# CITY OF AUSTIN
## Public Works Department

# PROJECT MANUAL
## Contract Documents and Technical Specifications

## VOLUME 2 of 3
## City of Austin
## Contract Documents

# Wastewater Collection System
# Replacement Lines – North

**C.I.P. PROJECT NUMBER: 2231.265 and 2231.266**
**SOLICITATION NUMBER: CLMC738**

STATE OF TEXAS
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10/1/2019

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**Public Works Department**
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*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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**VOL. 3 of 3** 03/01/17 **MBE/WBE Procurement Program Package**


**END**

# SCOPE OF WORK
# FOR
# ASBESTOS ABATEMENT
# ACTIVITIES

## IN SUPPORT OF

## WASTEWATER COLLECTION SYSTEM REPLACEMENT LINES

## GROUP A – SPICEWOOD SPRINGS ROAD

## AUSTIN, TEXAS

**BY**
**CITY OF AUSTIN**
**BUILDING SERVICES DEPARTMENT**
**AUSTIN, TEXAS 78702**
**(512) 974-7154**

**JANUARY 29, 2019**

## DIVISION 1 - GENERAL REQUIREMENTS


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C Wade Mullin 1.29.19

C. Wade Mullin
Licensed Asbestos Consultant
License Number 10-5093
Expiration Date 2/7/2021

**SECTION 1901**

**SCOPE OF WORK**
**ASBESTOS ABATEMENT**

## PROJECT/WORK IDENTIFICATION

Project name is Asbestos Abatement in support of the **Wastewater Collection System Replacement Lines Group A- Spicewood Springs.**

## PART 1 - GENERAL:

This project is to be conducted in accordance with the Texas Asbestos Health Protection Act, as amended, Chapter 1954, Texas Occupations Code, effective June 1 2003, formerly Texas Civil Statues, Article 4477-3a, 29 CFR 1910.1001, 29 CFR 1926.1101, 40 CFR part 763 subpart G and 40 CFR part 61 subpart M.

The location and approximate quantities of asbestos materials provided in these specifications are estimates only and do not include any hidden materials not identified. The Contractor is responsible to field verify for actual quantities which these plans and specifications represent. No additional compensation will be made to the Contractor(s) for differences between the estimated quantities and the actual quantities unless prior written approval is obtained from the Owner or his representative.

The Contractor's asbestos abatement workers shall have the appropriate certifications, licenses, and training for asbestos abatement work and supervision in the State of Texas.

### 1.01 Summary of Work:

Briefly and without force and effect upon the contract documents, the work of the contract can be summarized as follows:

The purpose of this item is to remove and dispose of asbestos containing materials (ACM) associated with asbestos containing (AC) transite pipe for the **Wastewater Collection System Replacement Lines Group A- Spicewood Springs.**

The Contractor is required to assist the general contractor in removing the following AC pipe quantities in these locations;

> **approximately 10-13 linear feet of 10 inch diameter AC pipe along Spicewood Springs Road located approximately 12 feet deep**

**The asbestos contractor will assist with any connections, removal of segments and all taps and tie-ins to AC pipe. Any AC pipe scheduled to be abandoned will be properly grouted per CoA specifications.** The contractor will remove and dispose of as ACM all asbestos cement pipe and debris using the procedures as outlined below. In addition, the contractor is to assist with any connections to existing asbestos cement piping.



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The Contractor shall conduct all abatement work in accordance with the current revisions to the Texas Department of Health Rules, T.A.H.P.R. dated March 2003.

Asbestos Superintendent: Provide a full-time Asbestos Superintendent on site who is licensed in accordance with Texas Civil Statutes, Article 4477-3a, paragraph 289.144, and all adoptions to Article 4477-3a, and experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by OSHA in 29 CFR 1926.1101 for the Contractor and is the Contractor's representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to asbestos containing materials.

Asbestos Workers: All workers actively involved in the removal and replacement of asbestos material will be Licensed Asbestos Workers with the State of Texas.

**Removal of AC Water and/or Wastewater Lines**

The Contractor shall establish a regulated area with caution tape surrounding the work area and place a drop cloth consisting of six mil thick sheet plastic below the pipe where it will be cut or otherwise disturbed. The Contractor can use a hammer and chisel to split the top and bottom of the couplings (collars) on each end so that an entire section of pipe can be removed. The couplings shall be kept wet with amended water (water to which a surfactant has been added) or a removal encapsulant while this is being done. Once this has been accomplished, the section of pipe and the couplings can be removed from the trench and wrapped in two layers of true six mil thick sheet plastic. Completely seal the sheet plastic with duct tape and duct tape any tears in the plastic. The Contractor is not allowed to use high speed saws to cut the pipe at any time. If needed, hand operated cutters or chain mounted snap cutters can be used as long as the area to be cut is kept wet with amended water or a removal encapsulant during this process. As stated above, if the Contractor chooses to use a hand operated cutter or chain mounted snap cutter, a drop cloth consisting of six mil thick sheet plastic shall be placed below the area to be cut. All debris collected on the drop cloth as well as the drop cloth itself, shall be kept wet during removal and promptly placed into a disposal bag and sealed using duct tape at the completion of the removal process. All visible debris located in the trench shall also be placed into a disposal bag. Once this has been accomplished, the disposal bag containing the debris and the drop cloths shall be placed into another disposal bag and sealed using duct tape. All protective clothing worn by the Contractor and their personnel shall also be placed in disposal bags. At the end of the project, the Contractor shall discard their respirator filters as ACM by disposing of them in disposal bags. The disposal bags used to contain all asbestos containing debris, drop cloths, protective clothing, and respirator filters shall adhere to the following guidelines:

Disposal Bags: Provide 6 mil thick leak-tight polyethylene bags labeled with three labels with text as follows:

First Label:

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID OPENING OR BREAKING CONTAINER
BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

Second Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's



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Hazard Communication standard:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR
ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

Third Label: Provide in accordance with U.S. Department of Transportation Regulation on hazardous waste marking. 49 CFR parts 171 and 172. Hazardous Substances: Final Rule:

RQ HAZARDOUS
SUBSTANCE,
CLASS 9,
NA2212, PG III
(ASBESTOS)

