac spots, bruises and flaking if present to any considerable extent, shall provide a basis for rejection. Where practicable, all inspection and tests shall be made at the place of manufacturer prior to shipment and shall be so conducted as not to interfere unnecessarily with the progress of the work.

Damaged spelter coating shall be repaired by thoroughly wire brushing the damaged area and removing all loose, cracked or weld-burner spelter coating. The cleaned area shall be painted with 2 coats of zinc oxide-zinc dust paint conforming to the requirements of Federal Specification TT-P-641B. The paint shall be furnished at the Contractor's expense.

F. Concrete Post Anchorages

Concrete for post footings, catch blocks, anchors and other such items related to the fence construction, shall be Class B Concrete conforming to Item No. 403S, "Concrete for Structures" or as indicated on the Drawings. Maximum size of aggregate shall be ¾ inch (19 mm). Hand mixing of concrete will be permitted on batches under ½ cubic yard (0.38 cubic meter). All batches exceeding this volume will be machine mixed.

Concrete shall be placed promptly and without segregation after mixing. The Contractor shall consolidate the concrete satisfactorily by tamping or vibrating. Excess excavation from footings shall be satisfactorily disposed of.

The tops of post footings shall extend slightly above ground and shall be steel troweled to a smooth finish sloped to drain away from posts. Posts, braces and other units shall be centered in footings.

G. Mowing Strip

When called out in the drawings, a mowing strip shall be Class A concrete. It shall be 24 inches (610 mm) wide and a minimum of 4 inches (100 mm) thick. Three (3) number 3 (#3) bars shall be evenly

spaced and supported along the full length of the mow strip, and a number 3 (#3) bar shall be cross-tied every 4 feet (1.2 m). Fence posts shall be installed in center of mow strip.

701S.4 - Inspection and Sampling

The Contractor shall furnish, upon request of the Engineer or designated representative, samples of each component part of the fence including fittings. These samples shall be subjected to the galvanizing, weight and where required, strength tests. A sample may be taken for each project or for each shipment to a project, when requested by the Engineer or designated representative. All samples shall be furnished to the City free of charge.

If any specimen tested fails to meet the requirements of this specification, two (2) additional specimens shall be cut from the remainder of the sample and tested, both of which shall meet the requirements in every respect or the lot represented by the sample may be rejected.

701S.5 - Construction Methods

The Chain Link Fence shall be erected to lines and grades established by the Engineer or designated representative in accordance with the details indicated on the Drawings. The fence shall be true to line, taut and shall comply with the best practice for fence construction of this type.

A. Clearing and Grading

The Contractor shall perform all clearing of brush, rocks and debris necessary for the installation of this fencing.

B. Erection of Posts

Posts shall be set plumb and permanently positioned and anchorages firmly set before fabric is placed. Posts shall be set in concrete, unless otherwise indicated on the Drawings.

Concrete footings shall be carried to the depth and dimensions indicated on the Drawings. Where rock is encountered within the required depth to which the post is to be erected, a hole of a diameter slightly larger than the largest dimension of the post may be drilled into the rock and the post grouted in. The regular dimensioned concrete footing as indicated on the Drawings shall then be placed between the top of the rock and required grade indicated on the Drawings. Posts shall be approximately centered in their footings. All concrete shall be placed promptly and compacted by tamping or other approved methods. Concrete shall be finished in a dome and shall be cured a minimum of 48 hours before further work is done on the posts.

Pull posts shall be placed not over 500 feet (15.25 meters) apart in straight runs and at each vertical angle point, all as directed by the Engineer or designated representative. Corner posts shall be placed at each horizontal angle point greater than 15 degrees. Corner and pull posts shall have horizontal braces and tie rods as specified above and as indicated or designated representative.

C. Erection of Top Rail and Tension Wire

The top rail and bottom tension wire and/or top and bottom tension wires shall be installed before installing the chain link fabric. The top rail shall be firmly attached in final position. Tension wires shall be within 4 inches (100 mm) of the top and bottom of the fabric and shall be pulled taut.

D. Erection of Fabric

After all posts have been permanently positioned and anchorages firmly set with the cables drawn taut with the turnbuckles, the fabric shall be placed by securing one end and applying sufficient tension to the other end to remove all slack before making attachments. Unless otherwise indicated on the Drawings, the fabric shall be cut and each span shall be attached independently at all corner posts and pull posts.

Fabric shall be fastened as indicated on the Drawings and the bottom of the fabric shall be placed a normal distance of 2 inches (50 mm) above the ground line; however, over irregular ground this distance may vary between 1 inch (25 mm) and 6 inches (150 mm) for a distance not to exceed 8 feet (2.44 meters). Any necessary backfilling required, in order to comply with these provisions, will be considered as incidental work.

E. Fence Grounding

This fence shall be grounded where a power line passes over the fence. In any case, a ground shall be provided at locations not to exceed 1,000 feet (30 meters) apart in straight runs of fence. Each individual section of fence shall have at least 1 ground. The ground shall consist of a copper-weld rod 8 feet (2.44 meters) long and a minimum of 5/8 inch (16 mm) in diameter driven or drilled in vertically until the top of the rod is approximately 6 inches (150 mm) below the top of the ground. A No. 6 solid copper conductor shall be brazed to the rod and to the fence in such a manner that each element of the fence is grounded.

F. Erection of Wood Fencing Material

After all posts have been permanently positioned and anchorages firmly set, stringers shall be placed and boards secured to the stringers. Other techniques utilizing modular precut panels may be used, when indicated on the Drawings.

701S.6 - Measurement

Chain Link Fence, of each height specified, will be measured by the lineal foot of fence measured at the bottom of the fabric along the centerline of fence from center to center of terminal posts, excluding gates. Gates will be measured as each gate, complete in place.

701S.7 - Payment

The work performed and material furnished as prescribed by this item, measured as provided under "Measurement" will be paid for at the unit bid price for "Chain Link Fence" of the height specified. The unit bid price shall include full compensation for furnishing and installing all fencing materials (except gates) including all miscellaneous fittings, braces, post caps, line wires, connection clips or wires; digging post holes and grouting in rock where required; furnishing and placing concrete for setting posts; furnishing and installing all electrical grounds; all hauling and handling charges; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work, including excavation, backfilling and disposal of surplus material.

Gates measured as provided under "Measurement" will be paid for at the unit bid price for "Pedestrian Gate" or "Vehicular Gate", of the type, height and opening specified. The unit bidprice shall include full compensation for furnishing all materials; fabricating, preparation, hauling, handling charges and erecting, including all miscellaneous fittings, braces, latches, gate hinges, stops and center anchorage; and for all manipulations, labor, tools, equipment and incidentals necessary for complete installation.

Payment will be made under one of the following:

Pay Item No. 701S-A:	Chain Link Fence,	Per Lineal Foot.
Pay Item No. 701S-BS:	Chain Link Pedestrian Single Swing Gate, ___ Foot. × ___ Foot.	Per Each.
Pay Item No. 701S-BD:	Chain Link Pedestrian Double Swing Gate, ___ Foot. × ___	Per Each

	Foot.	
Pay Item No. 701S-CS:	Chain Link Vehicular Single Swing Gate, ___ Foot. × ___ Foot.	Per Each.
Pay Item No. 701S-CD:	Chain Link Vehicular Double Swing Gate, ___ Foot. × ___ Foot.	Per Each
Pay Item No. 701S-D:	Wire Fence	Per Lineal Foot.
Pay Item No. 701S-E:	Wood Fence	Per Lineal Foot.
Pay Item No. 701S-F:	Wood Fence Pedestrian Gate, ___ Foot. × ___ Foot.	Per Each.
Pay Item No. 701S-G:	Wood Fence Vehicular Gate, ___ Foot. × ___ Foot.	Per Each.
Pay Item No. 701S-H:	Security Fence, ___ Foot High, Type ___	Per Lineal Foot.
Pay Item No. 701S-T:	Temporary Fence, ___ Foot High, ___ Type	Per Lineal Foot.
Pay Item No. 701S-MS:	Mowing Strip	Per Lineal Foot

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 701S, "Fencing"	
City of Austin Standard Specifications	
Designation	Description

Item No. 403	Concrete for Structures
City of Austin Code of Ordinances, Volume I	
Designation	Description
Section 10-1-9	Barbed Wire Fences
Texas Department of Transportation: Standard Specifications For Construction of Highways, Streets and Bridges	
Designation	Description
Item No. 445	Galvanizing
American Society For Testing And Materials (ASTM)	
Designation	Description
A 53/A 53M	Specification For Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A 116	Specification For Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
A 121	Specification For Zinc-Coated (Galvanized) Steel Barbed Wire
A 153/A 153M	Specification For Zinc-Coated (Hot-Dip) on Iron and Steel Hardware
A 239	Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron and Steel Articles
A 392	Specification For Zinc-Coated Steel Chain-Link Fence Fabric

A 491	Specification For Aluminum-Coated Steel Chain-Link Fence Fabric
A 585	Specification For Aluminum-Coated Steel Barbed Wire
B 117	Practice for Operating Salt Spray (Fog) Apparatus Federal Specification TT-P-641B

RELATED CROSS REFERENCE MATERIALS	
Specification 701S, "Fencing"	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
Designation	Description
Item No. 550	Chain Link Fence
Item No. 552	Wire Fence

End

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ITEM NO. 702S - REMOVAL AND RELOCATION OF EXISTING FENCES 5-20-02

702S.1 - Description

This item shall govern the removal and relocation of existing fence, gates and hardware to a new alignment at the location in conformance to the typical details indicated on the Drawings or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text inch-pound units are given preference followed by SI units shown within parentheses.

702S.2 - Removal of Existing Materials

The existing boards, fabric, posts, wire, rails, braces, hardware, gates and miscellaneous items shall be carefully removed, bundled, rolled and stockpiled as indicated on the Drawings for installation at the new fence assignment. The removal and handling shall be such that the fence materials may be reused in the relocated fence.

A. Removal of Fabric and Wire

Fabric and wire of all types shall be carefully untied or disassembled from the posts and other appurtenances and shall be rolled in bundles of a size that will allow handling with ordinary equipment.

B. Removal of Posts

Posts shall be carefully removed from the ground and the concrete footing removed. The concrete shall be disposed of off site. Post holes shall be filled with suitable embankment material and thoroughly compacted.

C. Removal of Boards

Boards of all types shall be carefully disassembled from the rails and other appurtenances to facilitate removal in panels. Excess material removed shall be disposed of as indicated below.

D. Storage of Materials

Storage of all salvageable materials, that will be reinstalled at a new location, shall be stored on-site or at such other locations as the Contractor may elect, subject to approval by the Engineer or designated representative. Security and maintenance of the salvageable materials shall be the responsibility of the Contractor.

E. Excess Materials

Materials, that are damaged, unsuitable for reinstallation or unnecessary for completion of the scope of the fence work in the new alignment shall be considered as excess but shall be offered to the Owner before removal from the site by the Contractor.

702S.3 - New Materials

New materials that are required to complete the fence at the location indicated on the Drawings shall be of equal quality to the existing materials. Used materials from other projects or from the Contractor's own used material stocks will not be allowed. The new materials to be furnished will be those necessary to replace items from the existing fence which were damaged during removal operations or which for other reasons cannot be reused.

702S.4 - Construction Methods

The removed fence shall be installed at the new assignment in accordance with the typical details indicated on the Drawings and shall comply with Standard Specification Item No. 701S, "Fencing" and the best practice for fence construction of the specified type.

702S.5 - Measurement

Fences of the height and type to be relocated will be measured by the lineal foot (lineal meter: 1lineal foot equals 0.31 meters) of fence in its new location measured at the bottom of the fence along the centerline of the fence from center to center of terminal posts, excluding gates.

702S.6 - Payment

The work performed and material furnished as prescribed by this item measured under "Measurement" will be paid for at the unit bid price for "Removing and Relocating Fences" of the size and type specified to be relocated. The unit bid price shall include full compensation for removing, salvaging, storing and handling all existing fence materials; furnishing new posts, boards, rails, braces, tie wires, connection clips, fabric, rails, brace rods and any other fence component items that were damaged during removal and necessitating new material being furnished to complete the project; digging post holes and grouting in rock where required; furnishing concrete for post footings; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work including excavation, backfilling and disposal of surplus materials.

Gates as provided under "Measurement" will be paid for at the unit bid price for Removal and Relocation of Existing Pedestrian or Vehicular Gates of the type and size specified to be relocated. The unit bid price shall include full compensation for removing the gate from the existing locations, handling, storing and hauling all gate materials, furnishing any new materials necessary for installing at new locations; providing new center anchorage blocks, latches and catch blocks and for manipulations, labor, tools, equipment and incidentals necessary to complete the gate relocation.

Payment will be made under one of the following:

Pay Item No. 702S-A:	Removing and Relocating Existing ___ Ft. Chain Link Fence	Per Lineal Foot.
Pay Item No. 702S-B:	Removing and Relocating Existing ___ Ft. × ___ Ft. Chain Link Pedestrian Gate	Per Each.
Pay Item No. 702S-C:	Removing and Relocating Existing ___ Ft. × ___ Ft. Chain Link Vehicular Gate	Per Each.
Pay Item No. 702S-D:	Removing and Relocating Existing ___ Ft. Wooden Fence	Per Lineal Foot.
Pay Item No. 702S-E:	Removing and Relocating Existing ___ Ft. × ___ Ft. Wooden Pedestrian Gate	Per Each.
Pay Item No. 702S-F:	Removing and Relocating Existing ___ Ft. × ___ Ft. Wooden Vehicular Gate	Per Each.

Pay Item No. 702S-G:	Removing and Relocating Existing ___ Ft. Wire Fence	Per Lineal Foot.
Pay Item No. 702S-H:	Removing & Relocating Existing ___ Ft. × ___ Ft. Metal Gate	Per Each.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification 702S, "Removal and Relocation of Existing Fences"	
City of Austin Standard Specifications	
Designation	Description
Item No. 701S	Fencing

RELATED CROSS REFERENCE MATERIALS	
Specification 702S, "Removal and Relocation of Existing Fences"	
City of Austin Standard Specifications	
Designation	Description
Item No. 403S	Concrete for Structures
Texas Department of Transportation: Standard Specifications For Construction of Highways, Streets and	

Bridges	
Designation	Description
Item No. 445	Galvanizing

American Society For Testing And Materials (ASTM)	
Designation	Description
A 53/A 53M	Specification For Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A 116	Specification For Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
A 121	Specification For Zinc-Coated (Galvanized) Steel Barbed Wire
A 153/A 153M	Specification For Zinc-Coated (Hot-Dip) on Iron and Steel Hardware
A 239	Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron and Steel Articles
A 392	Specification For Zinc-Coated Steel Chain-Link Fence Fabric
A 491	Specification For Aluminum-Coated Steel Chain-Link Fence Fabric
A 585	Specification For Aluminum-Coated Steel Barbed Wire
B 117	Practice for Operating Salt Spray (Fog) Apparatus

End

ITEM NO. 703 - FENCING FOR EXCAVATIONS 9-22-88

703.1 - Description

This item to consist of temporary safety fencing supported on posts and constructed of materials as indicated and removed when excavation is backfilled.

703.2 - Materials

(1) Fabric

(a) Fabric to be 4 feet in width, made of high density polyethylene resin, extruded and stretched to provide a highly visible international orange, non-fading fence which will remain flexible from -60 F to 200 F, and be inert to most chemicals and acid. Pattern may vary from diamond to circular with a minimum weight per foot of 0.4 lbs./Ft., a 4 foot width minimum tensile yield strength (Horiz.) of 2000 psi, ultimate tensile strength of 2680 psi (Horiz.) and a maximum opening no greater than 2 inches.

(2) Metal Posts

Steel pipe, tee posts, U posts or 2" x 4' timber posts, 5½ feet in length minimum, spaced no more than 8 feet on centers. Fabric to be secured to post by bands or wire ties.

703.3 - Construction Methods

Prior to commencing construction suitable "Barricades, signs and traffic handling" devices to be installed to protect workers and public. Safety fencing to be erected to lines and grades indicated. Excavations within 750 ft. of schools or day care centers require special attention by Contractor to secure entry while work is in progress. Fence to be installed prior to excavation and maintained until excavation is backfilled. Fence to be placed a minimum of 4 feet from edge of excavation. Posts to be driven in ground a minimum of 18 inches. At completion of each day's work, safety fencing to be pulled taut, and entry secured. When safety fence is no longer needed, Contractor to remove fence and posts and patch any damage to surfaces.

703.4 - Measurement

Safety fencing to be measured by linear foot of fence measured along ground; gates will not be measured separately.

703.5 - Payment

Work performed and materials furnished as prescribed by this item, measured as provided under "Measurement", to be paid for at the unit price bid for "Safety Fencing" which price to be full compensation for furnishing, installing and removing safety fencing and gates, including posts, bands or ties, and for manipulations, labor, tools, equipment and incidentals necessary to complete the work, removal and patching damaged surfaces.

Payment will be made under:

Pay Item 703:	Safety Fencing	Per Linear Foot

Ref. 803, 824

End

ITEM NO. 860S - PAVEMENT MARKING PAINT 9-26-12

860S.1 - Description

This item shall govern the installation of reflectorized paint pavement marking. The width of the line shall be 4 inches (100 millimeters) and the color as indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

860S.2 - Submittals

The submittal requirements of this specification item include:

A. Proposed paint color(s), brand names, raw materials and products for traffic paint.

B. Sampling and testing procedures and specific test results for pigment, calcium carbonate, acrylic resins and other materials used in the traffic paints.

C. Proposed shipping requirements including container type(s) (drums and/or buckets), and labeling.

D. Manufacturer's recommendations for mixing, storage and application of the traffic glass beads and traffic paint.

E. All applicable Materials Safety data Sheets for the traffic paint.

860S.3 - Materials

A. Traffic Stripe Reflective Glass Traffic Beads

1. The glass spheres shall not contain more than 30 percent (by weight {mass}) irregular shaped particles when tested in accordance with TxDoT Test Method-832-B. The no. 20 (850 mm) sieve shall have a maximum of 35% by weight (mass) allowed irregular particles, based on a visual inspection.

   Unless noted otherwise on the Drawings or designated in writing by the Engineer or designated representative, the application rate of the glass traffic beads shall not be less than 6 pounds per gallon (0.7 kilograms per liter). Glass traffic beads shall be essentially free of sharp angular particles and particles showing milkiness or surface scarring or scratching. Glass traffic beads shall be water white in color.