**All transporters of asbestos containing materials shall be licensed by the Department of State Health Services.**

**The Contractor shall label all piping wrapped in true six mil thick sheet plastic with the same type of labeling as the disposal bags.**

All equipment used on this project ( i.e. HEPA-vacuums ) shall be free of any visible debris and operational. The Owner's Representative along with the Contractor's designated supervisor shall inspect all equipment prior to it being brought into the work area. If any debris found on the equipment is suspected to be ACM, the equipment shall be wet wiped and decontaminated. **The decontamination of the equipment shall not take place on the project site.**

**If applicable, all taps to existing water lines are to be conducted using wet/pressure tapping. Once the taps are made the hydrants shall be flushed on both sides of the work area to help prevent contamination of the water supply. Installing a wastewater service in AC pipe shall be done by removing a full section of pipe and installing a "tee". Replace the remainder of pipe as specified.**

All removal work associated with the ACM piping shall be done using the appropriate worker protection and respiratory protection as stated below as a minimum:

**The minimum respiratory protection during removal will be half face dual cartridge respirators equipped with HEPA cartridges. The Contractor shall provide information to assure that the above respiratory protection is sufficient in accordance with 29 CFR 1926.1101 negative exposure assessment requirements.**

The abatement must comply with these Specifications, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), State of Texas and local regulations. Whenever there is a conflict or overlap of the above references, the most stringent provisions are applicable.



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The Contractor shall submit a work plan detailing the work procedures they will employ. This work plan shall be reviewed and approved by the Owner's Representative prior to any removal work.

The Contractor shall provide all workers working in the vicinity of active electrical sources with appropriate protective equipment including insulating gloves, boots, and non-conductive tools (while HEPA-Vacuuming).

The Contractor will inform the Owner and Owner's Representative of any hidden or unidentified conditions which may result in a change order or additional cost to the bid price of the contract. This notice will require written approval by the Owner's Representative prior to accomplishing the additional work.

The Contractor will be required to repair any damage to the facility or equipment of the Owner as the result of the abatement project. Any replacement items (paint, panels, etc.) will be of equal quality and color of the damaged items. This work shall be accomplished at the completion of the abatement project and prior to the Owner re-occupying the space. The project will not be considered complete until the repair work has been done and found acceptable by the Owner.

All asbestos containing materials shall be wetted with amended water or a removal encapsulant prior to and during the removal. The contractor can start the removal process after the Owner's Representative is satisfied that the ACM has been adequately wetted. The Owner's Representative has been given the authority to present the contractor with either a written or verbal Stop Work Order if they notice that any ACM is being removed without it being adequately wetted or if they become aware of any deviation from the project specifications or Department of State Health Services Regulations.

**Final clearance for asbestos abatement work shall be obtained by PCM method as outlined in Section 01915.** Upon successful completion of required work activities the Owner's Representative shall visually inspect the work area for final clearance. Downwind area air samples collected during abatement can be used as final clearance samples if they do not exceed 0.01 f/cc by Phase Contrast Microscopy analysis.

All equipment used on this project ( i.e. HEPA-vacuums, negative air machines ) shall be free of any visible debris and operational. The Owner's Representative along with the contractor's designated supervisor shall inspect all equipment prior to it being brought into the work area. If any debris found on the equipment is suspected to be ACM, the equipment shall be wet wiped and decontaminated. The decontamination of the equipment shall not take place on the project site.

The Contractor shall adequately staff this project such that it will be completed in accordance with the Contract Documents. If the project is not completed within this time frame, the Owner will backcharge the Contractor for any charges incurred by the Owner for additional Owner Representative services required to complete this project.

**The Contractor shall submit the names and resumes (including pertinent project experience) of at least two (2) properly licensed supervisors to be used to conduct this asbestos abatment project. If the supervisors submitted are approved by the Owner, the Contractor shall ensure that at least one of these project supervisors are on site throughout the project including final tear down operations. The Contractor shall not substitute an approved project supervisor without the prior approval of the Owner.**



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All Contractor worker and supervisory personnel at the work site shall properly trained, equipped and possess valid and current Texas Department of State Health Services Asbestos Licenses and associated training certificates. During all phases of this project, the Contractor project site supervisor shall remain at the project site during all work activities.

The Contractor shall submit a work plan detailing the work procedures they will employ. This work plan shall be reviewed and approved by the Owner's Representative prior to any removal work.

The Contractor shall provide all workers working in the vicinity of active electrical sources with appropriate protective equipment including insulating gloves, boots, and non-conductive tools (while HEPA-Vacuuming).

The abatement must comply with these Specifications, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), State of Texas and local regulations. Whenever there is a conflict or overlap of the above references, the most stringent provisions are applicable.

The Contractor will inform the Owner and Owner's Representative of any hidden or unidentified conditions which may result in a change order or additional cost to the bid price of the contract.

This notice will require written approval by the Owner's Representative prior to accomplishing the additional work.

## ASBESTOS ABATEMENT

During the Work, the City or the City's Representative will provide a licensed asbestos inspector to oversee the Contractor's abatement work, collect area samples, and identify asbestos-containing materials. The Contractor shall coordinate the abatement schedule with the asbestos inspector such that the inspector can be present at key times during the abatement and identify asbestos-containing materials as soon as suspect material is encountered. The Contractor shall also accept all City Representative decisions regarding the presence of asbestos-containing materials. **The contractor shall conduct their own required employee monitoring for asbestos related activities in conformance with OSHA requirements.**

The Contractor shall notify the City's Representative asbestos inspector of any suspected asbestos-containing materials encountered during the work as soon as it is discovered.

The Contractor shall abate or contain for disposal all asbestos-containing materials encountered during the equipment dismantling work if abatement or containment is required to prevent asbestos release during dismantling.

Where asbestos-containing materials requiring abatement are encountered during the project, the Contractor shall stop work and abate the material or otherwise contain it for disposal as necessary. Until abatement can be performed, the Contractor shall take actions as necessary and feasible to protect workers from exposure to airborne asbestos and prevent disturbance of the material. The contractor will establish a regulated area until such time as the area or equipment can be abated.

The Contractor shall provide personnel to perform the surveillance of asbestos abatement



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containment areas 24 hours per day, 7 days per week during the operation of ventilation units. The duties of such personnel shall include maintenance of pressure differential containment and regular inspection of the work areas for fire prevention and prevention of incidents which could cause the release of materials.

**ASBESTOS CONTAINING MATERIALS**

The following asbestos containing materials are known to be present at a work site on Spicewood Springs Road as listed below. If any other materials are found, which are suspected of containing asbestos notify immediately the Owner's Representative. The amount of ACM listed below are approximate. The Contractor shall field verify the quantities.

| LOCATION | ITEM | APPROXIMATE AMOUNT | TYPE OF ASBESTOS |
|---|---|---|---|
| Spicewood Springs Rd | AC Pipe | 13 LF(10") | est 50% Chrysotile |

**1.02 INSPECTION:**

Prior to commencement of work, inspect all areas in which work will be performed. Prepare a listing of damage to structure, surfaces, equipment or of surrounding properties which could be misconstrued as damage resulting from the work. Photograph or video tape existing conditions as necessary to document conditions. Submit to Owner's Representative prior to starting work.

**1.03 PLAN OF ACTION:**

Submit a detailed plan of the procedures proposed for use in complying with the requirements of this Specification. Include in the plan the location and layout of decontamination areas, the sequencing of asbestos work, the interface of trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the site, disposal plan including location of approved disposal site, and a detailed description of the methods to be employed to control pollution. Expand upon the use of portable HEPA ventilation system, closing out of the area HVAC system, method of removal to prohibit visible emissions in work area, and packaging of removed asbestos debris. The plan must be approved by the Owner's Representative prior to commencement of work.

**1.04 POTENTIAL ASBESTOS HAZARD:**

The disturbance or dislocation of asbestos containing materials may cause asbestos fibers to be released into the building's atmosphere, thereby creating a potential health hazard to workmen and building occupants. Apprise all workers, supervisory personnel, subcontractors and consultants who will be at the jobsite of the seriousness of the hazard and of proper work procedures which must be followed.

Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified



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asbestos containing materials, take appropriate continuous measures as necessary to protect the building from the contamination with airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state and local agencies.

## 1.05 CONTRACTOR USE OF PREMISES:

General: The Contractor shall limit his use of the premises to the work indicated.

Use of the Site: Confine operations at the site to the areas permitted under the contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project abatement.

Keep existing driveways, parking spaces and entrances serving the premises clear and available to the Owner and his employees at all times.

Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage to areas indicated at the pre-abatement meeting.

Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place or accessible to unauthorized persons.

Use of existing toilets within the building by the Contractor and his personnel, will not be permitted.

Owner Occupancy: The building will not be occupied by the Owner during the asbestos abatement project.

## 1.06 SUBMITTALS

The Contractor shall prepare an Asbestos Abatement Plan and submit it to the City with the Contractor's Health and Safety Plan (HASP) prior to mobilization. The Asbestos Abatement Plan shall include the following information:

Discussion of the general plan for containment around equipment to be abated, decontamination plans, and waste management procedures.

Drawings showing general containment, decontamination, and bag out facility plans.

Contractor's work schedule, including a plan for sequencing work around areas or individual pieces of equipment that require asbestos abatement.

Waste containment plan, describing how the Contractor will abate particular pieces of equipment.

A plan for protecting the safety of workers and visitors in the surrounding areas.

A fire and containment protection plan, including emergency procedures and contacts.



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Current copies of all applicable permits, licenses, certifications, training documents, and regulatory notices.

List of asbestos abatement workers with social security numbers

Certificates of worker acknowledgement

Medical examination results

Before the Start of Work: Submit the following to the Owner and Owner's Representative for review. Do not begin work until these Submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use or final-but-restricted use. ***Allow 3 days time for review of submittals.***

**A.** **Plan of Action:** Submit as a written report.

**B.** **Inspection:** Submit written report on inspection carried out as required by this section. Include copies of all photographs, videotapes, etc.

**C.** **Alternative Methods:** Submit, in writing, any alternative methods proposed to accomplish the work of this contract.

**D.** Submit copies of valid and current Texas Department of State Health Services Asbestos Licensing and associated training certificates for all worker and supervisory personnel at the work site. In addition, copies of the appropriate DOT certifications required for the manifesting and transporting of hazardous materials must be submitted.

## SPECIAL SPECIFICATIONS

***In addition to the work procedures outlined in the Master Specification which apply to the project described herein, the following Special Specifications apply:***

***The contractor shall conduct all abatement work in accordance with the current revisions to the Department of State Health Services Rules, T.A.H.P.R. dated March 2003.***

**END OF SECTION**



1-29-19

## SECTION 01902

## PROJECT COORDINATION

### PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division-1 Specification sections, apply to work of this section.

### 1.02 ABATEMENT TIME:

The use of insufficient labor or equipment for abatement purposes or inadequate scheduling of materials or equipment will not be allowed as cause for delay. Extension of time or extra cost will not be allowed for failure to complete the project on time due to insufficient labor or equipment.

### 1.03 ADMINISTRATIVE AND SUPERVISORY PERSONNEL:

General Superintendent: Provide a full-time General Superintendent on site who is licensed in accordance with Texas Civil Statutes, Article 4477-3a, paragraph 289.144, and all adoptions to Article 4477-3A, and experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by OSHA in 29 CFR 1926 for the Contractor and is the Contractor's representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to asbestos containing materials.

Asbestos Workers: All workers actively involved in the removal and replacement of asbestos material will be Licensed Asbestos Workers with the State of Texas.

### 1.04 PROGRESS MEETING

In addition to specific coordination and pre-construction meetings, and other regular project meetings held for other purposes, the Owner's Representative will hold general progress meetings as required. The meetings will be attended by a representative of the contractor authorized to make decisions for the contractor.

### 1.05 PRE-CONSTRUCTION CONFERENCE:

An initial progress meeting, recognized as the "Pre-Construction Conference" will be convened by the Owner and the Owner's Representative prior to the start of any work. The meeting will be attended by the general superintendent of the contractor, Owner's Representative(s), project administrator, and other entities concerned with the asbestos abatement work.