2. The glass traffic beads shall meet the following graduation requirements when tested in accordance with TxDoT Test Method Tex-831-B:

US Sieve	SI Sieve	% weight (mass) retained
# 20	(850 mm)	3 to 10
# 30	(600 mm)	20 to 40
# 40	(425 mm)	30 to 50
# 50	(300 mm)	15 to 35

# 80	(180 mm)	0 to 10

3. Index of Refraction: The glass traffic beads, when tested by the liquid immersion method at 770F (250C), shall show an index of refraction within the range of 1.50 to 1.53.
4. Wetting: The glass traffic beads shall be capable of being readily wet with water, when tested according to TxDOT Test Method Tex-826-B.
5. Stability: The glass traffic beads shall show no tendency toward decomposition, surface etching, change in retroreflective characteristics or change in color after
   (a) One-hour exposure to concentrated hydrochloric acid at 77°F (25°C),
   (b) 24 hours exposure to weak acids, weak alkali, and
   (c) 100 hours of weather-o-meter (Atlas, Sunshine Type) exposure, ASTM G-23, Method 1, Type EH.
6. Contaminants: Glass traffic beads shall:
   (a) contain less than ¼ of 1 percent moisture by weight (mass).
   (b) free of trash, dirt, etc.
   (c) show no evidence of objectionable static electricity when flowing through a regular traffic bead dispenser.
7. Sampling and Testing (TxDoT Test Method Tex-801-B) shall be in accordance with the latest applicable procedures included in the TxDOT Manual on Testing. Applicable test methods include but are not limited to the following:

   Tex 806-B, "Method for Determining Grind and Oversize Pigment Particles"

   Tex-810-B, "Test Method for Color and Color Stability of Opaque Colored Pigments"

   Tex-811-B, "Skinning Characteristics of Coatings"

   Tex-822-B, "Method for Determining Refractive Index of Glass Beads"

   Tex-826-B, "Water Absorption Test of Beads"

   Tex-828-B, "Determining Functional Characteristics of Pavement Markings"

   Tex-830-B, "Method for Sampling Traffic Stripe Beads"

   Tex-831-B, "Method for Determining The Gradation of Glass Traffic-Stripe Beads"

   Tex-832-B, "Methods for Determining the Roundness of Glass Spheres"

B. Pavement Marking Paint

1. Functional Requirements
   (a) All paint-type materials that are applied at ambient or slightly elevated temperatures shall conform to TxDoT Departmental Materials Specifications DMS-8200, YPT 10 and/or WPT-10 and DMS-8290.
   (b) The paint shall be homogenous, well ground to a uniform and smooth consistency and shall not skin nor settle badly nor cake, liver, thicken, curdle or gel in the container.

(c) The paint, when applied to a bituminous pavement surface under normal field conditions at the required rate of .015 inch (0.4 mm) wet film thickness, shall have a maximum "no pickup" drying time of 15 minutes to prevent displacement or discoloration under traffic.

(d) In preparation of the paint, the pigments shall be dispersed in the vehicle by appropriate methods so that a fineness reading of not less than 4 is obtained with a Hegman grind gauge.

(e) Consistency viscosity, measured with a Krebs-Modified-Stormer Viscometer at 77°F (25°C), shall be from 80-90 K.U (with water deleted).

(f) A thin film of paint spread on a glass plate and allowed to dry thoroughly shall not darken or show any discoloration when subjected to ultraviolet rays for a period of 5 minutes.

2. Material Requirements

(a) Raw Materials

(1) The exact brands and types of raw materials used in the wet standards are listed for the purpose of facilitating the selection of parallel materials that are equal, not only in quality and composition but also in physical and chemical behavior after aging in the finished product.

(2) After proposed brand names and types of raw materials by the City of Austin, no substitution will be allowed during the manufacture without prior agreement with the City.

(3) It shall be the responsibility of the Contractor to utilize materials that not only meet the individual raw material specification, but that also produce a coating that meets the specific formula requirements.

(4) All materials required to meet TxDoT, Federal and ASTM specifications must meet the latest specification as indicated on the Drawings in effect on the date of the proposal or invitation to bid.

(b) Pigments

(1) Titanium Dioxide:

Titanium Dioxide shall meet ASTM D-476, Type II requirements.

(2) Yellow Pigment:

Yellow Pigment CI 65 (Reddish Yellow)	
Characteristic	Values
Specific Gravity	1.74 to 1.76
Oil Absorption	20 to 30%
Moisture	0.5% maximum
Pigment retained on #325 (45 mm) sieve	0.1% maximum

C.I. Number	11740
Heat Stability	266°F (130°C)

In addition to the requirements identified above, evidence shall be provided that the infrared spectrum matches the standard spectrum on file with TxDoT's Construction Division, Materials Section (CSTM)

(3) Calcium Carbonate: Calcium Carbonate shall conform to ASTM D-1199, Type GC, Grade I, with a minimum of 95% CaCO3 and Type PC, with a minimum of 98% CaCO3.

(c) Acrylic Traffic Resins: The acrylic traffic resin shall be similar and equal to the standard sample submitted by the manufacturer. The resin shall be approved prior to the contract award for the proposed use of the pavement paint.

Acrylic Traffic Emulsion	
Characteristic	Values
Solids Content	49.5 to 50.5
Viscosity, #2 Spindle, 60 rpm, 77°F (25°C), cps	250 maximum
pH	10.0 to 10.6
Film appearance, 3 mil (75 mm) dry	Smooth, clear, continuous

In addition to the requirements identified above, evidence shall be provided that the infrared spectrum matches the standard spectrum on file with TxDot's Construction Division, Materials Section (CSTM)

(d) Miscellaneous Materials: These materials shall be similar and equal to the standard sample submitted by the vendor. The specific materials shall be approved prior to the contract award for the proposed use of the pavement paint.

1) Dispersant

Byk 156

Tamol 850

Colloids 226/35

2) Surfactant

Triton X-405

Colloids CA-407

3) Defoamer

Foamaster 111

Drew 493

Colloids 654

4) Hydroxy Ethyl Cellulose

Natrosol 250 HBR

Bermocoll E431FQ

Cellosize QP - 30,000

5) Coalescent

Texanol

Exxate 1200

6) Preservative

Troysan

Dowicil 75

Nuosept 101

7) Methyl Alcohol

ASTM D-1152, 1.3320 maximum

(e) Standard Formulae:

The following tables represent the Standard Formulae to be followed by the manufacturer when manufacturing paint to be used by the Contractor on City of Austin paint striping contracts.

Formula: White Traffic Paint

WPT-11 - LEAD FREE WHITE TRAFFIC PAINT		
Component	Pounds	Kilograms
Acrylic Emulsion, 50% Solids, Fastrack 2706	540.	245.

Coalescent, Texanol	20.	9.1
Titanium Dioxide, Rutile, Type II, Tiona RCL-9	100.	45.4
Calcium Carbonate, Type PC, Mississippi M-60	150.	68.
Calcium Carbonate, Type GC, Hubercarb M-4	440.	199.6
Hydroxy Ethyl Cellulose, Natrosol 250 HBR (*)	0.5	0.2
Defoamer, Foamaster 111	5.	2.3
Disapersant, Colloids 226/35	9.	4.1
Surfactant, Triton X-405	2.	0.9
Methyl Alcohol	30.	13.6
Preservative, Troysan 192	2.	0.9
Water, Potable (**)	18.**	8.1**
TOTALS	1316.5	597.2

(*) The Hydroxy Ethyl Cellulose amount may be varied up to two (2) pounds [0.9 kilograms].

(**) Only 10 pounds (4.5 kilograms) shall be used in the actual manufacture of the pavement paint. The remaining 8 pounds (3.6 kilograms) shall be used as a drum float.

Formula: Yellow Traffic Paint

YPT-11 - LEAD FREE YELLOW TRAFFIC PAINT		
Component	Pounds	Kilograms
Acrylic Emulsion, 50% Solids, Fastrack 2706	540	245.

Coalescent, Texanol	20	9.1
C.I. Pigment Yellow 65, Sunglow Yellow 1244	30.	13.6
Titanium Dioxide, Rutile, Type II, Tiona RCL-9(***)	20.	9.1
Calcium Carbonate, Type PC, Mississippi M-60	150	68.
Calcium Carbonate, Type GC, Hubercarb M-4	450	204.1
Hydroxy Ethyl Cellulose, Natrosol 250 HBR (*)	0.5	0.2
Defoamer, Foamaster 111	5.	2.3
Dispersant, Colloids 226/35	9.	4.1
Surfactant, Triton X-405	2.	0.9
Methyl Alcohol	30.	13.6
Preservative, Troysan 192	2.	0.9
Water, Potable (**)	18.**	8.1**
TOTALS	1276.5	579.0

Additional Criteria for Pavement Paint

Item	Requirements
Grind Particles:	4 minimum, 8 maximum (TxDoT Test Method Tex-806-B)
Gallon Weight:	± 0.10 lbs. of theoretical gallon weight
(Liter mass:)	(± 0.012 kilograms of theoretical liter mass)
Consistency:	80 to 90 K.U.

PH:	a minimum of 9.6
Skinning:	No skinning within 48 hours (TxDoT Test Method Tex-811-B)

(*) The Hydroxy Ethyl Cellulose amount may be varied up to two (2) pounds [0.9 kilograms]

(**) Only 10 pounds (4.5 kilograms) shall be used in the actual manufacture of the pavement paint. The remaining 8 pounds (3.6 kilograms) shall be used as a drum float.

(***) Titanium Dioxide, Rutile, Special, Hilox will be allowed as a substitute in the YPT-11 formula only.

(f) Container and Marking

1) Shipment: Shipment shall be made in suitable, strong, well-sealed containers that meet this specification, State of Texas, and federal requirements and are sufficiently sturdy to withstand normal shipping and handling.

2) Drum Package Requirements. The paint shall be provided in a new, serviceable, non-leaking, 55 gallon (209 liter) lined, steel drum meeting all applicable federal regulations. Drums are to be non-returnable with full removable heads, three (3) rolling hoops and 12 gauge locking rings with 5/8 inch (15.9 millimeter) locking nut bolt. The nominal metal thickness is to be 0.044 inch (1.1 mm). Each drum is to be equipped with a natural sponge-rubber cord, high-density gasket. The rubber shall be approximately 0.4375 inch (10.9 mm) thick. The gasket, when compressed, shall produce an airtight closure when the drum is sealed.

When a locking nut is used on drum rings, the locking nut shall be in a non-locking position while tightening the ring. After the ring is tight, the locking nut shall be secured in the locking position.

A seal shall be affixed to each drum in a manner that the contents of the drum cannot be adulterated without destroying the seal.

3) Bucket Packaging Requirements: Paint is to be furnished in new 5 gallon (19 liter) lined, 24 gauge steel, non-leaking buckets.

4) Filling Instructions: The paint drums will be filled at 54.5 gallons (206.4 liters) by weight (mass) with a water float of 0.53 gallons (2.0 liters).

The paint buckets will be filled at 4.95 gallons (18.75 liters) by weight (mass) with a water float of 0.05 gallons (0.18 liters).

5) Labeling: Finished paint product containers and cases shall be plainly and securely labeled with:

a) City of Austin

b) Name and designation of the product,

c) Requisition number,

d) Batch number,

e) Manufacturing date,

f) Gross weight, and

g) Manufacturer's name.

Labeling shall be prominently displayed on the sides of containers and cases and must be moisture resistant to withstand outdoor storage for a minimum of one year. When the finished product is palletized for shipment, the labels shall be displayed on the outside fore easy identification. Once the finished product has been labeled properly, the label shall not be modified or changed in any manner without specific approval from the City of Austin. (Note: The material manufacturer shall supply a Materials Safety Data Sheet to comply with OSHA's "Hazard Communication Standard 29 CFR § 1910.1200").

860S.4 - Construction Methods

The Contractor shall use a crew, that is experienced in the work of installing pavement markings and in the necessary traffic control for such operations on the roadway surface, and shall supply all the equipment, personnel, traffic control and materials necessary for the placement of the pavement markings as indicated on the Drawings or directed by the Engineer or designated representative. All work shall conform to the current edition of the Texas Manual of Uniform Traffic Control Devices (TMUTCD), The City of Austin Transportation Criteria Manual, Standard Details 804S-3C and 804S-3D, and this standard specification item.

The pavement surface to receive the pavement markings shall be thoroughly cleaned of all dirt, organic growth or other material that will prevent adhesion of the paint to the roadway surface.

The pavement markings shall be placed in the proper alignment with guides established on the roadway. Deviation from the alignment established shall not exceed 2 inches (50 millimeters) and in addition, the deviation in alignment of the markings being placed shall not exceed 1 inch per 200 feet (25 millimeters per 30 meters) of roadway nor shall any deviation be abrupt.

When deemed necessary by the Engineer or designated representative, the Contractor, at the Contractor's expense, shall place any additional pilot markings required to facilitate the placement of the permanent markings in the alignment specified. Any and all additional markings placed on the roadway for alignment purposes shall be temporary in nature and shall not establish a permanent marking on the roadway.

Materials used for pilot markings and equipment used to place such markings shall be approved by the Engineer or designated representative.

Paint markings on the roadway that are not in alignment or sequence as indicated shall be totally and completely removed by any effective method approved by the Engineer or designated representative, except that grinding will not be permitted.

Paint shall be applied at a rate of not less than 15 gallons nor more than 20 gallons per mile of solid 4 inch stripe (not less than 35 liters nor more than 45 liters per kilometer of solid 100-mm stripe). Application rate for solid 8-inch (200-mm) stripe shall be between 30 and 40 gallons per mile (between 70 and 90 liters per kilometer). (These rates yield wet film thickness from 15 to 20 mils [0.4 to 0.5 mm].)

Beads shall be applied to the paint markings at a uniform rate sufficient to achieve the retroreflective characteristics specified when observed conforming to TxDoT Test Method Tex-828-B. All markings placed shall have uniform and distinctive retroreflective characteristics.

Applied markings shall be protected from traffic until they have dried sufficiently so as not to be damaged or tracked by normal traffic movements.

860S.5 - Equipment

Paint striping equipment used to place 4 inch (100 mm) solid or broken lines shall have the capability of placing a minimum of 60,000 linear feet (18 300 lineal meters) of marking per working day. Equipment used for placing markings in widths other than 4 inches (100 mm) shall have capabilities similar to 4 inch (100 mm) marking equipment and shall be capable of placing linear markings up to 8 inches (200 mm) in width in 1 pass.

The equipment shall be maintained in satisfactory operating condition. The equipment shall be equipped so that one 4-inch (100-mm) broken line and either 1 or 2 solid lines can be placed at the same time in alignment and spacing as indicated on the drawings. Four inch (100 mm) marking equipment will be considered as unsatisfactorily maintained if it fails to attain an average hourly placement rate of 7000 linear feet (2 100 linear meters) in any 5 consecutive working days of 7 hours or more.

The equipment shall be equipped with an automatic cutoff device (with manual operating capabilities) to provide clean, square marking ends and to provide a method of applying broken line in a stripe to gap ratio of 15 to 25. The length of the stripe shall not be less than 15 feet nor longer than 15.5 feet (less than 4.5 meters nor longer than 4.7 meters). The total length of the stripe-gap cycle shall not be less than 39.5 feet nor longer than 40.5 feet (less than 12 meters nor longer than 12.3 meters) in variance from one cycle to the next nor shall the average total length of a cycle for a road mile (1.6 kilometer) of broken line exceed 40.5 feet or be less than 39.5 feet (exceed 12.3 meters or be less than 12 meters).

The equipment shall be capable of placing lines of all widths with clean edges and of uniform cross section. Four-inch (100-mm) lines shall be 4 inches (100 mm) plus or minus 1/8 inch (3 mm). Eight inch (200 mm) lines shall be 8 inches (200 mm) minimum and 8 ¼ inches (210 mm) maximum in width.

The equipment shall be equipped with an outrigger or outriggers as required to place edge-lines as called for in the plans.

The equipment shall be equipped with traffic glass bead dispensers, 1 for each paint spray gun, placed on the equipment so that beads are applied to the paint almost instantly as the marking is being placed on the roadway surface. The traffic glass bead dispensers shall be designed and aligned so that the beads are applied uniformly to the entire surface of the marking. The traffic glass bead dispensers shall be equipped with automatic cutoff controls, synchronized with the cutoff of the marking equipment. Paint pots or tanks shall be equipped with an agitator that will keep the paint thoroughly mixed and may be either a pressurized or non-pressurized type.

860S.6 - Measurement

Work for Pavement Marking Paint lines will be measured by the lineal foot (lineal meter: 1 meter equals 3.28 feet) of the various widths. Work for pavement marking, paint letter or figures will be measured by the square foot (square meter: 1 square meter equals 10.76 square feet).

860S.7 - Payment

Work performed as prescribed by this item, measured as provided under "Measurement", shall be paid for at the unit bid price for "Pavement Marking Paint" per lineal foot or square foot of the various widths specified. This price shall include full compensation for furnishing all labor, tools, equipment, materials and incidentals necessary to complete the work specified.

Payment will be made under one of the following:

Pay Item No. 860S-A:	Pavement Marking Paint, ___ In.	Per Lineal Foot.

Pay Item No. 860S-B:	Pavement Marking Paint	Per Square Foot.
Pay Item No. 860S-C:	Pavement Marking Paint (Reflectorized), ___ In.	Per Lineal Foot.
Pay Item No. 860S-D:	Pavement Marking Paint (Reflectorized)	Per Square Foot.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 860S "Pavement Marking Paint (Reflectorized)"	
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex 801-B	Testing Coatings and Related Materials
Tex 806-B	Method for Determining Grind and Oversize Pigment Particles
Tex-810-B	Test Method for Color and Color Stability of Opaque Colored Pigments
Tex-811-B	Skinning Characteristics of Coatings
Tex-822-B	Method for Determining Refractive Index of Glass Beads
Tex-826-B	Water Absorption Test of Beads
Tex-828-B	Determining Functional Characteristics of Pavement Markings
Tex-830-B	Method for Sampling Traffic Stripe Beads
Tex-831-B	Method for Determining The Gradation of Glass Traffic-Stripe Beads
Tex-832-B	Methods for Determining the Roundness of Glass Spheres

Texas Department of Transportation: Departmental Materials Specifications	
Designation	Description
DMS-8200	Pavement Paint
YPT-11 and/or WPT-11	Pavement Paint
American Society for Testing and Materials (ASTM)	
Designation	Description
D 476	Specification for Titanium Dioxide Pigments
D 1152	Specification for Methanol (Methyl Alcohol) with Refractive Index
D 1199	Specification for Calcium Carbonate Pigments
G-23	Recommended Practice for Operating Light-and- Water-Exposure
	Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials
Federal Specifications - OSHA 29 CFR	
Designation	Description
ξ 1910.1200	Hazard Communication Standard."
City of Austin Standard Details	

Designation	Description
804S-3C	Parking Stalls, Crosswalk, and Stop Bars
804S-3D	General Notes

City of Austin Transportation Criteria Manual

Designation	Description
Section 8	Traffic Control

State of Texas Manual on Uniform Traffic Control Devices for Streets and Highways

Designation	Description
Part III	Markings
Part VI	Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations
Part VI, Article D	Markings
Part VI, Article F	Control of Traffic Through Work Areas

RELATED CROSS REFERENCE MATERIALS	
Specification Item 860S "Pavement Marking Paint (Reflectorized)"	

City of Austin Standard Specifications

Designation	Description
Item No. 863S	Reflectorized Pavement Markers
Item No. 864S	Abbreviated Pavement Markings
Item No. 865S	Non-Reflectorized Traffic Buttons
Item No. 866S	Jiggle Bar Tile
Item No. 867S	Epoxy Adhesive
Item No. 870S	Work Zone Pavement Markings
Item No. 871S	Reflectorized Pavement Markings
Item No. 872S	Prefabricated Pavement Markings
Item No. 873S	Raised Pavement Markers
Item No. 874S	Eliminating Existing Pavement Markings and Markers
Item No. 875S	Pavement Surface Preparation For Markings

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 662	Work Zone Pavement Markings
Item No. 666	Reflectorized Pavement Markings
Item No. 667	Prefabricated Pavement Markings
Item No. 672	Raised Pavement Markers

Item No. 677	Eliminating Existing Pavement Markings and Markers
Item No. 678	Pavement Surface Preparation For Markings
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-829-B	Method For Measuring Pavement Temperature
American Society for Testing and Materials (ASTM)	
Designation	Description
D-235	Specification for Mineral Spirits
D-362	Specification for Industrial Grade Toluene
D-600	Specification for Liquid Paint Driers
D-605	Specification for Magnesium Silicate Pigment (Talc)
D-740	Specification for Methyl Ethyl Ketone
D-1210	Test Method For Fineness Of Dispersion Of Pigment-Vehicle Systems

End

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ITEM NO. 874S - ELIMINATING EXISTING PAVEMENT MARKINGS AND MARKERS 4-3-09

874S.1 - Description

This item shall govern the elimination of existing pavement markings of various types and sizes, and pavement markers as shown on the Drawings or as directed, in writing, by the Engineer or designated representative.