### 1.06 DAILY LOG

General: Maintain within the decontamination unit a daily log documenting the dates and time of, but not limited to, the following items:
Personnel, by name, entering and leaving the work area, air monitoring results, and any equipment/supplies decontaminated and brought out through the decontamination unit.

## 1.07 SPECIAL REPORTS:

General: Except as otherwise indicated, submit special reports directly to the Owner's Representative or the Owner within one day of occurrence requiring special report, with copy to others affected by occurrence.

Reporting Unusual Events: When an event of unusual and significant nature occurs at site (examples: failure of negative pressure system, rupture of temporary containments), prepare and submit a special report listing chain of events, persons participating, response by contractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise Owner in advance at earliest possible date.

Reporting Accidents: Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

## 1.08 CONTINGENCY PLAN:

Contingency Plan: Prepare a contingency plan for emergencies including fire, accident, power failure, negative air system failure, or any other event that may required modification or abridgment of decontamination or work area isolation procedures. Include in plan specific procedures for decontamination or work area isolation. Note that nothing in this specification should impede safe exiting or providing of adequate medical attention in the event of an emergency.

Post: In clean room of the personnel decontamination unit telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital, police, power company, telephone company.

## 1.09 NOTIFICATIONS

Notify other entities at the job site of the nature of the asbestos abatement activities, location of asbestos containing materials, requirements relative to asbestos set forth in these specifications and applicable regulations.

Notify Emergency Service Agencies including fire, police, ambulance or other agency that may service the abatement work site in case of an emergency. Notification is to include methods of entering work area, emergency entry and exit locations, and other information needed by agencies providing emergency services.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION (Not Applicable)

**- END OF SECTION -**

## SECTION 01904

## CODES AND REGULATIONS

### PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the contract, and other Division-1 Specification sections, apply to work of this section.

### 1.02 DESCRIPTION OF THE WORK:

This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specification. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.

Requirements include adherence to work practices and procedures set forth in applicable codes, regulations and standards.

Requirements include obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with codes, regulations and standards.

### 1.03 CODES AND REGULATIONS:

General Applicability of Codes, Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

Contractor Responsibility: The contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State and local regulations. The contractor shall hold the Owner and Owner's Representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees, or his subcontractors.

Federal Requirements: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:

Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; Final rules, Title 29, Part 1910, section 1001 and part 1926, Section 1101 of the Code of Federal Regulations

Respiratory Protection; Title 29, Part 1910, Section 134 of the Code of Federal Regulations Construction Industry; Title 29, Part 1926, of the Code of Federal Regulations

Construction Industry
Title 29, Part 1926 of the Code of Federal Regulations

Access to Employee Exposure and Medical Records, Title 29, Part 1910, Section 2 of the Code of Federal Regulations

Hazard Communication; Title 29, Part 1910, Section 1200 of the Code of Federal Regulations

Specifications for Accident Prevention Sign and Tags; Title 29, Part 1910, Section 145 of the Code of Federal Regulations

U.S. Department of Transportation:

Hazardous Substances
Title 49, Part 171 and 172 of the Code of Federal Regulations

U.S. Environmental Protection Agency (EPA) including but not limited to:

Asbestos Abatement Projects Rule 40

40 CFR Part 763

CPTS 62044, FRL 2843-9

Title 34, Part 231, Appendix C, Procedures for Containing and Removing Building Materials Containing Asbestos

Title 40, Part 61, Sub-part A of the Code of Federal Regulations National Emission Standard for Asbestos

Title 40, Part 61, Sub-part M (Revised Sub-part B) of the Code of Federal Regulations

American National Standards Institute (ANSI) Publication:

Z9.2-79 Fundamentals Governing the Design and Operation of Local Exhaust Systems

American Society for Testing and Materials (ASTM) Publication:

E 849-82 Safety and Health Requirements relating to Occupational Exposure to Asbestos

State Requirements: Texas Civil Statues, Article 4477-3a, and all adoptions, (TAHPR) Asbestos Exposure in Public Buildings, requires licensure of persons engaged in the removal or encapsulation of asbestos, or other asbestos related activities in all buildings of public occupancy or access.

Local Requirements: Abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

## 1.04 STANDARDS:

General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.

Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all standards pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying area adjacent to the site. The Contractor shall hold the Owner and the Owner's Representative harmless for failure to comply with any applicable standard on the part of himself, his employees, or his sub-contractors.

Standards: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

American National Standards Institute (ANSI)
1430 Broadway
New York, New York 10018
(212) 354-3300

Fundamentals Governing the Design and Operation of Local Exhaust Systems Publication Z9.2-79

Practices for Respiratory Protection
Publication Z288.2-80

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103
215/299-5400

Safety and Health Requirements Relating to Occupational Exposure to Asbestos E 849-82

Specification for Encapsulants for Friable Asbestos Containing Building Materials Proposal P-189

"Guide" Specification - 02080 Asbestos Removal AIA Service Corporation
1735 New York Avenue NW
Washington, DC

AWCI Guide Specifications for the abatement of asbestos release from spray-or trowel applied materials in buildings and other structural designs

U.S. Department of Commerce

National Institute of Standards & Technology

National Engineering Lab

Center for Building Technology

## 1.05 EPA GUIDANCE DOCUMENTS:

EPA Guidance Documents: Which discuss asbestos abatement work or hauling and disposal of asbestos waste materials are listed below for the Contractor's information only. These documents do not describe the work and are not a part of the work of this contract. EPA maintains an information number (800-334-8571), publications can be ordered from (800-424-9065) and (554-1404 in Washington, DC):

Asbestos-Containing Materials in School Buildings - A Guidance Document
Part 1 & 2 (Orange Books)
EPA C00090 (out of print)

Guidance for Controlling Asbestos-Containing Materials in Buildings
EPA 560/5-85-024 (Purple Book)

Friable Asbestos-Containing Materials in Schools: Identification and Notification Rule (40 CFR Part 763)

Evaluation of the EPA Asbestos-In-Schools Identification and Notification Rule
EPA 560/5-84-005

Asbestos in Buildings: National Survey of Asbestos-Containing Friable Materials
EPA 560/5-84-006

Asbestos in Buildings: Guidance for Service and Maintenance Personnel
EPA 560/5-85-018

Asbestos Waste Management Guidance
EPA 530-SW-85-007

Asbestos Fact Book
EPA Office of Public Affairs

Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials

Commercial Laboratories with Polarized Light Microscopy Capabilities for Bulk Asbestos Identification.