874S.2 - Materials

All surface treatment material application rates shall be as directed by the Engineer or designated representative. Unless otherwise shown on the Drawings, surface treatment materials shall conform to the requirements of Specification Item No. 301S, "Asphalts, Oils and Emulsions," and Specification Item No. 302S, "Aggregates for Surface Treatment." Testing of surface treatment materials may be waived by the Engineer or designated representative. Asphalt and aggregate types and grades shall be as shown on the Drawings or as approved by the Engineer or designated representative.

874S.3 - Construction Methods

Elimination of existing pavement markings and markers shall be accomplished by one or more of the following methods as approved by the Engineer or designated representative.

A. Markings on Asphaltic Surfaces.

1. Placement of a surface treatment a minimum of 2 feet (600 mm) wide to cover the existing marking.
2. Placement of a surface treatment, thin overlay or microsurfacing a minimum of 1 lane in width in areas where directional changes of traffic are involved or other areas as directed by the Engineer or designated representative. Construction methods for surface treatments shall conform to Specification Item No. 320S, "Two Course Surface Treatment."

B. Markings on Concrete Surfaces.

Removal by an approved burning method.

C. Markings on Asphaltic or Concrete Surfaces.

Removal by water, water-sand blasting techniques or any other method(s) proven satisfactory to the Engineer.

D. Markers on Asphaltic or Concrete Surfaces.

Removal by any mechanical method to remove marker and adhesive.

Existing pavement markings and markers on both concrete and asphaltic surfaces shall be removed in such a manner that color and/or texture contrast of the pavement surface will be held to a minimum.

Removal of pavement markings on concrete surfaces by blast cleaning shall be accomplished in accordance with Specification Item No. 875S, "Pavement Surface Preparation for Markings," except for measurement and payment. Blast cleaning shall be performed in such a manner that damage to the Portland cement concrete surface is held to a minimum.

When thermoplastic pavement markings or prefabricated pavement markings are encountered, the application of heat may be used to remove the bulk of the marking material prior to blast cleaning. When heat is used, care shall be taken to prevent spalling of Portland cement concrete surfaces.

A burner may be used for complete removal of pavement markings. Broom removal or light blast cleaning may be used for removal of minor residue.

Damage to asphaltic surfaces, such as spalling, shelling, etc., that is greater than ¼ inch (6 mm) in depth and is caused by the removal of pavement markers shall be repaired by the application of a 2 foot (600 mm) wide surface treatment for longitudinal markers with no directional change or a minimum of 1 lane width surface treatment in areas where directional changes of traffic are involved.

Grinding is not an acceptable method of marker or marking removal. However, equipment utilizing special milling flails is considered acceptable in the removal of markings and markers on asphalt and Portland cement concrete surfaces.

874S.4 - Measurement

This Specification Item will be measured by the square yard (square meter: 1 square meter is equal to 1.196 square yards) of surface treatment, thin overlay or microsurfacing (full lane width) placed; by each word, symbol or shape eliminated; by the lineal foot (lineal meter: 1 lineal meter is equal to 3.281 lineal feet) of markings eliminated; or by any other unit as shown on the Drawings.

Payment for revised quantities will be paid for at the unit price bid for that bid item.

The elimination of pavement markers required in conjunction with the elimination of longitudinal markings will not be measured for payment.

874S.5 - Payment

The work performed and materials furnished in accordance with this Specification Item and measured as provided under "Measurement" will be paid for at the unit bid price for "Eliminating Existing Pavement Markings and Markers" of the various types specified. This price shall include full compensation for blast cleaning, mechanical cleaning and/or other cleaning methods; for all materials, tools, equipment and incidentals necessary to complete the Work, except as specified below.

Elimination of pavement markers when pavement markers are to be removed in conjunction with the elimination of longitudinal markings shall be included in the unit price bid for the item of construction indicated on the drawings.

Payment will be made under one or more of the following:

Pay Item 874S-A:	Eliminating Existing Pavement Markings: ___ inches in width,	Per Lineal Foot.
Pay Item 874S-B:	Eliminating Existing Work Zone Pavement Markings: ___ inches in width,	Per Lineal Foot.
Pay Item 874S-C:	Eliminating Existing Reflectorized Thermoplastic Pavement Markings: ___ inches in width	Words Per Each.
Pay Item	Eliminating Existing Reflectorized Thermoplastic Pavement Markings:	Shapes

874S-D:	___ inches in width	Per Each.
Pay Item 874S-E:	Eliminating Existing Reflectorized Thermoplastic Pavement Markings: ___inches in width	Symbols. Per Each.
Pay Item 874S-F:	Eliminating Existing Raised Pavement Markings, _____ Type,	Per Each.

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 874S, "Eliminating Existing Pavement Markings And Markers"	
City of Austin Contract Documents	
Designation	Description
Section 00300U	Bid Form (Unit Prices)
City of Austin Standard Specifications	
Designation	Description
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 302S	Aggregates for Surface Treatments
Item No. 320S	Two Course Surface Treatment
Item No. 875S	Pavement Surface Preparation For Markings

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 874S, "Eliminating Existing Pavement Markings And Markers"	
City of Austin Standard Specifications	
Designation	Description
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 312S	Seal Coat
Item No. 313S	Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)
Item No. 315S	Milling Asphaltic Concrete Paving
Item No. 340	Hot Mix Asphaltic Concrete Pavement
Item No. 341S	Paving Fabric
Item No. 350S	Heating, Scarifying and Repaving
Item No. 360	Concrete Pavement
Item No. 413S	Cleaning and/or Sealing Joints and Cracks (Portland Cement Concrete)
Item No. 801S	Construction Detours
Item No. 803S	Barricades, Signs and Traffic Handling
Item No. 860S	Pavement Marking Paint (Reflectorized)
Item No. 863S	Reflectorized Pavement Markers
Item No. 864S	Abbreviated Pavement Markings

Item No. 865S	Non-Reflectorized Traffic Buttons
Item No. 866S	Jiggle Bar Tile
Item No. 867S	Epoxy Adhesive
Item No. 870S	Work Zone Pavement Markings
Item No. 871S	Reflectorized Pavement Markers
Item No. 872S	Prefabricated Pavement Markings
Item No. 873S	Raised Pavement Markings

City of Austin Standard Details

Designation	Description
863S-1	Pavement Buttons (Reflectorized-Type I & Type II)
865S-1	Traffic Buttons (Non-Reflectorized)

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

Designation	Description
Item No. 302	Aggregates for Surface Treatments
Item No. 314	Emulsified Asphalt Treatment
Item No. 315	Emulsified Asphalt Seal
Item No. 316	Surface Treatments

Item No. 334	Hot Mix-Cold Laid Asphaltic Concrete Pavement
Item No. 340	Hot Mix Asphaltic Concrete Pavement
Item No. 342	Plant Mix Seal
Item No. 351	Repairing Existing Flexible Pavement Structure
Item No. 354	Planing and/or Texturing Pavement
Item No. 358	Asphaltic Concrete Surface Rehabilitation
Item No. 360	Concrete Pavement
Item No. 421	Hydraulic Cement Concrete
Item No. 427	Surface Finishes for Concrete
Item No. 428	Concrete Surface Treatment
Item No. 662	Work Zone Pavement Markings
Item No. 666	Reflectorized Pavement Markings
Item No. 667	Prefabricated Pavement Markings
Item No. 672	Raised Pavement Markers
Item No. 677	Eliminating Existing Pavement Markings and Markers
Item No. 678	Pavement Surface Preparation For Markings
Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex 729-I	Sampling of Traffic Markers

Tex-828-B	Determining Functional Characteristics of Pavement Markings
Tex-829-B	Method For Measuring Pavement Temperature
Tex-854-B	Evaluation Of Thermoplastic Striping For Uniformity And Thickness

Texas Department of Transportation: Departmental Materials Specification

Designation	Description
DMS-4100	Jiggle Bar Tile
DMS-4200	Pavement Markers (Reflectorized)
DMS-4300	Traffic Buttons
DMS-4210	Pavement Markers
DMS-6130	Bituminous Adhesive
DMS-8200	Pavement Paint
DMS-8220	Thermoplastic marking material
DMS-8240	Prefabricated Marking Materials
DMS-8241	Removable Tape
DMS-8290	Pavement Paint
YPT-10 and/or WPT	Pavement Paint

End

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ITEM NO. 875S - PAVEMENT SURFACE PREPARATION FOR MARKINGS 11-21-05

875S.1 - Description

This item shall govern the surface preparation of pavement surface areas prior to placement of pavement markings or raised pavement markers.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

875S.2 - Materials

Abrasive blasting medium, when used, shall be a quality commercial product capable of producing the specified surface cleanliness without the deposition of deleterious materials on the cleaned surface. Water used in blasting operations shall be potable.

875S.3 - Equipment

Equipment shall be maintained in good condition. Air compression equipment shall utilize moisture and oil traps, in working order, of sufficient capacity to remove contaminants from blasting air and prevent the deposition of moisture, oil or other contaminants on the street surface.

875S.4 - Construction Methods

Widths, lengths and shapes of the prepared surfaces shall be of sufficient size to include the full area of pavement markings or raised pavement markers shown on the Drawings.

Surface preparation of Portland cement concrete surfaces shall be sufficient to remove contaminants. Damage to the street due to over-blasting shall be held to a minimum. Asphaltic surfaces shall be cleaned by brushing, washing, compressed air, high pressure water or any combination thereof to remove all forms of contamination and loose materials. All other surfaces to be cleaned by blast cleaning shall be cleaned sufficiently to remove loose and flaking materials from the street surface.

When existing markings are encountered, they shall be cleaned sufficiently to remove all loose and flaking materials. Small spots of old markings or contaminants of up to 0.5 square inch (320 mm2) in area may remain if the contaminant is not removed by the following test:

Firmly press a 10 inch (250 mm) long, two-inch (50 mm) wide strip of monofilament tape onto the surface to be tested, leaving approximately 2 inches {50 mm} free. Grasp the free end and remove the tape with a sharp pull.

Blasting pressure and technique shall be controlled to prevent damage to the pavement surface. Portland cement concrete surfaces shall not be cleaned by grinding.

875S.5 - Measurement

This Specification Item will be measured by the lineal foot (lineal meter: 1 lineal meter is equal to 3.281 lineal feet) of the various widths, by each of the various words, symbols or shapes, or by any other unit as shown on the Drawings.

Payment for revised quantities will be paid for at the unit price bid for that bid item.

875S.6 - Payment

The work performed and materials furnished in accordance with this Specification Item and measured as provided under "Measurement" will be paid for at the unit bid price for "Pavement Surface Preparation for

Markings" of the various types specified. This price shall include full compensation for all materials, tools, equipment, labor and incidentals necessary to complete the Work.

Payment shall be made by one or more of the following:

Pay Item 875S-A:	Pavement Surface Preparation for existing pavement surface ___ inches in width, for _____ Surface Type	per lineal foot
Pay Item 875S-B:	Pavement Surface Preparation for existing ___ inches in width, for _____ Surface Type	Words per each
Pay Item 875S-C:	Pavement Surface Preparation for existing ___ inches in width, for _____ Surface Type	Shapes per each
Pay Item 875S-D:	Pavement Surface Preparation for existing ___ inches in width, for _____ Surface Type	Symbols per each

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 874S, "Eliminating Existing Pavement Markings And Markers"	
City of Austin Contract Documents	
Designation	Description
Section 00300U	Bid Form (Unit Prices)

RELATED CROSS REFERENCE MATERIALS	
Specification Item No. 875S, "Pavement Surface Preparation For Markings"	

City of Austin Technical Specifications	
Designation	Description
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 302S	Aggregates for Surface Treatments
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 312S	Seal Coat
Item No. 313S	Rubber Asphalt Joint and Crack Sealant
Item No. 315S	Milling Asphaltic Concrete Paving
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 341S	Paving Fabric
Item No. 350S	Heating, Scarifying and Repaving
Item No. 360	Concrete Pavement
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Item No. 866S	Jiggle Bar Tile
Item No. 867S	Epoxy Adhesive
Item No. 870S	Work Zone Pavement Markings
Item No. 871S	Reflectorized Pavement Markers
Item No. 872S	Prefabricated Pavement Markings
Item No. 873S	Raised Pavement Markings
Item No. 874S	Eliminating Existing Pavement Markings and Markers

City of Austin Standard Details

Designation	Description
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Item No. 342	Plant Mix Seal
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Texas Department of Transportation:Manual of Testing Procedures	
Designation	Description
Tex 729-I	Sampling of Traffic Markers

Tex-828-B	Determining Functional Characteristics of Pavement Markings
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DMS-8241	Removable Tape
DMS-8290	Pavement Paint
YPT-10 and/or WPT	Pavement Paint

End

DEMOLITION
Section 024100

PART 1 GENERAL

1.1 SUMMARY

A. Provide demolition activities.

1.2 SUBMITTALS

A. Schedule: Submit for approval selective demolition schedule, including schedule and methods for capping utilities to be abandoned and maintaining existing utility service.

1.3 QUALITY ASSURANCE

A. Codes and Regulations: Comply with governing codes and regulations. Use experienced workers.

1.4 PROJECT CONDITIONS

A. Occupancy: Immediate areas of work will not be occupied during selective demolition. The public, including children, may occupy adjacent areas.

B. Existing Conditions: No responsibility for buildings and structures to be demolished will be assumed by the Owner

PART 2 PRODUCTS

2.1 DEMOLITION APPLICATIONS

A. Structure Demolition:
   1. Application: Demolition of designated building structures.
   2. Application: Demolition of designated site improvements including paving, curbing, site walls, and utility structures.
   3. Application: Demolition of below-grade foundations and site improvements to depth to avoid conflict with new construction or site work.
   4. Application: Removal of hollow items or items which could collapse.
   5. Application: Salvage of designated items.
   6. Application: Protection of site work and adjacent structures.
   7. Application: Disconnection, capping, and removal of utilities.
   8. Application: Pollution control during building demolition, including noise control.
   9. Application: Removal and legal disposal of materials.
   10. Protection: Designated site improvements and adjacent construction.
   11. Hazardous Materials: Not present.

PART 3 EXECUTION

3.1 SELECTIVE DEMOLITION

A. Demolition Operations: Do not damage building elements and improvements

indicated to remain. Items of salvage value, not included on schedule of salvage items to be returned to Owner, shall be removed from structure. Storage or sale of items at project site is prohibited.

B. Utilities: Locate, identify, disconnect, and seal or cap off utilities in buildings to be demolished.

C. Shoring and Bracing: Provide and maintain interior and exterior shoring and bracing.

D. Occupied Spaces: Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.

E. Operations: Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

F. Security: Provide adequate protection against accidental trespassing. Secure project after work hours.

G. Restoration: Restore finishes of patched areas.

END

SELECTIVE DEMOLITION
Section 024119

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

C. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.

1.5 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

A. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.8 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of measured drawings preconstruction photographs or video and templates.

1. Inventory and record the condition of items to be removed and salvaged.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
1. Arrange to shut off utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 8 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END

CONCRETE FORMING AND ACCESSORIES
Section 031000

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Form-facing material for cast-in-place concrete.
2. Shoring, bracing, and anchoring.

B. Related Requirements:

1. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
2. Section 033000 "Cast in Place Concrete"

1.3 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Exposed surface form-facing material.
2. Concealed surface form-facing material.
3. Form-release agent.

B. Shop Drawings: Prepared by, and signed and sealed by, a qualified professional engineer responsible for their preparation, detailing fabrication, assembly, and support of forms.

1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
2. Indicate dimension and locations of construction and movement joints required to construct the structure in accordance with ACI 301.

    a. Location of construction joints is subject to approval of the Architect.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301 (ACI 301M), to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.

1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:

1. Provide continuous, true, and smooth concrete surfaces.
2. Furnish in largest practicable sizes to minimize number of joints.
3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete, and as follows:

    a. Plywood, metal, or other approved panel materials.
    b. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

        1) APA HDO (high-density overlay).
        2) APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
        3) APA Structural 1 Plyform, B-B or better; mill oiled and edge sealed.
        4) APA Plyform Class I, B-B or better; mill oiled and edge sealed.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.

1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

B. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

C. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
2. Form release agent for form liners shall be acceptable to form liner manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301 (ACI 301M).

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 (ACI 117M) and to comply with the Surface Finish designations specified in Section 033000 "Cast-In-Place Concrete" for as-cast finishes.

C. Limit concrete surface irregularities as follows:

1. Surface Finish-1.0: ACI 117 Class D, 1 inch (25 mm).

D. Construct forms tight enough to prevent loss of concrete mortar.

1. Minimize joints.
2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.

1. Provide and secure units to support screed strips

2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete unless specified otherwise.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.

1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:

1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.

    a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.

5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.

1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

A. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work.

1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.

1. Align and secure joints to avoid offsets.
2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Inspect formwork for shape, location, and dimensions of the concrete member being formed.