A Guide to Respiratory Protection for the Asbestos Abatement Industry
EPA-560-OPTS-86-001

Managing Asbestos In Place: A Building Owners Guide to Operations and Maintenance Programs for Asbestos Containing Materials
EPA 20T-2003 July 1990

## 1.06 NOTICES:

U.S. Environmental Protection Agency notification to the USEPA is mandated by the National Emission Standards for Hazardous Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) for any project which involves the removal of asbestos containing materials. The Texas Department of State Health Services requires written notification no less than ten working days prior to any asbestos abatement activity, renovation or O&M activity affecting ACM, or any demolition in facilities or public buildings.

Written notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) and the Texas Department of State Health Services shall be submitted by the Contractor to the following address:

Asbestos Notification Section
Department of State Health Services
PO Box 143538
Austin, Texas 78714-3538

Notification: The following information will be included in the notification sent to the NESHAP contact:

Name and address of owner or operator.

Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.

Estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet of pipe, and surface area of other facility components.

Location of the facility being renovated.

Scheduled starting and completion dates of renovation.

Nature of planned renovation and method(s) to be used.

Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M).

Name and location of the waste disposal site where the friable asbestos waste material will be deposited.

Supplement information may be required on the Contractor's part to obtain approval. The Contractor will provide whatever information requested by the regulatory agencies.

## 1.07 NOTICES:

Submit notices required by federal, state and local regulations together with proof of timely transmittal to agency requiring the notice.

Permits: All asbestos waste is to be transported by an entity maintaining a current "Industrial Waste Hauler Permit" specifically for asbestos containing materials, as required for transporting of asbestos containing materials to a disposal site.

Licenses: Maintain current State Asbestos Abatement Contractor License or local jurisdiction for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION (Not Applicable)

**- END OF SECTION -**

# SECTION 01910

# WORKER PROTECTION

## PART 1 - GENERAL

THE MINIMUM RESPIRATORY PROTECTION DURING REMOVAL INSIDE CONTAINMENTS WILL BE POWERED AIR-PURIFYING RESPIRATORS. HALF FACE DUAL CARTRIDGE RESPIRATORS EQUIPPED WITH HEPA/ORGANIC CARTRIDGES CAN BE USED DURING THE REMOVAL OF FLOOR TILE MASTIC IF USING CHEMICAL SOLVENTS. THE CONTRACTOR SHALL PROVIDE INFORMATION TO ASSURE THAT THE ABOVE RESPIRATORY PROTECTION IS SUFFICIENT IN ACCORDANCE WITH 29 CFR 1926.1101 NEGATIVE EXPOSURE ASSESSMENT REQUIREMENTS.

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division-1 Specification sections, apply to work of this section.

### 1.02 DESCRIPTION OF WORK:

This section describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

### 1.03 RELATED WORK SPECIFIED ELSEWHERE:

Respiratory protection is specified in Section 01911.

### 1.04 WORKER TRAINING:

Train, in accordance with 29 CFR 1926 and 40 CFR part 763, all workers in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. Include but do not limit the topics covered in part 763 to the following:

Methods of recognizing asbestos.

Health effects associated with asbestos.

Relationship between smoking and asbestos in producing lung cancer.

Nature of operations that could result in exposure to asbestos.

Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

Engineering controls
Work practices
Respirators
Housekeeping procedures
Hygiene facilities
Protective clothing
Decontamination procedures
Emergency procedures

Waste disposal procedures

Purpose, proper use, fitting, instructions, and limitations of respirators as required by 29 CFR 1910.134.

Appropriate work practices for the work.

Requirements of medical surveillance program.

Review of 29 CFR 1926.

Negative air systems.

Work practices including hands on or on-job training.

Personal decontamination procedures.

Air monitoring, personal and area.

## 1.05 MEDICAL EXAMINATIONS:

Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average. In the absence of specific airborne fiber data, provide medical examination for all workers who will enter the work area for any reason. Examination shall, as a minimum, meet OSHA requirements as set forth in 29 CFR 1926. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.

## 1.06 SUBMITTALS:

Before start of work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative action stamp indicating that the submittal is returned for unrestricted use.

State and local License: Submit evidence that all workers have been trained, certified and accredited as required by state or local code or regulation.

Certificate Worker Acknowledgment: Submit an original signed copy of the Certificate of Worker's Acknowledgment found at the end of this section, for each worker who is to be at the job site or enter the work area.

Report from medical examination: Conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the work area. Submit, at a minimum, for each worker the following:

Name and Social Security Number

Physicians written opinion from examining physician including at a minimum the following:

Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to asbestos.

Any recommended limitations on the worker or on the use of personal protective equipment such as respirators.

Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.

Copy of information that was provided to physician in compliance with 29 CFR 1926.

Statement that the worker is able to wear and use the type of respiratory protection proposed for the project, and is able to work safely in an environment capable of producing heat stress in the worker.

## PART 2 - EQUIPMENT

### 2.01 PROTECTIVE CLOTHING:

Coveralls: Provide disposable full-body coveralls and disposable head covers and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes for all workers in the work area.

Hard Hats: Provide head protectives (hard hats) as required by OSHA for all workers and provide spares for use by Owner. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats of type with plastic strap type suspension. Require hats to remain in the work area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from work area at the end of the work.

Goggles: Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.

Gloves: Provide work gloves to all workers and require that they be worn at all times in the work area. Do not remove gloves from work area, dispose of an asbestos contaminated waste at the end of the work.

### 2.02 ADDITIONAL PROTECTIVE EQUIPMENT:

New/unused respirators, disposable coveralls, head covers, and footwear covers shall be provided by the Contractor for the Owner and other authorized representatives. Provide two (2) respirators and six (6) complete coveralls and, where applicable, six (6) respirator filter changes per day.

## PART 3 - EXECUTION

### 3.01 GENERAL:

Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the work area.

Each time work area is entered, remove all street clothes in the changing room of the personnel decontamination unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.

## 3.02 DECONTAMINATION PROCEDURES:

Require all workers to adhere to the following personal decontamination procedures whenever they leave the work area:

Type C Supplied Air or Powered Air-Purifying Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area:

When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room.

Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:

Thoroughly wet body including hair and face. If using a Powered Air-Purifying Respirator (PAPR), hold blower unit above head to keep canisters dry.

With respirator still in place, thoroughly wet body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.

Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breath.

Carefully wash facepiece of respirator inside and out.

If using PAPR, shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.

Shower completely with soap and water.

Rinse thoroughly.

Rinse shower room walls and floor prior to exit.

Proceed from shower to changing room and change into street clothes or into new disposable work items.

Air Purifying-Negative Pressure Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area with a half or full face cartridge type respirator:

When exiting area, remove disposable coveralls, disposable headcovers, and disposable footwear covers or boots in the equipment room.

Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required as a minimum:

Thoroughly wet body from neck down.

Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.

Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breath.

Dispose of wet filters from air purifying respirator.

Carefully wash facepiece of respirator inside and out.

Shower completely with soap and water.

Rinse thoroughly.

Rinse shower room walls and floor prior to exit.

Proceed from shower to changing room and change into street clothes or into new disposable work items.

Require that workers NOT eat, drink, smoke, chew gum or tobacco in the work area. To eat, chew, drink or smoke, workers shall follow the procedure described above, then dress in street clothes before entering the non-work areas of the building.

## 3.03 CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT:

Following this section is a Certificate of Worker Training. After each worker has been included in the contractor's Respiratory Protection Program, completed the training program, and medical examination, secure a fully executed copy of this form.

**END OF SECTION -**

## SECTION 01911

## RESPIRATORY PROTECTION

**PART 1 - GENERAL** - THE MINIMUM RESPIRATORY PROTECTION DURING REMOVAL WILL BE HALF FACE DUAL CARTRIDGE RESPIRATORS EQUIPPED WITH HEPA CARTRIDGES. THE CONTRACTOR SHALL PROVIDE INFORMATION TO ASSURE THAT THE ABOVE RESPIRATORY PROTECTION IS SUFFICIENT IN ACCORDANCE WITH 29 CFR 1926.1101 NEGATIVE EXPOSURE ASSESSMENT REQUIREMENTS.

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division-1 Specification sections, apply to work of this section.

### 1.02 DESCRIPTION OF WORK:

Instruct and train each worker involved in asbestos abatement in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may cause airborne asbestos dust until the work area is completely decontaminated. Use respiratory protection appropriate for the dust level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.

### 1.03 STANDARDS:

Except to the extent that more stringent requirements are written directly into the contract documents, the following regulations and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents or as if published copies were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards, meet the more stringent requirement.

### 1.04 SUBMITTALS:

Before start of work submit the following to the Owner's Representative for review. Do not begin work until these submittals are returned with the Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use.

Product Data: Submit manufacturer's product information for each component used, including NIOSH and MSHA Certifications for each component in an assembly and/or for entire assembly.

System Diagram: When a Type "C" supplied air respiratory system is required by the work, submit drawing showing assembly of components into a complete supplied air respiratory system. Include diagram showing location of compressor, filter banks, backup air supply tanks, hose line connections in work area(s), routing of air lines to work area(s) from compressor.

Operating Instruction: Submit complete operating and maintenance instructions for all components and systems as a whole. Submittal is to be in bound manual form suitable for field use.

Respiratory Protection Program: Submit level of respiratory protection intended for each operation required by the project. Submit this information on a "Respiratory Protection Program" form.

Historic Airborne Fiber Data/Negative Initial Exposure Assessment: Submit airborne asbestos fiber count data calculated by an independent air monitoring firm within the last 12 months to substantiate selection of proposed respiratory protection. Data should include Negative Initial Exposure Assessment which means a demonstration by the employer/contractor, which complies with the criteria in the paragraph of this section; 29 CFR 1926.110 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PELs. Data submitted shall include at least the following for each procedure required by the work:

Date of Measurements

Employees Monitored

Operations Monitored and Control Methods Used

Sampling and Analytical Methods Used and Evidence of their Accuracy

Number, Duration, and Results of Samples Taken

## 1.05 AIR QUALITY FOR SUPPLIED AIR RESPIRATORY SYSTEMS:

If at any time, Type "C" supplied air respirator are used or required, provide air used for breathing in Type "C" supplied air respiratory systems that meets or exceeds standards set for C.G.A. Type 1 (Gaseous Air) Grade D.

## 1.06 ALLOWABLE CONTAMINANTS:

The following table sets for the quantity of any given contaminant allowed according to the referenced standards:

| CONTAMINANT | CGA TYPE 1 (Gaseous Air) Grade D | Grade E | Grade H | CSA Z180.1 |
|---|---|---|---|---|
| Carbon Monoxide, PPM/V | 10 | 10 | 5 | 5 |
| Carbon Dioxide, PPM/V | 1000 | 500 | .5 | 500 |
| Condensed Hydrocarbons, (mg/cu meter) | 5 | 5 | --- | 1 |
| Gaseous Hydrocarbons - As Methane, PPM/V | --- | --- | 10 | 25 |
| Water Vapor - PPM/V | (1) | (1) | (1) | 27 |
| Dewpoint | -50F | -50F | -50F | -63F |
| Objectionable Odors | None | None | None | None |
| Nitrogen Dioxide, PPM/V | --- | --- | 0.5 | 0.2 |

| | | | | |
|---|---|---|---|---|
| Nitrous Oxide, PPM/V | --- | --- | --- | 5 |
| Sulfur Dioxide | --- | --- | 0.5 | --- |
| Halogenated solvents, PPM/V | --- | --- | 1 | --- |
| Other gaseous contaminants | --- | --- | --- | (2) |
| Inorganic particles, (mg/cu meter) | --- | --- | --- | 1 |
| Oxygen content (v/v) | 19.5 – 23.5% | | | |

NOTE:

Indicates that the standard shows no limiting characteristics:

(1) The CGA standards do not call out a specific moisture limit when the ambient temperature is above freezing. However, since a moisture content no greater than a -50 Degrees Fahrenheit dewpoint (66 PPM/V) is necessary for carbon monoxide elimination, the CO limits could not be met unless the air were dried to a -50 Degrees Fahrenheit dewpoint or better.