END OF SECTION 031000

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Steel reinforcement bars.
2. Welded-wire reinforcement.

B. Related Requirements:
1. Section 031000 "Concrete Forming and Accessories" for form-facing materials and form liners.
2. Section 033000 "Cast in Place Concrete"

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Each type of steel reinforcement.
2. Bar supports.
3. Mechanical splice couplers.

B. Shop Drawings: Comply with ACI SP-066:

1. Include placing drawings that detail fabrication, bending, and placement.
2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.4 INFORMATIONAL SUBMITTALS

A. Material Test Reports: For the following, from a qualified testing agency:

1. Steel Reinforcement:

a. For reinforcement to be welded, mill test analysis for chemical composition and carbon equivalent of the steel in accordance with ASTM A706/A706M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: As indicated.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place.

1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

C. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch (1.2908 mm) in diameter.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:

1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.

1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch (25 mm), not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318 (ACI 318M).

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars shall be lapped not less than 36 bar diameters at splices, or 24 inches (610 mm), whichever is greater.
2. Stagger splices in accordance with ACI 318 (ACI 318M).

G. Install welded-wire reinforcement in longest practicable lengths.

1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."

    a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches (305 mm).

2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches (50 mm) for plain wire and 8 inches (200 mm) for deformed wire.

3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117 (ACI 117M).

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.

B. Inspections:

1. Steel-reinforcement placement.

END OF SECTION 032000

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:

1. Section 031000 "Concrete Forming and Accessories" for form-facing materials.
2. Section 032000 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. City of Austin Standard Technical Specifications, Series 400
    a. Where a conflict exists regarding execution (construction), materials, or testing between this Section and the City of Austin Items, inform the Architect and Owner for a determination of the more stringent requirement to take precedence.
4. COA Specification Item No. 401S – Structural Excavation and Backfill
5. COA Specification Item No. 403S – Concrete for Structures
6. COA Specification Item No. 405S – Concrete Admixtures
7. COA Specification Item No. 406S – Reinforcing Steel
8. COA Specification Item No. 409S – Membrane Curing
9. COA Specification Item No. 410S – Concrete Structures
10. COA Specification Item No. 411S – Surface Finishes for Concrete

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

a. quality control.

1.4 ACTION SUBMITTALS

A. Product Data: For each of the following.

1. Portland cement.
2. Fly ash.
3. Aggregates.
4. Admixtures:

a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.

5. Vapor retarders.
6. Curing materials.
7. Joint fillers.
8. Repair materials.

B. Design Mixtures: For each concrete mixture, include the following:

1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
10. Intended placement method.
11. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

C. Shop Drawings:

1. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

a. Location of construction joints is subject to approval of the Architect.

D. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:

1. Concrete Class designation.
2. Location within Project.

3. Exposure Class designation.
4. Formed Surface Finish designation and final finish.
5. Final finish for floors.
6. Curing process.
7. Floor treatment if any.

E. Placement Schedule: Submit before start of placement operations.

INFORMATIONAL SUBMITTALS

F. Qualification Data: For the following:

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.

G. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Floor and slab treatments.
5. Bonding agents.
6. Adhesives.
7. Vapor retarders.
8. Semirigid joint filler.
9. Joint-filler strips.
10. Repair materials.

H. Material Test Reports: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Silica fume.
6. Performance-based hydraulic cement.
7. Aggregates.
8. Admixtures:

    a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

I. Research Reports:

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.

J. Preconstruction Test Reports: For each mix design.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Advanced Concrete Flatwork Finisher and a supervisor who is an ACI-certified Concrete Flatwork Finisher.

1. When requested, the installer shall furnish a Quality Control Plan.

2. Post-Installed Concrete Anchors Installers: ACI-certified Adhesive Anchor Installer.

B. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301 (ACI 301M).

1.7 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 306.1 and as follows.

1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301 (ACI 301M).
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F (1.7 deg C), other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M), and as follows:

1. Maintain concrete temperature at time of discharge to not exceed 95 deg F (35 deg C).

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 (ACI 301M)unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Source Limitations:

1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
3. Obtain aggregate from single source.
4. Obtain each type of admixture from single source from single manufacturer.

B. Cementitious Materials:

1. Portland Cement: As indicated.
2. Fly Ash: As indicated.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 1N coarse aggregate or better, graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: as indicated
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those

permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Accelerating Admixtures, ASTM C494/C494M Type C, Type E
4. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
5. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
6. High-Range, Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type G.
7. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable or complying with ASTM C1602/C1602M, including all limits listed in Table 2 and the requirements of paragraph 5.4

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, ASTM E1745, Class A, except with maximum water-vapor permeance of 0.01:
   1. Manufacturer's product data sheet shall include the following test data:
      a. Water Vapor Permeance, As Received, as tested by ASTM E-154 Section 7
      b. Water Vapor Permeance After Wetting and Drying and After Long Term Soaking as tested by ASTM E-154 Section 8
      c. Water Vapor Permeance Resistance to Plastic Flow and Elevated Temperature as tested by ASTM E-154 Section 11
      d. Water Vapor Permeance Effect Low Temperature and Flexibility as tested by ASTM E-154, Section 12
      e. Water Vapor Permanence Resistance to Deterioration from Organisms and Substances in Contacting Soil as tested by ASTM E-154, Section 13
      f. Puncture Resistance (ASTM D1709): > 2,200 grams
      g. Tensile Strength (ASTM E154, Section 9): >45 lb/in
   2. Not less than 10 mils
   3. Include manufacturer's recommended adhesive or pressure-sensitive tape, to fully seal all penetrations and sheet edges, installed per manufacturer's instructions.

B. Products:
   1. Stego Wrap 10 mil, by Stego.
   2. W. R. MEADOWS, INC. PERMINATOR 10 mil.

2.4 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film burlap-polyethylene sheet.

1. Color:

a. Ambient Temperature Below 50 deg F (10 deg C): Black.
b. Ambient Temperature between 50 deg F (10 deg C) and 85 deg F (29 deg C): Any color.
c. Ambient Temperature Above 85 deg F (29 deg C): White.

D. Water: Potable or complying with ASTM C1602/C1602M.

E. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.

2.5 RELATED MATERIALS

A. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.6 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm) or coarse sand, as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested in accordance with ASTM C109/C109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C150/C150M portland cement or hydraulic or blended hydraulic cement, as defined in ASTM C219.

2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested in accordance with ASTM C109/C109M.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301 (ACI 301M).

1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Other Pozzolans: 25 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.

1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, and concrete with a w/cm below 0.50.

2.8 CONCRETE MIXTURES

1. As indicated.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete in accordance with ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:

1. Daily access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.

1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.

1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
2. Face laps away from exposed direction of concrete pour.
3. Lap vapor retarder over footings and grade beams not less than 6 inches (150 mm), sealing vapor retarder to concrete.
4. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.
5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
7. Protect vapor retarder during placement of reinforcement and concrete.

    a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches (150 mm) on all sides, and sealing to vapor retarder.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.

1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
2. Place joints perpendicular to main reinforcement.

    a. Continue reinforcement across construction joints unless otherwise indicated.
    b. Do not continue reinforcement through sides of strip placements of floors and slabs.

3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches (38 mm) into concrete.
4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Doweled Joints:

1. Install dowel bars and support assemblies at joints where indicated on Drawings.

2. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.

1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M), but not to exceed the amount indicated on the concrete delivery ticket.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.

1. If a section cannot be placed continuously, provide construction joints as indicated.
2. Deposit concrete to avoid segregation.
3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301 (ACI 301M).

    a. Do not use vibrators to transport concrete inside forms.
    b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer.
    c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.

1. Do not place concrete floors and slabs in a checkerboard sequence.
2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
3. Maintain reinforcement in position on chairs during concrete placement.
4. Screed slab surfaces with a straightedge and strike off to correct elevations.
5. Level concrete, cut high areas, and fill low areas.
6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 (ACI 301M) Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.

    a. Patch voids larger than 1-1/2 inches (38 mm) wide or 1/2 inch (13 mm) deep.
    b. Remove projections larger than 1 inch (25 mm).
    c. Tie holes do not require patching.
    d. Surface Tolerance: ACI 117 (ACI 117M) Class D.
    e. Apply to concrete surfaces not exposed to public view

2. ACI 301 (ACI 301M) Surface Finish SF-2.0: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.

    a. Patch voids larger than 3/4 inch (19 mm) wide or 1/2 inch (13 mm) deep.
    b. Remove projections larger than 1/4 inch (6 mm).
    c. Patch tie holes.
    d. Surface Tolerance: ACI 117 (ACI 117M) Class B.
    e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:

1. Smooth-Rubbed Finish:

a. Perform no later than one day after form removal.
b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.

2. Grout-Cleaned Rubbed Finish:

a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
b. Do not clean concrete surfaces as Work progresses.
c. Mix 1-part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
d. Wet concrete surfaces.
e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.

3. Cork-Floated Finish:

a. Mix 1 part portland cement to 1 part fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint.
b. Mix 1 part portland cement and 1 part fine sand with sufficient water to produce a mixture of stiff grout. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
c. Wet concrete surfaces.
d. Compress grout into voids by grinding surface.
e. In a swirling motion, finish surface with a cork float.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:

1. While still plastic, texture concrete surface that has been screeded and bull-floated or darbied.
2. Use stiff brushes, brooms, or rakes to produce a profile depth of 1/4 inch (6 mm) in one direction.
3. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.

C. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155 (ASTM E1155M), for a randomly trafficked floor surface:

    a. Slabs on Ground:

        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch (6 mm)
        2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.

D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

1. Comply with ACI 301 (ACI 301M) and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 (ACI 301M) and ACI 305.1 (ACI 305.1M) for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h (1 kg/sq. m x h), calculated in accordance with ACI 305.1,) before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:

    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 (ACI 308.1M) as follows:

1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:

    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:

        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

            a) Lap edges and ends of absorptive cover not less than 12-inches (300-mm).

b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive.

a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

b. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.

a) Lap edges and ends of absorptive cover not less than 12 inches (300 mm).
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

a) Water.
b) Continuous water-fog spray.

c. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

d. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches (150 mm) and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Curing and Sealing Compound:

1) Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Repeat process 24 hours later, and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

3.10 TOLERANCES

A. Conform to ACI 117 (ACI 117M).

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.

1. Defer joint filling until concrete has aged at least [**one**] [**six**] month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.12 CONCRETE SURFACE REPAIRS

A. Concrete surface repairs are repairs that do not extend into the reinforcing cage. Extent of repairs are typically determined by destructive exploration.

B. Surface Defects in Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Owner's approval.

C. Contractor shall submit a detailed, descriptive procedure listing proposed pre-packaged repair materials and methods for the repair of surface defects prior to the start of repair work. The procedure shall be in accordance with the ACI/ICRI Concrete Repair Manual and industry standards.

D. Patching Mortar: Mix, place and finish pre-packaged repair mortar in accordance with manufacturer's instructions.

E. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete.

2. Repair defects on surfaces exposed in coordination with the Architect.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.

F. Repairing Unformed Surfaces:

1. Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface.

    a. Correct low and high areas.
    b. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

2. Repair finished surfaces containing defects. Surface defects include minor spalls, pop outs, honeycombs and rock pockets with no exposed reinforcement, crazing and cracks in excess of 0.01 inch wide that do not penetrate to reinforcement, and other objectionable conditions.

    a. Finish repaired areas to blend into adjacent concrete.

3. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar.

    a. Groove top of cracks and cut out holes to sound concrete, and clean off dust, dirt, and loose particles.
    b. Dampen cleaned concrete surfaces and apply bonding agent.
    c. Place patching mortar before bonding agent has dried.
    d. Compact patching mortar and finish to match adjacent concrete.
    e. Keep patched area continuously moist for at least 72 hours.

3.13 STRUCTURAL REPAIRS

A. Concrete structural repairs are repairs that extend into the reinforcing cage

B. Structurally Defective Concrete: Structural defects include spalls, honeycombs or rock pockets with exposed reinforcement, hollow-sounding concrete, cracks that penetrate to the reinforcement or completely through concrete elements, inadequate cover over reinforcement, and other conditions. Sometimes it is unknown whether there is a structural defect without destructive exploration.

C. Repairs shall be performed in accordance with the Concrete Repair Manual. Contractor to engage a qualified concrete repair consultant who is a licensed engineer. Contractor shall submit repair documents, including drawings and specifications sealed by a professional engineer licensed in the State of Texas, for SEOR review and acceptance.

D. A completion letter from the repair consultant is needed to close out the repairs. The completion letter will confirm the repairs were performed in accordance with the reviewed and accepted submittal, confirm test results were reviewed and they comply with the original project specifications, and state that the originally intended capacity of the structural element has been restored.

E. Repairs that do not meet project specifications shall be removed and replaced at no additional cost to the Owner.

3.14 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency shall immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency shall report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.

    a. Test reports shall include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:

        1) Project name.
        2) Name of testing agency.

3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.
10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

D. Inspections are as required by the General Building Code and are as indicated in the Statement of Special Inspections and the Structural Drawings. Inspections will typically include the following:

1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

E. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M shall be performed in accordance with the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M:

a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete;

   a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

4. Concrete Temperature: ASTM C1064/C1064M:

   a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C31/C31M:

   a. Cast and laboratory cure two sets of two 6-inch by 12-inch cylinder specimens for each composite sample.

6. Compressive-Strength Tests: ASTM C39/C39M.

   a. Test one set of two laboratory-cured specimens at seven days and one set of two specimens at 28 days.
   b. Test additional cylinders at age as needed (at Contractor's discretion and cost)
   c. Test one set of two field-cured specimens at seven days and one set of two specimens at 28 days.
   d. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa) if specified compressive strength is 5000 psi (34.5 MPa), or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi (34.5 MPa).
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests:

    a. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive

strengths, or other requirements have not been met, as directed by Architect.

b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.

1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 (ACI 301M), section 1.6.6.3.

11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.15 SLAB FLATNESS/SLAB LEVELNESS

A. Summary: FF (flatness) is most affected by the finishing operation. FL (levelness) is most affected by forming and strike-off. Both numbers are dimensionless and the higher the number the more accurate the floor construction. The FF number relates to the rate of change of the elevation of a concrete floor over a 12" interval. The FL number relates to the general floor slope of a concrete slab from an assumed datum elevation. The difference in elevation of two points which are 10'-0" apart is measured for the calculation of FL. Note that it is entirely possible that the floor can be within specified tolerances during the initial testing process but become out of spec prior to actual use because of slab cracking, curling or sub-grade settlement.

B. Floor Designation: All floor areas not specified to be part of the "defined traffic floor" should be part of the "random traffic floor". Any floor slab comprising part of the random traffic floor shall be designated a “random traffic slab".

C. Flatness and Levelness Tolerances: The random traffic floor shall conform to the following surface profile tolerances:
1. Floor Flatness Number: FF
   a. Specified Overall Value = [35]
   b. Minimum Local Value* = [24]
2. Floor Levelness Number: FL
   a. Specified Overall Value = [25]
   b. Minimum Local Value* = [18]

*Areas with joints shall be omitted from minimum local value tests.

D. General Conformity to Design Grade: Except as set forth in Paragraph D below, the entire Random Traffic Floor shall fall within +- 3/4" of its specified elevation.

E. Exceptions: The FL levelness tolerances set forth above shall not apply to any Random Traffic Slab that is to be inclined or cambered. Similarly, no FL levelness tolerances will be applied to any unshored elevated construction. The general

conformity to design grade tolerance set forth above will apply to unshored elevated slab constructions, but in all such cases, the tolerance will be increased to + or - 1-1/2".

F. Testing: All floor flatness, levelness, and grade conformity tests shall be made at the owner's expense on each newly installed Random Traffic Slab within 8 hours after completion of the final troweling operation. FF and FL tests shall be made by a factory certified technician in accordance with ASTM E1155 (latest revision) using an "F-Meter" or "D-Meter" as manufactured by Allen Face & Company of Wilmington, NC. Grade conformity tests shall be made using either an optical or laser level. Results of all floor tolerance tests - including a formal notice of acceptance or rejection of the work - shall be provided to the contractor within 12 hours after testing. Failure to adhere to the testing and reporting requirements set forth in this paragraph shall constitute *de facto* acceptance of work.

NOTE: Weekends and holidays shall be ignored when computing specified testing and reporting deadlines.

G. Remedy for Out-of-Tolerance Work: The entire Random Traffic Floor shall be subdivided into Minimum Local Floor Sections bounded either by the column and half-column lines, or the construction and control joints, whichever subdivision yields the smaller areas.

H. All Minimum Local Floor Sections measuring at or above the specified MLFF and MLFL numbers shall be accepted for F-number compliance as constructed. All Minimum Local Floor Sections which fail to meet or exceed both specified minimum local F-numbers shall be removed and replaced (in the case of slabs-on-grade), or ground and/or retopped (in the case of elevated slabs).

3.16 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit vehicles from interior concrete slabs.
4. Prohibit use of pipe-cutting machinery over concrete surfaces.
5. Prohibit placement of steel items on concrete surfaces.
6. Prohibit use of acids or acidic detergents over concrete surfaces.
7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 033000

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Concrete masonry units.
2. Pre-faced concrete masonry units.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Embedded flashing.
7. Miscellaneous masonry accessories.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:

1. Decorative CMUs, in the form of small-scale units.
2. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:

1. Decorative CMUs.
2. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Material Certificates: For each type and size of the following:

1. Masonry units.

a. Include data on material properties.
b. For masonry units, include data and calculations establishing average net-area compressive strength of units.

2. Integral water repellant used in CMUs.
3. Cementitious materials. Include name of manufacturer, brand name, and type.
4. Mortar admixtures.
5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
6. Grout mixes. Include description of type and proportions of ingredients.
7. Reinforcing bars.
8. Joint reinforcement.
9. Anchors, ties, and metal accessories.

C. Mix Designs: For each type of mortar. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C109/C109M for compressive strength, ASTM C1506 for water retention, and ASTM C91/C91M for air content.
2. Include test reports, according to ASTM C1019, for grout mixes required to comply with compressive strength requirement.

D. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM C1093 for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups for typical exterior and interior walls in sizes approximately 48 inches (1200 mm) long by 48 inches (1200 mm) high by full thickness, including face and backup wythes and accessories.

2. Protect accepted mockups from the elements with weather-resistant membrane.
3. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

    a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.9 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.2 PERFORMANCE REQUIREMENTS

A. Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C1314.

2.3 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.4 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.

1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
    1) BASF Corporation
    2) Euclid Chemical Company; an RPM company
    3) GCP Applied Technologies Inc.

C. CMUs: ASTM C90.

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi (14.8 MPa).
2. Density Classification: Medium weight.
3. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less-than-nominal dimensions.
4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

D. Concrete Masonry Units - infill

1. Manufactured to specified dimensions of 3/8 inch less than nominal widths by nominal heights by nominal weights. Where dimensons are not shown on the drawings, provide units 16 inches long by 8 inches high by the width shown or otherwise required.

E. Concrete Masonry Units: Basis-of-Design: Custom Masonry Units as manufactured by Featherlite Building Products, Lubbock Texas

1. Split face CMU veneer: Limestone color.

2. Burnished CMU veneer: Limestone color.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Cement: ASTM C1329/C1329M.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C979/C979M. Use only pigments with a record of satisfactory performance in masonry mortar.

G. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.

4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

H. Aggregate for Grout: ASTM C404.

I. Epoxy Pointing Mortar: ASTM C395, epoxy-resin-based material formulated for use as pointing mortar for glazed or pre-faced masonry units (and approved for such use by manufacturer of units); in color indicated or, if not otherwise indicated, as selected by Architect from manufacturer's colors.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

K. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

L. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60 (Grade 420).

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.

1. Interior Walls: Mill- galvanized carbon steel.
2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.148-inch (3.77-mm) diameter.
4. Wire Size for Cross Rods: 0.148-inch (3.77-mm) diameter.
5. Spacing of Cross Rods: Not more than 16 inches (407 mm) o.c.
6. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.

2.7 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into masonry but with at least a 5/8-inch (16-mm) cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Mill-Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A641/A641M, Class 1 coating.

2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A82/A82M, with ASTM A153/A153M, Class B-2 coating.
3. Galvanized-Steel Sheet: ASTM A653/A653M, Commercial Steel, G60 (Z180) zinc coating.
4. Steel Sheet, Galvanized after Fabrication: ASTM A1008/A1008M, Commercial Steel, with ASTM A153/A153M, Class B coating.
5. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel stainless steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication.

    a. 0.064-inch- (1.63-mm-) thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.

2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from 0.060-inch- (1.52-mm-) thick steel sheet, galvanized after fabrication 0.105-inch- (2.66-mm-) thick steel sheet, galvanized after fabrication with dovetail tabs for inserting into dovetail slots in concrete.

    a. 0.064-inch- (1.63-mm-) thick, galvanized sheet may be used at interior walls unless otherwise indicated.

E. Partition Top Anchors: 0.105-inch- (2.66-mm-) thick metal plate with a 3/8-inch- (9.5-mm-) diameter metal rod 6 inches (152 mm) long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTMA 153/A153M Rust-inhibitive paint.

2.8 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
   1. Copper: ASTM B370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. (4.9-kg/sq. m) weight or 0.0216 inch (0.55 mm) thick or ASTM B370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. (3.7-kg/sq. m) weight or 0.0162 inch (0.41 mm) thick.
   2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
   3. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees.
   4. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

   1. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. (1.5-kg/sq. m) copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

C. Application: Unless otherwise indicated, use the following:

   1. Where flashing is indicated to receive counterflashing, use metal flashing.
   2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
   3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge or flexible flashing with a metal sealant stop.
   4. Where flashing is fully concealed, use flexible flashing.

D. Single-Wythe CMU Flashing System: System of CMU cell flashing pans and interlocking CMU web covers made from UV-resistant, high-density polyethylene. Cell flashing pans have integral weep spouts designed to be built into mortar bed joints and that extend into the cell to prevent clogging with mortar.

E. Solder and Sealants for Sheet Metal Flashings:
   1. Elastomeric Sealant: ASTM C920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

F. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.9 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.
3. For exterior masonry, use portland cement-lime mortar.
4. For reinforced masonry, use portland cement-lime mortar.
5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For reinforced masonry, use Type S.
2. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
3. For interior nonload-bearing partitions, Type O may be used instead of Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of mortar cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints with the following units:
    a. Pre-faced CMUs.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
1. Application: Use colored-aggregate mortar for exposed mortar joints with the following units:

a. Decorative CMUs.
b. Pre-faced CMUs.
c. Cast-stone trim units.

F. Grout for Unit Masonry: Comply with ASTM C476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1.
3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm).

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm).

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch (6 mm) and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).

1. Space reinforcement not more than 16 inches (406 mm) o.c.
2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

1. Provide an open space not less than 1/2 inch (13 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

3.8 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.9 LINTELS

A. Provide masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

3.10 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
3. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
4. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
5. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts

aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

3.12 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. (464 sq. m) of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C1019.

3.13 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.14 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches (100 mm) in each dimension.

2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches (450 mm) of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042200

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Structural steel.
2. Shrinkage-resistant grout.

B. Related Requirements:

1. Section 053100 "Steel Decking" for field installation of shear stud connectors through deck.

1.3 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

1.4 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 ACTION SUBMITTALS

A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Anchor rods.

4. Threaded rods.
5. Shop primer.
6. Galvanized-steel primer.
7. Etching cleaner.
8. Galvanized repair paint.
9. Shrinkage-resistant grout.

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members not to be shop primed.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Welding certificates.

C. Mill test reports for structural-steel materials, including chemical and physical properties.

D. Product Test Reports: For the following:

1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.

E. Survey of existing conditions.

F. Source quality-control reports.

G. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).

1. A fabricator that does not satisfy the above will be accepted provided that the owner-engaged special inspector performs the fabrication plant inspections that are required by IBC 2015 and its referenced documents.

B. Installer Qualifications: Company specializing in performing the work of this section with a minimum of 5 years documented experience.

C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable provisions of the following specifications and documents:

1. ANSI/AISC 303.
2. ANSI/AISC 360.
3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."

B. Connection Design Information:
1. [Hybrid Option] For shear, moment, joist seat to panel, joist girder seat to panel, braced frame, and moment frame connections
   a. Option 2: Fabricator's qualified professional engineer shall select or complete connections in accordance with ANSI/AISC 303.

1) Select and complete connections using schematic details and configuration as indicated and ANSI/AISC 360.
2) Use Load and Resistance Factor Design; data are given at factored-load level.
3) Clearly provide capacity of each connection selected or completed.
4) Connection details and analysis data shall be signed and sealed by the qualified professional engineer responsible.

2. Option 1: Connection designs have been completed and connections indicated on the Drawings.

2.2 BOLTS AND CONNECTORS

A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH (ASTM A563M, Class 10S), heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F959/F959M, Type 325-1 (Type 8.8-1), compressible-washer type with plain finish.

2.3 RODS

A. Unheaded Anchor Rods: ASTM F1554, Grade 36

1. Configuration: Straight.
2. Nuts: ASTM A563 (ASTM A563M) hex carbon steel.
3. Plate Washers: ASTM A36/A36M carbon steel.
4. Washers: ASTM F436 (ASTM F436M), Type 1, hardened carbon steel.
5. Finish: Plain.

2.4 PRIMER

A. Steel Primer:

1. SSPC-Paint 23, latex primer.
2. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: MPI#26.

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: MPI#18

2.5 SHRINKAGE-RESISTANT GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.

1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, mechanically thermal cut or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.

F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel in accordance with ASTM A123/A123M.

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize shelf angles attached to structural-steel frame and located in exterior walls.

2.9 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
1. Surfaces to be field welded.
2. Surfaces of high-strength bolted, slip-critical connections.
3. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
4. Galvanized surfaces .

B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:

1. SSPC-SP 2.

C. Surface Preparation of Galvanized Steel: Prepare galvanized-steel surfaces for shop priming by thoroughly cleaning steel of grease, dirt, oil, flux, and other foreign matter, and treating with etching cleaner.

D. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

1. Do not remove temporary shoring supporting composite deck construction and structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.

B. Baseplates Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.

C. Maintain erection tolerances of structural steel within ANSI/AISC 303.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces

that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.

1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing, and repair galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.6 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a special inspector to perform special inspections as indicated. The special inspector and the testing laboratory may be the same agency.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.

a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

1) Liquid Penetrant Inspection: ASTM E165/E165M.
2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
3) Ultrasonic Inspection: ASTM E164.
4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 051200

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Roof deck.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Roof deck.

B. Shop Drawings:

1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

D. Research Reports: For steel deck, from ICC-ES.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

A. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230)
2. Profile Depth: As indicated
3. Design Uncoated-Steel Thickness: As indicated.
4. Span Condition: As indicated.
5. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 (4.8-mm) minimum diameter.

D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.

E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

F. Galvanizing Repair Paint: ASTM A780/A780M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches (38 mm) long, and as follows:

1. Weld Diameter: 5/8 inch (16 mm), nominal.
2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of one-half of the span or 18 inches (457 mm), and as follows:

1. Mechanically fasten with self-drilling, No. 10 (4.8-mm-) diameter or larger, carbon-steel screws.
2. Mechanically clinch or button punch.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:

1. End Joints: Lapped 2 inches (51 mm) minimum.

D. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

END OF SECTION 053100

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

A. Section Includes:

1. Rough hardware.

2. Loose bearing and leveling plates.

3. Miscellaneous framing and supports for applications where framing and supports are not specified in other sections.

4. Loose lintels.

5. Shelf angles.

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 degrees F, ambient; 180 degrees F, material surfaces.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for products used in miscellaneous metal fabrications, including paint products and grout.

1. For each type of product indicated, provide one hard copy of the operation and maintenance instructions.

C. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their

connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other sections.

1. Where installed metal fabrications are indicated to comply with certain design loadings, include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by the qualified professional engineer who was responsible for their preparation.

D. Samples representative of materials and finished products as may be requested by Architect.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing metal fabrications similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Arrange for installation of metal fabrications specified in this section by same firm that fabricated them.

1.6 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit, by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of Work.

PART 2 - PRODUCTS

2.1 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view upon completion of the Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials whose exposed surfaces exhibit pitting, seam marks, roller marks, rolled trade names, roughness, and, for steel sheet, variations in flatness exceeding those permitted by reference standards for stretcher-leveled sheet.

B. Steel Plates, Shapes, and Bars: ASTM A 36.

C. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500, grade as indicated below:

   a. Grade A, unless otherwise indicated or required for design loading.

2. Hot-Formed Steel Tubing: ASTM A 501.

   a. For exterior installations and where indicated, provide tubing with hot-dip galvanized coating per ASTM A 53.

D. Uncoated Structural Steel Sheet: Product type (manufacturing method), quality, and grade, as follows:

1. Cold-Rolled Structural Steel Sheet: ASTM A 611, grade as follows:

a. Grade A, unless otherwise indicated or required by design loading.

E. Uncoated Steel Sheet: Commercial quality, product type (method of manufacture) as follows:

1. Cold-Rolled Steel Sheet: ASTM A 366.

F. Galvanized Steel Sheet: Quality as follows:

1. Commercial Quality: ASTM A 526, G90 coating designation unless otherwise indicated.

G. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 316L.

H. Stainless-Steel Bars and Shapes: ASTM A 276, Type 316L.

I. Steel Pipe: ASTM A 53; finish, type, and weight class as follows:

1. Black finish, unless otherwise indicated.

2. Galvanized finish for exterior installations and where indicated.

3. Type F, standard weight (schedule 40), unless otherwise indicated, or another weight, type, and grade required by structural loads.

J. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: 1-5/8 by 1-5/8 inches.

2. Material: Galvanized steel complying with ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.

K. Gray Iron Castings: ASTM A 48, Class 30.

L. Brackets, Flanges and Anchors: Cast or formed metal of the same type material and finish as supported component.

M. Concrete Inserts: Threaded or wedge type; galvanized ferrous castings, either malleable iron, ASTM A 47, or cast steel, ASTM A 27. Provide bolts, washers, and shims as required, hot-dip galvanized per ASTM A 153.

N. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for the metal alloy to be welded.

2.2 ALUMINUM

A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, alloy 6061-T6.

2.3 GROUT AND ANCHORING CEMENT

A. Nonshrink Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD- C 621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

B. Erosion-Resistant Anchoring Cement: Factory-prepackaged, nonshrink, nonstaining, hydraulic controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without need for protection by a sealer or waterproof coating and is recommended for exterior use by manufacturer.

C. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include but are not limited to the following:

1. Nonshrink Nonmetallic Grouts:

    a. "Bonsal Construction Grout"; W. R. Bonsal Co.

    b. "Diamond-Crete Grout"; Concrete Service Materials Co.

    c. "Euco N-S Grout"; Euclid Chemical Co.

    d. "Kemset"; Chem-Masters Corp.

    e. "Crystex"; L & M Construction Chemicals, Inc.

    f. "Masterflow 713"; Master Builders.

    g. "Sealtight 588 Grout"; W. R. Meadows, Inc.

    h. "Sonogrout"; Sonneborn Building Products Div., Rexnord Chemical Products, Inc.

    i. "Stoncrete NM1"; Stonhard, Inc.

    j. "Five Star Grout"; U. S. Grout Corp.

    k. "Vibropruf #11"; Lambert Corp.

2. Erosion-Resistant Anchoring Cement:

    a. "Super Por-Rok"; Minwax Construction Products Division.

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

1. Provide stainless-steel fasteners for fastening aluminum.

2. Provide stainless-steel fasteners for fastening stainless steel.

B. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 2 (A4).Bolts and Nuts: Regular hexagon head type, ASTM A 307, Grade A.

C. Lag Bolts: Square head type, FS FF-B-561.

D. Machine Screws: Cadmium plated steel, FS FF-S-92.

E. Wood Screws: Flat head carbon steel, FS FF-S-111.

F. Plain Washers: Round, carbon steel, FS FF-W-92.

G. Drilled-In Expansion Anchors: Expansion anchors complying with FS FF-S-325, Group VII (anchors, expansion), Type I (internally threaded tubular expansion anchor); and machine bolts complying with FS FF-B-575, Grade 5.

H. Toggle Bolts: Tumble-wing type, FS FF-B-588, type, class, and style as required.

I. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

2.5 PAINT

A. Shop Primer for Ferrous Metal: Manufacturer's or fabricator's standard, fast-curing, lead-free, universal modified alkyd primer selected for good resistance to normal atmospheric corrosion, for compatibility with finish paint systems indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure complying with performance requirements of FS TT-P-645.

B. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint-20.

C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

D. Zinc Chromate Primer: FS TT-P-645.

2.6 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints, and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and nighttime sky heat loss.

1. Temperature Change (Range): 100 degrees F (55.5 degrees C).

D. Shear and punch metals cleanly and accurately. Remove burrs.

E. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

F. Remove sharp or rough areas on exposed traffic surfaces.

G. Weld corners and seams continuously to comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

H. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

J. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling

limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

K. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware, screws, and similar items.

L. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.7 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

C. Fabricate interior masonry lateral bracing clips from 3 inch x 3 inch x 3/16 inch x 6 inch long steel angles. Each clip shall be punched with two 3/8 inch bolt holes in one leg, each 1 inch from each end for securing with expansion bolts to structure above. Do not secure clips to partition. Provide clips with shop applied rust inhibiting primer.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

    a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches wide by 1/4 inch by 8 inches long.

C. Galvanize miscellaneous framing and supports in the following locations:

1. Exterior locations.

2. Interior locations where indicated.

2.9 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

2.10 STEEL AND IRON FINISHES

A. Galvanizing: For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:

1. ASTM A 153 for galvanizing iron and steel hardware.

2. ASTM A 123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

B. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning:

C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 "Paint Application Specification No. 1" for shop painting.

1. Stripe paint all edges, corners, crevices, bolts, welds, and sharp edges.

2.11 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Finish: AA-M10

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.

C. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from water and concrete entry.

3.2 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

   2. Obtain fusion without undercut or overlap.

   3. Remove welding flux immediately.

   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint or zinc chromate primer.

3.3 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of any bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges, or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

   1. Use nonmetallic nonshrink grout, unless otherwise indicated.

2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 INSTALLING METAL BOLLARDS

A. Anchor bollards in concrete in formed or core-drilled holes not less than 8 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.

B. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

C. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

3.5 ADJUSTING AND CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.

1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.

B. Related Requirements:

1.3 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal (114 mm actual) size or greater in least dimension.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent.

2.2 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.

1. Application: Interior partitions not indicated as load bearing.
2. Species:

a. Southern pine or mixed southern pine; SPIB.
b. Spruce-pine-fir; NLGA.
c. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

B. Joists No. 2 grade.

1. Species:
a. Southern pine; SPIB.
b. Southern pine or mixed southern pine; SPIB.

2.3 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.

B. Dimension Lumber Items: Construction or No. 2

1. Mixed southern pine or southern pine; SPIB.

2.4 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F1667.

2.5 METAL FRAMING ANCHORS

A. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction.

C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

D. Do not splice structural members between supports unless otherwise indicated.

E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet (6 m) o.c.

G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.

2. Use copper naphthenate for items not continuously protected from liquid water.

I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

J. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF FLOOR JOIST FRAMING

A. General: Install floor joists with crown edge up and support ends of each member with not less than 1-1/2 inches (38 mm) of bearing on wood or metal, or 3 inches (76 mm) on masonry. Attach floor joists as follows:

1. Where supported on wood members, by toe nailing or by using metal framing anchors.
2. Where framed into wood supporting members, by using wood ledgers as indicated or, if not indicated, by using metal joist hangers.

B. Frame openings with headers and trimmers supported by metal joist hangers; double headers and trimmers where span of header exceeds 48 inches (1200 mm).

C. Do not notch in middle third of joists; limit notches to one-sixth depth of joist, one-third at ends. Do not bore holes larger than one-third depth of joist; do not locate closer than 2 inches (50 mm) from top or bottom.

D. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist at ends of joists unless nailed to header or band.

E. Lap members framing from opposite sides of beams, girders, or partitions not less than 4 inches (102 mm) or securely tie opposing members together. Provide solid blocking of 2-inch nominal (38-mm actual) thickness by depth of joist over supports.

F. Provide solid blocking between joists under jamb studs for openings.

G. Under non-load-bearing partitions, provide double joists separated by solid blocking equal to depth of studs above.

1. Provide triple joists separated as above, under partitions receiving ceramic tile and similar heavy finishes or fixtures.

H. Provide bridging of type indicated below, at intervals of 96 inches (2438 mm) o.c., between joists.

1. Diagonal wood bridging formed from bevel-cut, 1-by-3-inch nominal- (19-by-64-mm actual-) size lumber, double-crossed and nailed at both ends to joists.
2. Steel bridging installed to comply with bridging manufacturer's written instructions.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board - walls.
2. Polyisocyanurate foam-plastic board - roof.
3. Glass fiber blanket – metal stud walls.

B. Related Requirements:

1. Section 03 11 19 "Insulating Concrete Forming" for insulation installed outside ICF walls.
2. Section 07 41 13.16 “Standing Seam Metal Roof Panels” for roof insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.

B. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

   a. DiversiFoam Products.

   b. Dow Chemical Company (The).

   c. Owens Corning.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 POLYISOCYANUARATE RIGID COMPOSITE BOARD

A. Polyisocyanurate Board, Oriented Strand Board Faced: ASTM C 1289, Type I, Class 1 or 2.

B. Standard APA/TECO rated OSB.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Atlas Roofing Corporation.
   b. Carlisle Coatings & Waterproofing Inc.
   c. Dow Chemical Company (The).
   d. Firestone Building Products.
   e. GAF Cornell Corporation.

2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.3 GLASS-FIBER BLANKET

A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. CertainTeed Corporation.

b. Johns Manville; a Berkshire Hathaway company.

c. Knauf Insulation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

1. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END

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GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes standing-seam metal roof panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's literature, construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1. Product Test Reports: For each product, for tests performed by a qualified testing agency.

2. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Metal roof assemblies shall comply with performance requirements specified as determined by testing manufacturers' standard assemblies similar to those indicated for this Project, by a qualified testing and inspecting agency.

B. Contractor must provide proof as a licensed installer with all current and applicable licensures per the 2010 UGC and Special Conditions.

C. Contractor must show evidence of 3 years prior experience in roof installation to be eligible for award of this contract.

D. Contractor to provide his own equipment for rolled roofing or other fabrications.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package off site fabricated metal roof panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Contractor shall be responsible for the proper care and protection of all materials, supplies, and equipment stored at the job site.

D. Store all material according to manufacturer recommendations.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.10 WARRANTY

A. Contractor shall furnish a certificate of warranty from the manufacturer for free from defects in the products.

B. Provide a twenty-five (25) year manufacturer's finish warranty.

PRODUCTS

2.1 STRUCTURAL PERFORMANCE

A. Provide metal roof panel assemblies capable of withstanding the effect of gravity loads and the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592 structural loading test with maximum deflection 1/240 and ASTM E 331 water penetration under static pressure test for IBC 90 mph wind rating (3 second gust).

2.2 STANDING-SEAM METAL ROOF PANELS

A. Install 24 gauge galvalume standing seam roof system with double folded, min. 1½" high standing seams.

B. Install synthetic roofing underlayment over ¾" oriented strand board over polyisocyanuarate foam rigid insulation board meeting ASTM D226, ASTM D4869, ASTM E108/UL 790 (Class A Fire Resistance).

C. Provide and install sealant tape and sealants as recommended by the metal roofing manufacturer for a water tight installation.

D. Install 24 gauge galvalume soffit panels and downspouts provided by the standing-seam metal roof panel manufacturer.

E. Roof panels may be fabricated on site.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 coating designation or ASTM A 792/A 792M, Class AZ50 coating designation unless otherwise

indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

F. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

G. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

2.4 FABRICATION

A. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using UL-certified, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.

3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.

5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.

6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

   a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages

have been installed within alignment tolerances required by metal roof panel manufacturer.

2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

   a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

2.7 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

2.8 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.

2. Install pressure plates at locations indicated in manufacturer's written installation instructions.

3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.

5. Watertight Installation:

   a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
   b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
   c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure

strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.

2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

2.9 THERMAL INSULATION INSTALLATION

A. Board Insulation: Extend insulation thickness indicated to cover entire roof. Comply with installation requirements in 07 21 00 Thermal Insulation.

1. Erect insulation and hold in place with fasteners spaced per manufacturer’s recommendations.

2.10 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

2.11 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 41 13.16

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Nonstaining silicone joint sealants.
3. Mildew-resistant joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.7 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Silicone, S, NS, 100/50, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Dow Corning Corporation.
   b. May National Associates, Inc.; a subsidiary of Sika Corporation.
   c. Pecora Corporation.

B. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dow Corning Corporation.
   b. May National Associates, Inc.; a subsidiary of Sika Corporation.
   c. Pecora Corporation.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Dow Corning Corporation.
   b. Pecora Corporation.
   c. Sika Corporation; Joint Sealants.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Dow Corning Corporation.
    b. May National Associates, Inc.; a subsidiary of Sika Corporation.
    c. Pecora Corporation.

2.5 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Alcot Plastics Ltd.
    b. BASF Corporation; Construction Systems.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Construction joints in cast-in-place concrete.
    b. Joints in dimension stone veneer.
    c. Joints between metal panels.
    d. Joints between different materials listed above.
    e. Perimeter joints between materials listed above and frames of doors windows and louvers.
    f. Control and expansion joints in ceilings and other overhead surfaces.
    g. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Tile control and expansion joints.
    c. Vertical joints on exposed surfaces of unit masonry walls and partitions.
    d. Other joints as indicated on Drawings.

2. Joint Sealant: Urethane, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

   a. Control joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints between interior wall surfaces and frames of interior doors windows.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.
   c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

E. Joint-Sealant Application: Concealed mastics.

1. Joint Locations:
   a. Sill plates.
   b. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes hollow-metal work.

B. Related Requirements:
   1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

   1. Elevations of each door type.
   2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Verification:

1. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches.

D. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ceco Door; ASSA ABLOY.

2. Curries Company; ASSA ABLOY.
3. Deansteel Manufacturing Company, Inc.
4. Door Components, Inc.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

2.3 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2. At locations indicated in the Door and Frame Schedule.

1. Physical Performance: Level B according to SDI A250.4.
2. Doors:

    a. Type: As indicated in the Door and Frame Schedule.
    b. Thickness: 1-3/4 inches
    c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
    d. Edge Construction: Model 1, Full Flush.
    e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
    f. Core: Kraft-paper honeycomb Polystyrene Vertical steel stiffener.

3. Frames:

    a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
    b. Construction: Full profile welded.

4. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

2.6 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
3. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors of same material as face sheets.
4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
2. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Compression Type: Not less than two anchors in each frame.
    c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

6. Terminated Stops: Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.8 ACCESSORIES

A. Louvers: Provide louvers for interior doors, where indicated, which comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.

1. Sightproof Louver: Stationary louvers constructed with inverted-V or inverted-Y blades.
2. Lightproof Louver: Stationary louvers constructed with baffles to prevent light from passing from one side to the other.

B. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
2. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
3. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
4. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:

a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
b. At Bottom of Door: 3/4 inch plus or minus 1/32 inch.
c. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow-metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes the supply and installation of the Finish Hardware.
1. Include the termination of all Electrified Hardware.
2. Include field verification of any existing doors, frames or hardware.

B. Related Sections
1. Division 1
2. Sealants – Division 7 / Division 7
3. Openings – Division 8 / Division 8
4. Finishes – Division 9 / Division 9
5. Fire Alarm – Division 13/ Division 28
6. Electrical – Division 16 / Division 26
7. Security – Division 16 / Division 28

1.02 REFERENCES

A. Documents and Institutes that shall be used in estimating, detailing and installing the items specified.

1. International Building Code – Current/Adopted Edition
2. ICC/ANSI A117.1 – Accessible and Usable Building and Facilities - Current/Adopted Edition
3. NFPA 70 – Current/Adopted Edition
4. NFPA80 –Standards For Fire Doors and Fire Windows – Current/Adopted Edition
5. NFPA101 – Life Safety Code – Current/Adopted Edition
6. NFPA105 – Installation of Smoke-Control Door Assemblies – Current/Adopted Edition.
7. ANSI - American National Standards Institute
8. BHMA – Builders Hardware Manufacturers Association
9. UL – Underwriters Laboratory
10. DHI – Door and Hardware Institute
11. Texas Accessibility Standards – Current Adopted Edition
12. Local Building Codes

1.03 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Finish Hardware Schedule to be in vertical format to include:
1. Heading #/Hardware Set

2. Door #, Location, Hand, Degree of Opening, Door Size and Type, Frame Size and Type, Fire Rating
3. Quantity, type, style, function, product, product number, size, fasteners, finish and manufacturer of each hardware item.
4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
5. Keying schedule
6. Title Sheet, Index, Abbreviations, Manufacturers List, Template List and Templates.
7. Mounting locations for hardware.
8. Explanation of abbreviations, symbols, and codes contained in schedule.
9. Date of the Finish Hardware Specification and Drawing / Door Schedule used in completing the Finish Hardware Schedule.
10. In Name, Company and Date of Field Verification if required.
11. Door Index; include door number, heading number, and hardware group.
12. Name and phone number for local manufacturer's representative for each product.
13. Submit in conjunction with Door and Frame Submittal.
14. Operation Description of openings with electrified hardware.

C. Product Data: Provide product data in the form of a binder, manufacturer's technical product fact sheets for each item of hardware. Include whatever information may be necessary to show compliance with requirements, including instructions for installation and for maintenance of operating parts and finish.

D. Wiring Diagrams: Provide Riser/Elevation and Point to Point Wiring Diagrams for all openings with electrified hardware. Include all information that is necessary for coordination with other trades.

E. Samples: Provide samples as requested by Owner or Architect with Heading # and Door# marked on boxes. All samples will be returned to the contractor and used on doors for which they were marked.

F. Templates: Provide templates of finish hardware items to each fabricator of doors, frames and other work to be factory or shop prepared for the installation of hardware.

G. Keying Schedule: After meeting with the Owner, a keying schedule shall be submitted using keyset symbols referenced in DHI manual "Keying Systems and Nomenclature." The keying schedule shall be indexed by door number, keyset, hardware heading number, cross keying instructions and special key stamping instructions.

H. Operations and maintenance data: At the completion of the job, provide to the Owner one hard copies or one electronic copy of an Owner's operation and maintenance manual. The manual shall consist of a labeled hardcover three ring binder with the following technical information:

1. Title page containing: Project name, address and phone numbers. Supplier's name, address and phone numbers.
2. Table of Contents.
3. Copy of final (file and field use/as-installed) Finish Hardware Schedule.
4. Final Keying Schedule.
5. Maintenance instruction, adjustment, and preservation of finishes for each item of hardware.
6. Catalog pages for each items of hardware.
7. Installation Instructions for each item of hardware
8. Parts List for each item of hardware.
9. As installed point to point wiring diagrams for electrified hardware.
10. Warranties include Order #.

1.04 QUALITY ASSURANCES

A. Substitutions: Request for substitutions shall not be accepted within this project. Architect, Owner and Finish Hardware Consultant have selected one (1) specified and two (2) equals listed hereinafter in the Hardware Schedule. By this selection process they have established three (3) equal products for competitive pricing, while insuring no unnecessary delays by a substitution process. If any specified product is listed as a "No Substitution" product, this product will be supplied as specified, with no alteration or request of substitution. The reason for this is to comply with the uniformity established at this project. Parts and supplies are inventoried for these particular products for ease and standardization of replacement.

B. Supplier Qualifications: Supplier shall be recognized architectural finish hardware supplier, with warehousing facilities, who have been furnishing hardware in the project vicinity for a period of not less than 2 year and who is or employs a DHI Certified AHC, DHC, DHSC or person with a minimum of 10 years of experience as a hardware supplier. This person shall be available at reasonable times during the course of the work for consultation about products hardware requirements, to the Owner, Architect and General Contractor.

C. Installer Qualifications (Mechanical Hardware): All finish hardware shall be installed by the Finish Hardware Installer with a minimum of at least two (2) years documented experience. Installer shall attend a pre-installation meeting between the General Contractor, Finish Hardware Supplier/s, hardware manufacturer's representative for locks, closers and exit devices, and all door / frame suppliers. The Finish Hardware Installer shall be responsible for the proper installation and function of all doors and hardware.

D. Installer Qualifications (Electrified Hardware): All electrified finish hardware (power source, electrified locking or control device, switching device, through wire device and monitoring device) shall be installed by an Electronic Access Control Installer licensed by the Texas Department of Public Safety. The Electrified Finish Hardware Installer shall have a minimum of at least two (2) years of documented experience. Installer shall attend a pre-installation

meeting between the General Contractor, Finish Hardware Supplier/s, Electrical Contractor, Fire Alarm Contractor, Security Contractor, hardware manufacturer's representative for electrified hardware, all door / frame suppliers. The Electrified Finish Hardware Installer shall be responsible for the proper installation, termination and function of all opening with electrified hardware. Installation shall include termination of all electrified products (including the required wire to the power supply and/or junction box).

1.05 DELIVERY, STORAGE AND HANDLING

A. Marking and packaging: Mark each item or package separately, with identification related to hardware set number, door number and keyset symbol.

B. Delivery:
   1. Deliver individually packaged and properly marked finish hardware at the proper time and location to avoid any delays in construction or installation.
   2. At time of delivery, inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

C. Storage: Store hardware in enclosed, dry and locked area.

1.06 WARRANTY

A. All finish hardware products shall be covered by a 1 year factory warranty from the date of substantial completion of the project.

B. Supply warranty verification to the owner for all products that provide factory warranty. Warranty should include Factory Order # and date.

1.07 MAINTENANCE

A. Maintenance Service
   1. None

B. Extra Materials:
   1. All extra screws, fasteners, and all special installation tools furnished with the hardware shall be turned over to the owner at the completion of the job.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Screws and Fasteners:
   1. All closers and exit devices provided for exterior doors, hollow metal doors, and all other required shall be provided with thru-bolts.

2. All finish hardware shall be installed to manufacturer's recommendations, using screws, attachments and installation tools provided with the hardware. No other screws or attachments are acceptable.
3. All other products to meet door and frame conditions.

B. Hinges:
1. Template: Provide templated units only.
2. Exterior: All exterior hinges shall be stainless steel base with stainless steel pin and stainless steel finish.
3. Interior: All interior hinges steel based.
4. Interior corrosive: All interior hinges at corrosive areas shall be stainless steel base with stainless still pin and stainless steel finish.
5. All hinges on doors over 36" wide, with exit devices, or with push/pull shall be heavy weight.
6. Electric Hinge: Provide minimum 8 wire.
7. Provide non-removable pins for outswinging doors that are locked or are lockable.
8. All hinges on doors with door closers shall be ball bearing.
9. All hinges shall be full mortise.
10. Size: Provide 4 ½ x 4 ½ hinges on doors up to 3'0" in width. Provide 5 x 4 ½ hinges over 3'0" to 4'0" in width. Reference manufacturers catalog for all other sizes.
11. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90" or less in height and one additional hinge for each 30" of additional height.
12. Adjust hinge width as required for door, frame, trim and wall conditions to allow proper degree of opening.
13. Provide hinges conforming to ANSI/BHMA A156.1.
14. Provide spring hinges where specified. Provide two spring hinges and one bearing hinge per door leaf for doors 90 inches (2286 mm) or less in height. Provide one additional bearing hinge for each 30 inches (762 mm) of additional door height.
15. Supply from the following list of manufacturers:

Ives	IVE
Hager	HAG
Bommer	BOM

C. Continuous Hinges
1. Continuous hinges to be manufactured of 6063-T6 aluminum.
2. Continuous hinge shall be certified to ANSI 156.26, Grade 1
3. Continuous hinge should be tested an approved UL10C.
4. Electrified – Provide minimum 8 wire with removable panel.
5. Provide hinges 1 inch shorter in length than nominal height of door, unless otherwise noted.
6. Provide reinforcing for doors weighing over 450 pounds and up to 600 pounds.
7. Supply from the following list of manufacturers:

Ives	IVE

Select SEL
Stanley STA

D. Mortise Locks
1. All locks on this project should be manufactured by the same manufacturer.
2. Mortise locksets shall meet ANSI/BHMA A156.13, Series 1000, Grade 1 Operational with all standard trims and conventional mortise cylinders.
3. All mortise locks shall be UL Listed for 3 hour fire door. Review lock for any height restriction.
4. Provide locks with a standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.
5. Provide standard ASA strikes unless extended lip strike is necessary for frame/trim or 7/8" lip strike is necessary at pair with overlapping astragal.
6. Provide dust box.
7. Supply from the following list of manufacturers:
   Schlage SCH
   Falcon FAL
   Best BES

E. Cylindrical Locks
1. All locks on this project should be manufacturer by the same manufacturer.
2. All locks shall meet the new ANSI/BHMA A156.2, Series 4000, Grade 1.
3. All cylindrical locks shall be UL Listed for 3 hour fire door. Review lock for any height restriction.
4. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with a 1/2 inch (13 mm) latch throw. Provide proper latch throw for UL listing at pairs.
5. Provide standard ASA strikes unless extended lip strike is necessary for frame/trim or 7/8" lip strike is necessary at pair with overlapping astragal.
6. Provide dust box.
7. Lockset shall adjust to fit door thickness from 1 ¾" to 2 1/8".
8. Supply from the following list of manufacturers:
9. Schlage SCH
   Falcon FAL
   Best BES

F. Exit Devices
1. All exit device types on this project should be manufactured by the same manufacturer.
2. Exit devices are to be architectural grade touch bar type. Touchpad to extend one half of door width.
3. Mechanism case to be smooth.

4. Exit devices shall meet ANSI A156.3, Grade 1.
5. All exit devices are UL listed Panic Exit or Fire Exit Hardware.
6. All lever trim to match lock trim in design and finish.
7. Dogging: Non-rated devices are to be provided with dogging. Less dogging where shown in Hardware Sets (some exterior, electrical rooms, electrified) Cylinder dogging as shown in hardware sets.
8. Exit devices are to be supplied and installed with thru-bolts for exterior, hollow metal doors, or as required for application.
9. Provide proper power supply for exit devices as required. Coordinate with Fire Alarm, Electrical and Security Contractor.
10. Push pads shall be metal, no plastic inserts allowed.
11. Exit devices shall have a flush end cap.
12. Exit devices shall be ordered with the correct strike for application.
13. Exit devices shall be order in the proper length to meet door width.
14. Exit devices shall have deadlatching.
15. Exit device shall be provided in width/height required based on door size.
16. Install exit devices with fasteners supplied by exit device manufacturer.
17. Mount mechanism case flush on face of doors, or provide spacers to fill gaps behind devices. Where glass trim or molding projects off face of door, provide glass bead kits as required.
18. Provide proper concealed vertical rods for wood or hollow metal doors as required.
19. Factory or field drill weep holes for exit devices used in full exterior applications, highly corrosive areas, and where noted in the hardware sets.
20. Supply from the following list of manufacturers:

Von Duprin	VON	35/98 Series
Falcon	FAL	
Detex	DET	

G. Flush Bolts
1. Provide automatic, constant latching, and manual flush bolts with forged bronze or stainless steel face plates, extruded brass levers, and with wrought brass guides and strikes. Provide 12 inch (305 mm) steel or brass rods at doors up to 90 inches (2286 mm) in height. For doors over 90 inches (2286 mm) in height increase top rods by 6 inches (152 mm) for each additional 6 inches (152 mm) of door height. Provide dust-proof strikes at each bottom flush bolt.
2. Supply from the following list of manufacturers:

Ives	IVE
Trimco	TRI
Rockwood	ROC

H. Coordinators
1. Where pairs of doors are equipped with automatic flush bolts, an astragal, or other hardware that requires synchronized closing of the doors, provide bar-type coordinating device, surface applied to underside of stop at frame head.