(2) Maximum allowable content of tricholotrifluorethane, dichlorodifluoromethane, and chlorodifluoromethane is 2 PPM/V for each. Unlisted contaminants shall not exceed one-tenth of the threshold limit values (TLV's) for chemical substances in workroom air adopted by the American Conference of Governmental Industrial Hygienists (ACGIH).

**1.07 DELIVERY:**

Deliver replacement parts, etc., not otherwise labeled by NIOSH or MSHA to job site in manufacturer's containers.

**PART 2 - EQUIPMENT**

**2.01 AIR PURIFYING RESPIRATORS:**

Respirator Bodies: Provide half face or full face type respirators. Equip full face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees Fahrenheit.

Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with NIOSH certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH certification (P100).

Non-permitted respirators: Do not use single use, disposable or quarter face respirators.

## 2.02 SUPPLIED AIR RESPIRATOR SYSTEMS:

Provide equipment capable of producing air of the quality and volume required by the above reference standards applied to the job site conditions and crew size. Comply with provisions of this specification if more stringent than the governing standard.

Face Piece and Hose: Provide full face piece and hose by same manufacturer that has been certified by NIOSH as an approved Type "C" respirator assembly operating in pressure demand mode with a positive pressure face-piece.

Auxiliary backup system: In atmospheres which contain sufficient oxygen (greater than or equal to 10.5% oxygen) provide a pressure-demand full face piece supplied air respirator equipped with an emergency back up HEPA filter.

Escape air supply: In atmospheres which are oxygen deficient (less than 19.5% oxygen) provide a pressure-demand full face piece supplied air respirator incorporating an auxiliary self-contained breathing apparatus (SCBA) which automatically maintains an uninterrupted air supply in pressure demand mode with a positive pressure face piece.

Backup air supply: Provide a reservoir of compressed air located outside the work area which will automatically maintain a continuous uninterruptable source of air automatically available to each connected face piece and hose assembly in the event of compressor shut-down, contamination of air delivered by compressor, power loss or other failure. Provide sufficient capacity in the back-up air supply to allow a minimum escape time of one-half hour times the number of connections available to the work area. Air requirement at each connection is the air requirement of the respirators in use plus the air requirement of an average sized adult male engaged in moderately strenuous activity.

Warning-device: Provide a warning device that will operate independently of the building's power supply. Locate so that the alarm is clearly audible above the noise level produced by equipment and work procedures in use, in all parts of the work area and at the compressor. Connect alarm to warn of:

Compressor shut down or other fault requiring use of backup air supply, carbon monoxide (CO) levels in excess of 5 PPM/V.

Carbon Monoxide (CO) Monitor: Continuously monitor and record on a strip chart recorder carbon monoxide (CO) levels. Place monitors in the air line between compressor and back-up air supply and between backup air supply and workers. Connect monitors so that they also sound an alarm as specified under "Warning Devices".

Compressor Shut Down: Interconnect monitors, alarms and compressor so that compressor is automatically shut down and the alarms sounded if any of the following occur:

Carbon Monoxide (CO) concentrations exceed 5 PPM/V in the air line between the filter bank and backup air supply.

Compressor temperature exceeds normal operating range.

Compressor Motor: Provide a compressor driven by an electric motor. Do not use a gas or diesel engines to drive compressor. Insure that electrical supply available at the work site is adequate to energize motor.

Compressor Location: Locate compressor outside of building in location that will not impede access to the building, and that will not cause a nuisance by virtue of noise or fumes to occupied portions of the building.

Air Intake: Locate air intake remotely from any source of automobile exhaust or any exhaust from motors or buildings.

After Cooler: Provide an after cooler at entry to filter system which is capable of reducing temperatures to outside ambient air temperatures.

Self Contained Breathing Apparatus (SCBA): Configure system to permit the recharging of 1/2 hour 2260 PSI SCBA cylinders.

## PART 3 - EXECUTION

### 3.01 GENERAL:

Respiratory Protection Program: Comply with ANSI Z88.2 - 1980 "Practices for Respiratory Protection" and OSHA 29 CFR 1910 and 1926.

Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.

Require that a respirator be worn by anyone in a work area at all times, regardless of activity, during a period that starts with any operation which could cause airborne dust until the area has been cleared for re-occupancy in accordance with Section 01915.

Regardless of airborne fiber levels: Require that the minimum level of respiratory protection used be powered air-purifying respirators with high efficiency filters for removal work inside containments and half face dual cartridge respirators equipped with organic/high efficiency filters for the removal of floor tile mastic using chemical solvents.

Do not allow the use of single-use, disposable, or quarter-face respirators for any purpose.

### 3.02 FIT TESTING:

Initial Fitting: Provide initial fitting of respiratory protection during a respiratory protection course of training set up and administered by a Certified Industrial Hygienist. Fit types of respirator to be actually worn by each individual. Allow an individual to use only those respirators for which he has been trained and fit.

On a weekly basis, check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube in accordance with the fit test procedures outlined in 29 CFR 1910.134 Appendix A.

Upon each wearing: Require that each time an air-purifying respirator is put on that it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980) and 29 CFR 1910.134.

## 3.03 TYPE OF RESPIRATORY PROTECTION REQUIRED:

Provide respiratory protection as indicated in paragraph below. Where paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne fiber count in the work area by the "protection factors" given below. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed.

## 3.04 PERMISSIBLE EXPOSURE LIMIT (PEL):

8-Hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed the following.

Fibers: For purposes of this section, fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.

Time Weighted Average (TWA) - 0.1 fibers/cubic centimeter

Excursion Limit - 1.0 fiber/cubic centimeter over any thirty (30) minute sampling period.