2. Provide filler bar of correct length for unit to span entire width of opening, and appropriate brackets for parallel arm door closers and surface vertical rod exit device strikes. Factory-prep coordinators for vertical rod devices and hardware as required.
3. Supply from the following list of manufacturers:

Ives	IVE
Trimco	TRI
Rockwood	ROC

I. Pull Plates/Pulls/Push Plate

1. Pull and Push Plates to meet ANSI 156.6 for .050" thickness.
2. Pull and Push Plate size to 4" x 16".
3. Pull Plate to have 10" center and 1" round on pull plate with concealed fasteners.
4. Provide straight and offset pulls with fasteners as required
5. Provide concealed fasteners for all applications.
6. Prep plate for cylinder/lock as required.
7. Supply from the following list of manufacturers

Ives	IVE
Trimco	TRI
Rockwood	ROC

J. Door Closers

1. All door closers on this project should be manufactured by the same manufacturer.
2. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
3. Door closers shall be furnished with standard cover. Provide full cover as shown in hardware sets.
4. Size in accordance with the manufacturers recommendations for door size and condition.
5. Door closers shall be furnished with delayed action, hold-open as listed in the Hardware Sets.
6. Door closers shall be mounted out of the line of sight wherever possible (i.e., room side of corridor doors, etc.) with parallel arm mounting on out swinging doors.
7. All closer installation shall include thru bolts on exterior, hollow metal doors or where required for application.
8. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
9. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
10. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards.
11. Supply from the following list of manufacturers

LCN	LCN

Falcon	FAL
Norton	NOR

K. Door Protection Plates
1. Protective plates shall meet ANSI A156.6 requirements for .050 thickness.
2. Protection plates should be fabricated from stainless steel.
3. Protection plate shall be height as shown in Hardware Sets. Width shall be 10” by 2” less than door width on single door or pair with a mullion and 1” less than door width on pair of doors without a mullion.
4. Beveled 4 edges.
5. Provide kickplate on all doors with closers, unless not required for aesthetic reasons.
6. Prep protective plates for hardware as required.
7. Supply from the following list of manufacturers:

Ives	IVE
Rockwood	ROC
Trimco	TRI

L. Door Stops and Holders:
1. Supply wall stops at all openings to protect doors or door hardware. Install so lock does not lock unintentionally. Install blocking in wall where wall stop will be mounted.
2. When wall conditions do not permit use of wall stop provide floor stops with risers as needed to adjust for floor conditions.
3. When wall conditions do not permit use of wall stop provide overhead stops. Jamb mount where required to not be visible from Corridor.
4. Exterior Ground Level Doors: Provide security floor stop.
5. Exterior Roof Doors: Provide heavy duty overhead stop.
6. Supply from the following list of manufacturers:

Glynn Johnson	GLY
Rockwood	ROC
Trimco	TRI

M. Silencers
1. Provide silencers on all doors without seal. 3 for single doors and 2 for pairs.
2. Provide silencers as required for frame conditions. SR64 for hollow metal frames. SR65/SR66 for wood frames.
3. At wood frames, insure height of stop is compatible with silencer.
4. Supply from the following list of manufacturer’s

Ives	IVE
Rockwood	ROC
Trimco	TRI

N. Thresholds/Weatherstripping

1. Thresholds on doors in the accessible path shall conform to accessibility codes.
2. Threshold should be based on sill detail.

3. Smoke seal shall be teardrop design bulb seal.
4. Exterior seal/thresholds shall be silicone or brush as shown in hardware sets.
5. Drip strips shall protrude 2 ½" and be 4" wider than opening.
6. At S Label single doors provide seals on frame to comply with UL1784
7. At S Label pair of doors provide seals on frame and as meeting stile to comply with UL1784.
8. Automatic Door Bottom shall be mortised to comply with accessibility codes.
9. Supply from the following list of manufacturers

Zero	ZER
National Guard	NGP
Pemko	PEM

2.03 KEYING:

A. General: Finish Hardware Supplier shall meet in person with owner to finalize keying requirements prior to the locks and exit devices being ordered and match existing or start a new Master Key System for the project. During keying meeting all hardware functions should be reviewed with the owner to finalize lock and exit device functions. During keying meeting determine all expansion required.

B. Cylinders: Provide the correct and quantity of cylinders for all applications.

C. Keys: Provide nickel silver keys only. Furnish 2 change keys for each lock: 5 control keys: 5 master keys for each master system and 5 grandmaster keys for each grandmaster key system. Deliver all keys to Owners' Representative.

D. Cores and keys shall be provided with identification stamping.

E. Provide construction keying / construction cores for this project with constructions keys.

F. Provide Bitting List to Owner.

2.04 KEY CONTROL

A. Key Management: Key control shall be provided, by supplying a complete key storage and management system. Each key shall be fully cut, indexed, tagged and installed on cabinet hooks by the lock supplier and shipped with the locks. Key cabinet provided shall be wall-mounted type with capacity plus 50%.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine doors, frames and related items for conditions that would prevent the proper application of any finish hardware items. Do not proceed with installation until all defects are corrected.

B. Existing Door and Frame Compatibility: Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.

C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Follow Door and Hardware Institute Publication:
Recommended Location for Architectural Hardware for Standard Steel Doors and Frames
Recommended Location for Builder's Hardware for Custom Steel Doors and Frames
Recommended Locations for Architectural Hardware for Wood Flush Door

B. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.

C.

D. Follow ANSI A117.1-1998 Accessible and Usable Building and Facilities and Texas Accessibility Standards.

E. Review mounting locations with Architect where required.

F. Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Closers should not be visible in corridors, lobbies and other public spaces where possible.

G. Locate power supplies in accessible location and indicate in as-builts where located.

H. Set threshold in full bed of sealant complying with requirements specified in Division 07.

I. Pre Installation meeting required with attendees to include Architect, General Contractor, Mechanical Hardware Installer, Electrified Hardware Installer, Finish Hardware Supplier and Manufacturer's Representative for Exit Device, Locks and Closers and Door/Frame Suppliers before installation begins.

3.03 FIELD QUALITY CONTROL

A. After installation has been completed, obtain the services of an Architectural Hardware Consultant to check for proper installation of finish hardware, according to the finish hardware schedule and keying schedule. In addition, check all hardware for adjustments and proper operation.

3.04 ADJUST AND CLEAN

A. Adjust, clean and inspect all hardware, to ensure proper operation and function of every opening. Replace items, which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.05 PROTECTION

A. The General Contractor shall use all means at his disposal to protect all finish hardware items from abuse, corrosion and other damage until the owner accepts the project as complete.

3.06 TRAINING

A. After installation has been completed, provide training to the Owner on the operation of the Finish Hardware and programming of any electrified hardware.

3.07 HARDWARE SCHEDULE

A. These hardware set shown below are for use as a guideline. Provide hardware as required to meet the requirements of the openings, security, and code requirements.

HARDWARE SET LAYOUT

0 – Existing, No Hardware Required or Cylinders
1 – Lockset - Office
2 – Lockset – Storeroom
3 – Latchset - Privacy
4 – Latchset - Passage
5 – Lockset - Classroom
6 – Hospital Latch
7 – Panic Hardware
8 – Push/Pull
9 – Sliding

HARDWARE GROUP NO. 103
FOR USE ON DOOR #(S):
202 203
PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	OFFICE LOCK	9KAB 15D	626	BES
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE GROUP NO. 715
FOR USE ON DOOR #(S):
100
PROVIDE EACH DOOR(S) WITH THE FOLLOWING:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	112XY	628	IVE
1	EA	PANIC HARDWARE	99-NL X SNB	626	VON
1	EA	RIM CYLINDER	12E72	626	BES
1	EA	SURFACE CLOSER	4040XP RW/PA SNB	689	LCN
1	EA	PROTECTION PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	GASKETING	328AA H & J	AA	ZER
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A	A	ZER

END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Glass for windows.
2. Glazing sealants and accessories.

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass [the following products]; 12 inches square.

1. Tinted, insulated, wire mesh (square pattern) glass.

C. Glazing Accessory Samples: For sealants, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturers of insulating-glass units with sputter-coated, low-E coatings.

B. Product Certificates: For glass.

C. Product Test Reports: For tinted glass insulating glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance, Basis of Design: PPG, SolarBan, 1” insulated, low E, tinted.

B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.

1. Obtain tinted glass from single source from single manufacturer.
2. Obtain reflective-coated glass from single source from single manufacturer.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
   a. Basic Wind Speed: 90 mph.
   b. Importance Factor: 1.0
   c. Exposure Category: B.
2. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

B. Windborne-Debris-Impact Resistance: Exterior glazing shall comply with basic-protection testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on Project and shall be installed in same manner as glazing indicated for use on Project.

1. Large-Missile Test: For glazing located within 30 feet of grade.
2. Small-Missile Test: For glazing located more than 30 feet above grade.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum.[Provide glass that complies with performance requirements and is not less than the thickness indicated.]

1. Minimum Glass Thickness for Exterior Lites: 1 inch.
2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction.

3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.

3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Dow Corning Corporation.
b. May National Associates, Inc.; a subsidiary of Sika Corporation.
c. Pecora Corporation.
d. Sika Corporation.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

    a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

A. Immediately after installation remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 08 80 00

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).

2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.3 SUSTAINABLE DESIGN and WASTE MANAGEMENT

A. Refer to the following Division 01 Sections:

1. Section 01 33 00 “Submittal Procedures”.

2. Section 01 74 19 “Construction Waste Management and Disposal”.

3. Section 01 78 23 “Operation and Maintenance Data”.

4. Section 01 91 13 “General Commissioning Requirements”.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1. For each type of product indicated, provide one hard copy of the operation and maintenance instructions.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.

2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.

D. Furring Channels (Furring Members):

1. Steel Studs: ASTM C 645.

a. Minimum Base-Metal Thickness: As indicated on Drawings.

b. Depth: As indicated on Drawings.

2. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.

a. Minimum Base Metal Thickness: As indicated on Drawings.

E. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.

b. Chicago Metallic Corporation; 640-C Drywall Furring System.

c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: As indicated on Drawings.

B. Slip-Type Head Joints: Where indicated, provide the following:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: As indicated on Drawings.

2. Depth: As indicated on Drawings.

D. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical or hat shaped.

E. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.

2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.

2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.

3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.

4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.

4. Do not attach hangers to steel roof deck.

5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.

6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.5 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install studs so flanges within framing system point in same direction.

C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.

2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

a. Install two studs at each jamb, unless otherwise indicated.

b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.

c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.

4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

D. Direct Furring:

1. Screw to metal framing.

2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

E. Z-Furring Members:

1. Erect insulation (specified in Division 7 Section "Building Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.

2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Interior gypsum board

B. Related Requirements:

1. Section 07 21 00 "Building Insulation" for insulation and vapor retarders installed in assemblies that incorporate gypsum board.

2. Section 07 92 00 "Joint Sealants" for acoustical sealants installed in assemblies that incorporate gypsum board.

3. Section 09 22 16 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board.

4. Section 09 91 23 “Interior Painting” for primers applied to gypsum board surfaces.

1.3 SUSTAINABLE DESIGN and WASTE MANAGEMENT

A. Section 01 33 00 “Submittal Procedures”.

B. Section 01 74 19 “Construction Waste Management and Disposal”.

C. Section 01 78 23 “Operation and Maintenance Data”.

D. Section 01 91 13 “General Commissioning Requirements”.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1. For each type of product indicated, provide one hard copy of the operation and maintenance instructions.

B. Samples: For the following products:

1. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on same backing indicated for Work.

1.5 QUALITY ASSURANCE

A. Reference Publications On Site: Keep a copy of ASTM C 754 and GA 216 in the field office for the duration of the Project.

B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

C. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

1.6 STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. G-P Gypsum.

b. National Gypsum Company.

c. Temple.

d. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch.

2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

C. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.

2. Long Edges: Tapered.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.

2. Shapes:

a. Cornerbead.

b. LC-Bead: J-shaped; exposed long flange receives joint compound.

c. L-Bead: L-shaped; exposed long flange receives joint compound.

d. U-Bead: J-shaped; exposed short flange does not receive joint compound.

e. Expansion (control) joint.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape: Paper for interior gypsum wallboard

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.

4. Finish Coat: For third coat, use setting-type, sandable topping compound.

5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants"

2.6 TEXTURE FINISHES

A. Primer: As recommended by textured finish manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

2. Fit gypsum panels around ducts, pipes, and conduits.

3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: At all locations unless otherwise indicated.

2. Moisture- and Mold-Resistant Type: As indicated in Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.

    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.

4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.

2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations indicated in the documents for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.

2. LC-Bead: Use at exposed panel edges.

3. L-Bead: Use where indicated.

4. U-Bead: Use where indicated.

5. Fry Reveal: Use where indicated.

3.5 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.

2. Level 2: Panels that are substrate for tile.

3. Level 3: Where indicated in Drawings.

4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

5. Level 5: Ceilings and other painted surfaces in Lobby areas and where indicated on Drawings.

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

3.6 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Finish Application: Mix and apply finish to gypsum board and other surfaces indicated to receive finish in strict accordance with manufacturer's instructions to produce a uniform light roller soft ‘orange peel’ texture matching Architect's sample without starved spots or other evidence of thin application, and free of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

D. Provide texture samples for approval by Owner and Architect.

3.7 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END

SECTION 09 51 13 – ACOUSTICAL CEILING PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.2 SUMMARY

A. Section Includes: Acoustical panel ceilings with an exposed suspension system

1. Extent of each type of acoustical ceiling is shown and scheduled in Drawings.

1.3 SUSTAINABLE DESIGN and WASTE MANAGEMENT

A. Refer to the following Division 01 Sections:

1. Section 01 33 00 “Submittal Procedures”.

2. Section 01 78 23 “Operation and Maintenance Data”.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1. For each type of product indicated, provide one hard copy of the operation and maintenance instructions.

2. For each type of product indicated, provide one hard copy of the operation and maintenance instructions.

B. Samples:

1. Each acoustical panel type, pattern and color.

2. Exposed runners and moldings for each color and system type required.

3. Set of concealed suspension members.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.

B. Single-Source Responsibility for Ceiling Units: Obtain each type of acoustical ceiling unit from a single source.

C. Single-Source Responsibility for Suspension System: Obtain each type of suspension system from a single source.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical ceiling units to project site in original, unopened packages and store them in a fully enclosed space.

B. Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

1.7 PROJECT CONDITIONS

A. Space Enclosure: Do not install interior acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANEL CEILINGS [Drawing Designation ACT-2]

A. Basis of Design: Arktura, Soft Grid Skyline, Marble.

1. Classification (ASTM E 1264): Type III, Form 2, Pattern CE
2. Edge: SLT
3. Panel Size: 24 inches by 24 inches by 5/8 inch
4. Surface-Burning Characteristics (ASTM E 84):
    a. Fire Rating: Class A
    b. Flame-spread: 25
    c. Smoke-developed: 50
5. Noise Reduction Coefficient: .50
6. CAC (minimum): .35
7. Light Reflectance: .86
8. Color: White
9. Grid Profile Option: USG Donn® Brand DX®/DXL™ 15/16" Acoustical Suspension System
10. VOC Emissions: Low

11. Anti-Mold and Mildew: ClimaPlus™

12. Recycled Content: 44.9%

13. Weight: 0.78 lbs/sq ft

B. Acceptable Products: Provide proprietary products printed in the "List of Finish Materials" and located in the Room Finish or comparable products - subject to compliance with requirements of this Section - made by another manufacturer.

2.2 ACOUSTICAL CEILING UNITS, GENERAL

A. Standard for Acoustical Ceiling Units: Provide manufacturer's standard units of configuration indicated which are prepared for mounting method designated and which comply with FS SS-S-118 requirements, including those indicated by reference to type, form, pattern, grade (NRC or NIC' as applicable), light reflectance coefficient (LR), edge detail, and joint detail (if any).

1. Mounting Method for Measuring NRC: No. 7 (mechanically mounted on special metal support), FS SS-S-118; or Type E-400 mounting as per ASTM E 795.

B. Sound Attenuation Performance: Provide acoustical ceiling units with ratings for ceiling sound transmission class (STC) of range indicated as determined according to AMA 1-II "Ceiling Sound Transmission Test by Two-Room Method" with ceilings continuous at partitions and supported by a metal suspension system of type appropriate for ceiling unit of configuration indicated (concealed for tile, exposed for panels).

C. Colors, Textures, and Patterns: As indicated by manufacturers' proprietary designations in the List of Finishes.

2.3 METAL SUSPENSION SYSTEMS, GENERAL

A. Standard for Metal Suspension Systems: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.

B. Finishes and Colors: Provide manufacturer's standard factory-applied finish for type of system indicated.

C. Attachment Devices: Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung unless otherwise indicated.

D. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

1. Gage: Provide wire sized so that stress at 3 times hanger design load (ASTM C 635, Table 1, Direct-Hung), will be less than yield stress of wire, but provide not less than 0.106-inch diameter (12 gage).

2. Hanger Rods: Mild steel, zinc coated, or protected with rust-inhibitive paint.

3. Flat Hangers: Mild steel, zinc coated, or protected with rust inhibitive paint.

E. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit type of edge detail and suspension system indicated.

F. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings composed of lay-in panels weighing less than 1 lb per sq. ft. and interior ceilings to receive high humidity finish, provide hold-down clips spaced 24 inches o.c. on all cross-tees.

2.4 MISCELLANEOUS MATERIALS

A. Concealed Acoustical Sealant: Nondrying, non-hardening, non-skinning, non-staining, nonbleeding, gunnable sealant complying with requirement specified in Division 07 Section "Joint Sealers"

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which ceiling system attaches or abuts, for compliance with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for preset inserts, clips, and other ceiling anchors whose installation is specified in other sections.

B. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Unless indicated otherwise on the Drawings, avoid use of less-than-half-width units at borders, and comply with reflected ceiling plans.

3.3 INSTALLATION

A. General: Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire-resistance rating requirements as indicated, and CISCA standards applicable to work.

B. Arrange acoustical units and orient directionally-patterned units (if any) in manner shown by reflected ceiling plans.

C. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers not less than 6 inches from each end and spaced 48 inches along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8 inch in 12 feet.

D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.

1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.

2. Screw-attach moldings to substrate at intervals not over 16" o.c. and not more than 3" from ends, leveling with ceiling suspension system to tolerance of 1/8" in 12'-0". Miter corners accurately and connect securely.

3.4 CLEANING

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

END

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SECTION 09 65 13 - RESILIENT BASE

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Resilient wall base

B. Related Requirements:

1. Section 09 65 19 "Resilient Tile Flooring"

2. Section 09 66 23 "Resinous Matrix Terrazzo Flooring"

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

1. For each type of product indicated, provide one hard copy of the operation and maintenance instructions.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 degrees F or more than 90 degrees F.

1.6 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 degrees F or more than 95 degrees F, in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.

2. During installation.

3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 degrees F or more than 95 degrees F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PRODUCTS

1.7 RESILIENT BASE

A. Basis-of-Design: 4 inch high resilient base made by Johnsonite or a comparable product - subject to requirements of this Section and accepted by Architect - made by another manufacturer

B. Traditional Wall Base with the following physical characteristics:

1. Manufactured from a proprietary thermoplastic rubber formulation.

2. Performance Requirements:

a. ASTM F 1861 Standard Specification for Resilient Wall Base, Type TP, Group 1.

b. ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm^2 or greater, Class I.

c. ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building Materials, Class A, Smoke <450.

d. Flexibility: Does not crack, break, or show any signs of fatigue when bent around a 1-1/4 inch diameter cylinder when tested according to ASTM F 137 Standard Test Method for Flexibility of Resilient Flooring Materials protocols.

e. Color Stability: Meets or exceeds ASTM F 1861 requirements for color stability when tested to ASTM F 1515 Standard Test Method for Measuring Light Stability of Resilient Flooring protocols.

3. For Traditional Rubber Wall Base 1/8 inch thick

a. Cove with Toe for resilient flooring and Straight (toeless) for carpet

b. Color: 20 Charcoal

c. Height: 4 inches

d. Length: 120 foot coils for 4 inch height

1.8 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated. Compounds shall have low VOC limits.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use interior sealants and adhesives compliant with Austin Energy® Green Building VOC limits for "Low-Emitting Materials" specified in its "2013 Commercial Rating Guidebook".

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

EXECUTION

1.9 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

1.10 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

1.11 INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.

2. Inside Corners: Use straight pieces of maximum lengths possible.

I. Place resilient accessories so they are butted to adjacent materials of type indicated and bond to substrates with adhesive. Install reducer strips at edges of flooring that otherwise would be exposed.

1.12 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.

2. Sweep and vacuum surfaces thoroughly.

3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Concrete masonry units (CMUs).
3. Insulated concrete forms.
4. Steel and iron.
5. Galvanized metal.

B. Related Requirements:

1. Section 05 12 00 "Structural Steel Framing" Section 05 12 13 "Architecturally Exposed Structural Steel Framing" for shop priming structural steel.
2. Section 05 50 00 "Metal Fabrications" for shop priming metal fabrications.

1.3 DEFINITIONS

A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. MPI Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
2. Indicate VOC content.

3. Submit Samples on rigid backing, 8 inches square.
4. Apply coats on Samples in steps to show each coat required for system.
5. Label each coat of each Sample.
6. Label each Sample for location and application area.

B. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. Dulux (formerly ICI Paints); a brand of AkzoNobel.
3. Kelly-Moore Paint Company Inc.
4. The Sherwin Williams Company

B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to products listed in the Interior Painting Schedule for the paint category indicated.

2.2 PAINT, GENERAL

A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

B. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.
4. Rust-Preventive Coatings: 100 g/L.
5. Pretreatment Wash Primers: 420 g/L.

D. Colors: As indicated in a color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

D. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
1. SSPC-SP 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

    a. Equipment, including panelboards[and switch gear].
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Plastic conduit.
    g. Tanks that do not have factory-applied final finishes.
    h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.

b. Uninsulated metal piping.
c. Uninsulated plastic piping.
d. Pipe hangers and supports.
e. Metal conduit.
f. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:

1. Latex System, Alkyd Primer MPI INT 5.1Q:

a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
b. Intermediate Coat: Latex, interior, matching topcoat.

c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.

2. Water-Based Dry-Fall System MPI INT 5.1C:

a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.

b. Prime Coat: Shop primer specified in Section where substrate is specified.

c. Topcoat: Dry fall, latex (MPI Gloss Level 5), MPI #226.

B. Galvanized-Metal Substrates:

1. Latex System MPI INT 5.3A:

a. Prime Coat: Primer, galvanized, water based, MPI #134.

b. Intermediate Coat: Latex, interior, matching topcoat.
c. Topcoat: Latex, interior, low sheen.

C. Concrete Substrates, Nontraffic Surfaces:

1. Water-Based Concrete Floor Sealer System MPI INT 3.2G:

a. First Coat: Sealer, water based, for concrete floors, matching topcoat.
b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

D. CMU/Insulated Concrete Form Substrates:

1. Latex System MPI INT 4.2A:

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

b. Intermediate Coat: Epoxy, interior, matching topcoat.

c. Topcoat: Epoxy, interior, low sheen (MPI Gloss Level 5), MPI #54.

2. High-Performance Architectural Epoxy System MPI INT 4.2D (Showers, dish and sink areas):

a. Block Filler: Block filler, latex, interior/exterior, MPI #4.

b. Prime Coat: Primer, alkali resistant, water based, MPI #3.

c. Intermediate Coat: Water based epoxy, interior, high performance architectural, matching topcoat.

d. Topcoat: Water based epoxy, interior, high performance architectural, semi-gloss (MPI Gloss Level 5), MPI #141.

END

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GENERAL

1.1 SUMMARY

A. Section includes room-identification signs that are directly attached to the building.

B. Section includes aluminum letters at restroom entrances.

1.2 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.3 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For room-identification signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

4. Include representative Samples of available typestyles and graphic symbols.

   a. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
5. Variable Component Materials: 8-inch Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
6. Exposed Accessories: Half-size Sample of each accessory type.
7. Full-size Samples, if approved, will be returned to Contractor for use in Project.

C. Product Schedule: For room-identification signs.

1.5 INFORMATIONAL SUBMITTALS

Qualification Data: For manufacturer.

Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

Maintenance Data: For signs to include in maintenance manuals.

1.7 QUALITY ASSURANCE

Installer Qualifications: Manufacturer of products.

1.8 FIELD CONDITIONS

Field Measurements: Verify locations of anchorage devices and embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Deterioration of finishes beyond normal weathering.
    b. Deterioration of embedded graphic image.
    c. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PRODUCTS

1.10 PERFORMANCE REQUIREMENTS

Accessibility Standard: Comply with applicable provisions in 2012 Texas Accessibility Standards.

1.11 ROOM-IDENTIFICATION SIGNS

Room-Identification Sign: with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Building Image Group, 1200 E 3rd St, Austin, TX 78702, (512) 494-1466.
   a. Surface-Applied Graphics: Raised: City of Austin logo.
   b. Subsurface Graphics: Reverse etch image.
   c. Color(s): As selected by Architect from manufacturer's full range.

2. Frame:

   a. Material: Aluminum.
   b. Material Thickness: 1/4”.
   c. Profile: Raised letters, symbols.
   d. Finish and Color: Match Architect's sample.

3. Mounting: Surface mounted to wall with concealed anchors.
4. Text and Typeface: Accessible raised characters and Braille typeface matching Architect's sample and variable content. Finish raised characters to contrast with background color, and finish Braille to match background color.

1.12 SIGN MATERIALS

Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

1.13 ACCESSORIES

Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. For exterior exposure, furnish stainless-steel or hot-dip galvanized devices unless otherwise indicated.
3. Exposed Metal-Fastener Components, General:

   a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
   b. Fastener Heads: Use oval countersunk screws and bolts with tamper-resistant Allen-head one-way-head slots unless otherwise indicated.

4. Sign Mounting Fasteners:

   a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
   b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.

1.14 FABRICATION

General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.

Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

Subsurface-Etched Graphics: Reverse etch back face of clear face-sheet material. Fill resulting copy with manufacturer's standard enamel. Apply opaque manufacturer's standard background color coating over enamel-filled copy.

1.15 GENERAL FINISH REQUIREMENTS

Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

1.16 ALUMINUM FINISHES

Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

EXECUTION

1.17 INSTALLATION

General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.

2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard 2012 TAS.

Mounting Methods:

4. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

5. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.

1.18 ADJUSTING AND CLEANING

Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

Remove temporary protective coverings and strippable films as signs are installed.

On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguishers.

B. Related Requirements:

1. Section 10 44 16 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.

B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples for Verification: For each type of exposed finish required, prepared on Samples 6 by 6 inches square.

D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

1.6 SEQUENCING

A. Apply decals on field-painted fire-protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 FIRE-PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. JL Industries, Inc.; a division of the Activar Construction Products Group.
   b. Larsens Manufacturing Company.
   c. Nystrom, Inc.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

1. Shelf: Same metal and finish as cabinet.

D. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Steel sheet.

G. Door Style: Center glass panel with frame.

H. Door Glazing: Wire glass.

I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide projecting lever handle with cam-action latch.

2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
3. Door Lock: Cam lock that allows door to be opened during emergency by pulling sharply on door handle.
4. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect.

    a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

        1) Location: Applied to cabinet door.
        2) Application Process: Etched.
        3) Lettering Color: Red.
        4) Orientation: Vertical.

5. Alarm: Manufacturer's standard alarm that actuates when fire-protection cabinet door is opened and that is powered by batteries.

6. Extinguisher Bracket for Chases: B2-10. Surface mounted.

K. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

    a. Finish: Baked enamel or powder coat.
    b. Color: As selected by Architect from full range of industry colors and color densities.
2. Wire Glass: ASTM C 1036, Type II, Class 1, Form 1, Quality q8, Mesh m1 (diamond), 6 mm thick.

2.2 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
2. Fabricate door frames of one-piece construction with edges flanged.
3. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.3 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

1. Fire-Protection Cabinets: 54 inches above finished floor to top of cabinet.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Provide inside latch and lock for break-glass panels.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

C. Identification: Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers

B. Related Requirements:

1. Section 10 44 13 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure of hydrostatic test according to NFPA 10.
    b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. JL Industries, Inc.; a division of the Activar Construction Products Group.
    b. Larsens Manufacturing Company.
    c. Nystrom, Inc.

2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type: UL-rated 2.5 lb. nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END

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PART 1 GENERAL

1. RELATED DOCUMENTS

a. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

2. SUMMARY

a. Section Includes:

1) Quartz agglomerate surfacing countertops.

2) Quartz agglomerate backsplashes.

3) Quartz agglomerate endsplashes.

4) Quartz agglomerate vanities.

5) Quartz agglomerate window sills

6) Adhesives and sealants.

b. Related Requirements:

1) Section 05 50 00 "Metal Fabrications"

2) Section 06 10 00 "Rough Carpentry"

3) Section 07 92 00 "Joint Sealants"

3. REFERENCES

a. Reference Standards:

1) ASTM C 97: Standard Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone.

2) ASTM C 170: Standard Test Method for Compressive Strength of Dimension Stone.

3) ASTM C 501: Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic tile by the Taber Abraser.

4) ASTM C 834: Standard Specification for Latex Sealants.

5) ASTM C 920: Standard Specification for Elastomeric Joint Sealants.

6) ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

7) ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials

8) NEMA LD-3: High Pressure Decorative Laminates.

9) NSF/ANSI Standard 51: Food Equipment Materials.

10) ISO: International Organization for Standardization.

11) ISO 9001: Quality Management Systems.

12) SCAQMD Rule 1168: Adhesive and Sealant Applications.

13) UL 2818: GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings.

4. SUBMITTALS

a. Product Data:

1) Submit product data for each specified product. Include manufacturer's technical data sheets and published instruction instructions.

2) Submit Safety Data Sheets (SDS) for adhesives and sealants.

b. Shop Drawings:

1) Submit fully-dimensioned shop drawings showing countertop layouts, backsplashes, endsplashes, vanities, window sills, joinery, edge conditions, terminations, substrate construction, cutouts and holes. Show plumbing installation provisions. Include elevations, section details, and large scale details.

c. Samples:

1) Submit selection and verification samples for each color and pattern required.

d. Quality Assurance Submittals:

1) Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties, if required.

2) Warranty: Specimen copy of specified warranty.

e. Closeout Submittals:

1) Maintenance Data: Submit manufacturer's published Care & Maintenance manual with closeout submittals.

5. REGULATORY REQUIREMENTS

a. Accessibility Requirements: Comply with 2012 Texas Accessibility Standards (TAS) and U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines for Buildings and Facilities.

b. Adhesives, Sealants, and Sealant Primers:

1) SCAQMD (South Coast Air Quality Management District) Rule 1168.

6. QUALITY ASSURANCE

a. Qualifications:

1) Manufacturing Facility Qualifications: Quartz surfacing materials produced in an ISO 9001 certified facility.

2) Fabricator Qualifications: Minimum of five years documented experience in fabricating quartz surfacing countertops similar in scope and complexity to this Project, using water-cooled cutting tools. Currently certified by the manufacturer as an acceptable fabricator.

3) Installer Qualifications: Minimum of five years documented installation experience for projects similar in scope and complexity to this Project, and currently certified by the manufacturer as an acceptable installer. Installer shall be the fabricator**.**

7. DELIVERY, STORAGE, AND HANDLING

a. Delivery and Handling: Comply with manufacturer's recommendations for shipping and handling quartz surfacing materials to preclude breakage or damage. Brace quartz surfacing units as necessary during shipment, transporting in near-vertical position with finished face towards finished face. Do not allow finished surfaces to rub during shipping and handling.

b. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer. Store quartz surfacing sheet materials on racks in near-vertical position to preclude damage. Store with finished face turned towards finished face. Prevent warpage and breakage.

8. PROJECT CONDITIONS

a. Field Measurements: Verify actual measurements and openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

b. Adhesive: Acclimate adhesives to occupancy room temperatures with maximum temperature not to exceed 75 degrees F.

9. WARRANTY

a. Manufacturer's Limited Warranty: Provide manufacturer's standard 10 Year Commercial and Residential Limited Warranty against defects in quartz surfacing sheet materials.

PART 2 PRODUCTS

1. QUARTZ SURFACING SHEET MATERIAL

a. Basis-of-Design: "Wilsonart Quartz" made by Wilsonart

b. Composition: 93 percent quartz aggregate combined with polyester resin binders and proprietary pigments that are fabricated into slabs using vacuum vibrocompaction technology.

c. Material Thickness:

1) Product Type 062 - 0.79 inch (2 cm), nominal

2) Product Type 063 - 1.18 inch (3 cm), nominal

d. Material Weight: 15 lbs./ft^2 for 3 cm thick surfacing.

e. Countertop Dimensions: [Indicated on Drawings

f. Vanity Dimensions: Indicated on Drawings

g. Window Sill Dimensions: Indicated on Drawings

h. Conformance Standards:

1) NSF/ANSI Standard 51.

i. Physical Characteristics:

1) Flexural Strength: Greater than 4,500 psi; ASTM D 790.

2) Flexural Strain: Less than 0.375 percent; ASTM D 790.

3) Flexural Modulus: Greater than 3.75 MPsi; ASTM D 790.

4) Stain Resistance (24 Hour): No effect to moderate effect; NEMA LD-3.

5) Abrasion Resistance: Greater than 100 in.-lbs.; ASTM C 501.

6) Density: Greater than 2.1 g/cm_3; ASTM C 97.

7) Compressive Strength (One Axis - Dry): Greater than 20,000 psi; ASTM C 170.

8) Moisture Absorption: Maximum 0.022 percent; ASTM C 97.

j. Quartz Finish: Polished finish with Glossometer reading greater than 45.

k. Color and Pattern: SERENE Q1001 (4)

l. Edge Detail: Architect will select from manufacturer's standard details

2. ACCESSORY MATERIALS

a. Joint Adhesive: Methacrylate-based adhesive for chemically bonding quartz surfacing seams. Color complementary to quartz surfacing sheet material. UL 2818 GREENGUARD Gold certified and complies with SCAQMD Rule 1168.

1) Basis of Design: "Wilsonart Hard Surface Adhesive"

2) Other Acceptable Products: Pigmented knife grade adhesives suitable for use with quartz surfacing are also acceptable.

b. Elastomeric Sealant: Mildew-resistant silicone sealant for filling gaps between countertops and terminating substrates in wet environment applications. Complies with ASTM C 920, Type S (single component), Grade NS (nonsag).

1) Product: Acceptable to countertop manufacturer.

2) Color: Complementary to quartz surfacing color.

c. Siliconized Acrylic Sealant: Siliconized acrylic latex sealant. For general applications to fill gaps between countertops and at terminating substrates. Complies with ASTM C 834, Type OP, Grade NF, and SCAQMD Rule 1168.

1) Product: "Wilsonart Color Matched Caulk".

2) Color: Complementary to quartz surfacing color.

d. Construction Adhesive: Countertop manufacturer's recommended silicone-based construction adhesive for backsplashes, endsplashes, and other applications according to manufacturer's published fabrication instructions.

3. FABRICATION

a. Fabricate components in shop, to greatest extent practicable, in sizes and shapes indicated according to approved shop drawings and Wilsonart Quartz Fabrication Manual.

b. Form joint seams between quartz surfacing components with specified seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions.

c. Provide holes and cutouts for plumbing fixtures and accessories indicated on approved shop drawings. Rout cutouts and finish edges smooth.

PART 3 EXECUTION

1. EXAMINATION

a. Examine substrates and conditions that could adversely affect the work of this Section.

b. Substrates must be sound, flat, smooth, and free from dust or other surface contaminants.

c. Commencement of work will constitute acceptance of substrates and conditions to receive the work.

2. COUNTERTOP AND VANITY INSTALLATION

a. Install quartz surfacing components plumb, level, and true according to approved shop drawings and manufacturer's published installation instructions. Use woodworking and specialized fabrication tools acceptable to manufacturer.

   1) Fasten quartz surfacing components to base cabinets or other supporting substrates with suitable adhesives acceptable to manufacturer.

b. Form joint seams with specified seam adhesive. Seams to be inconspicuous in completed work. Seams in locations shown on approved shop drawings and acceptable to manufacturer. Promptly remove excess adhesive.

   1) Clamp or brace quartz surfaces in position until adhesive sets.

c. Fill gaps between countertop and terminating substrates with specified silicone sealant.

d. Install backsplashes and endsplashes where indicated on Drawings. Adhere to countertops with specified construction adhesive.

e. Vanities: Secure front panels to solid substrate with specified construction adhesive.

   1) Accessible Vanities: Angled front to permit wheelchair access to comply with referenced accessibility standard.

3. WINDOW SILL INSTALLATON

a. Install window sills for full length of each window unit, securing to substrates with concealed fasteners and specified adhesive.

b. Provide minimum 1/8 inch expansion gap on both sides of window sills. Fill gap with specified joint sealant.

c. Completed work to be plumb, level, and true, with edges eased and smooth.

4. REPAIRS

a. If permissible to Architect, minor surface marring for quartz surfacing components may be repaired according to manufacturer's published installation instructions.

b. Remove and replace quartz surfacing components that are damaged and cannot be satisfactorily repaired.

5. CLEANING AND PROTECTION

a. Clean quartz surfacing components according to manufacturer's published maintenance instructions. Completely remove excess adhesives and sealants from finished surfaces.

b. Protect completed work from damage during remainder of construction period.

END

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