## 3.05 RESPIRATORY PROTECTION FACTOR:

| RESPIRATOR TYPE | PROTECTION FACTOR |
|---|---|
| Air purifying:<br>Negative pressure respirator<br>High efficiency filter<br>Half facepiece | 10 |
| Air purifying:<br>Negative pressure respirator<br>High efficiency filter<br>Full facepiece | 50 |
| Powered-air purifying (PAPR):<br>Positive pressure respirator<br>High efficiency filter<br>Full facepiece | 1000 |
| Powered-air purifying (PAPR):<br>Positive pressure respirator<br>High efficiency filter<br>Half facepiece | 50 |
| Type C supplied air:<br>Positive pressure respirator<br>Continuous-flow<br>Half facepiece | 50 |

| | |
|---|---|
| Type C supplied air:<br>Positive pressure respirator<br>Continuous-flow<br>Full facepiece | 1000 |
| Type C supplied air:<br>Positive pressure respirator<br>Pressure demand<br>Half facepiece | 50 |
| Type C supplied air:<br>Positive pressure respirator<br>Pressure demand<br>Full facepiece | 1000 |
| Type C supplied air:<br>Positive pressure respirator<br>Demand mode<br>Half facepiece | 10 |
| Type C supplied air:<br>Positive pressure respirator<br>Demand mode<br>Full facepiece | 50 |
| Self-contained breathing apparatus (SCBA):<br>Demand mode<br>Half facepiece | 10 |
| Self-contained breathing apparatus (SCBA):<br>Demand mode<br>Full facepiece | 50 |
| Self-contained breathing apparatus (SCBA):<br>Pressure demand<br>Full facepiece | 10,000 |

## 3.06 AIR PURIFYING RESPIRATORS:

Negative pressure - half or full face mask: Supply a sufficient quantity of respirator filters approved for asbestos so that workers can change filters during the work day. Require that respirators be wet-rinsed and filters discarded each time a worker leaves the work area. Require that new filters be installed each time a worker re-enters the work area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use.

Powered air purifying - half or full face mask: Supply a sufficient quantity of high efficiency respirator filters approved for asbestos dust so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords to be washed each time a worker leaves the work area. Caution should be used to avoid shorting battery pack during washing. Provide an extra battery pack for each respirator so that one can be charging while one is in use.

### 3.07 TYPE "C" RESPIRATOR:

Air Systems Monitor: Continuously monitor the air system operation including compressor operation, filter system operation, backup air capacity and all warning and monitoring devices at all times that system is in operation. Assign an individual trained, by manufacturer of the equipment in use or by a Certified Industrial Hygienist, in the operation and maintenance of the system to provide this monitoring. Assign no other duties to this individual which will take him away from monitoring the air system.

### 3.08 RESPIRATORY PROTECTION PROGRAM:

Submit a completed "Respiratory Protection Program" form indicating type of respiratory protection proposed for each portion of the work.

**- END OF SECTION -**

**CERTIFICADO DE CONOCIMIENTO DEL TRABAJADOR:**
**(CERTIFICATE OF WORKER'S ACKNOWLEDGMENT: Spanish Version)**

NOMBRE DEL PROJECTO _____ FECHA _____

DOMICILIO DEL PROJECTO _____

NOMBRE DEL CONTRACTISTA _____

TRABAJAR CON ASBESTOS PUEDE SER PELIGROSO. EL RESPIRAR FIBRAS DE ASBESTOS A SIDO ASOCIADO CON VARIOS TIPOS DE CANCER. SI TU FUMAS Y RESPIRAS FIBRAS DE ASBESTOS, LAS POSIBILIDADES DE DESARROLLAR CANCER EN LOS PULMONES SON MAYORES QUE EN LAS PERSONAS QUE NO FUMAN.

El contrato de trabajo de tu patron con el dueño de este projecto requiere que: se te debe proporcionar un respirador apropiado y se te enseñe como usarlo. Tu debes ser entrenado para trabajar con medidas de seguridad y se te enseñe a usar el equipo y herramienta que se requiere para trabajar. Que seas examinado por un medico. Estas cosas deben ser hechas sin costo alguno para ti. Al firmar este certificado tu estas asegurando al dueno del projecto que tus patrones ya cumplieron con estas obligaciones (de proporcionarte equipo adecuado, entrenarte en practicas de seguridad y pasar por un chequeo medico). Por lo que se esta de acuerdo en mantener al dueño del projecto, sus consejeros, laboratorio de analisis y sus representantes fuera de responsabilidad en todas y cada una de las quejas que puedan resultar de, o relacionadas con este projecto.

PROTECCION RESPIRATORIA: Yo he sido entrenado en el use apropiado de respiradores, y he sido informado del tipo de respirador que debe ser usado en este projecto. Yo tengo una copia escrita del manual de proteccion respiratoria proporcionado por mis patrones. Yo he sido equipado sin costo alguno para me con el respirador que debe ser usado en este projecto.

CURSO DE ENTRENAMIENTO: Yo he sido entrenado en los peligros relacionados con el manejo de asbestos y con el respirar polvo de asbestos y he sido entrenado en los procedimientos de trabajo adecuados y medidas de proteccion personales en el area de trabajo. Los temas vistos en el curso incluyen los siguientes:

Caracteristicas fisicas de asbestos
Peligros de salud asociado con asbestos
Uso de equipo de proteccion
Sistemas de aire negativos
Practicas de trabajo mientras se trabaja o se entrena
Procedimientos de descontaminacion personal
Muestreo del aire, personal y del area

EXAMEN MEDICO: Yo he sido examinado dentro de lost ultimos 12 meses el cual fue pagado por mis patrones. Esta examinacion incluye: historia de salud, pruebas de funcion pulmonares y podria tener incluida una evaluacion de rayos x del torax.

Firma: _____

Nombre Escrito: _____

Numero Del Seguro Social: _____

Testigo: _____

## CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT

PROJECT _____ DATE_____

PROJECT ADDRESS _____

SUBCONTRACTOR'S NAME_____

WORKING WITH ASBESTOS CAN BE DANGEROUS. INHALING ASBESTOS FIBERS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCER. IF YOU SMOKE AND INHALE ASBESTOS FIBERS THE CHANCE THAT YOU WILL DEVELOP LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract for the above project requires that: You be supplied with the proper respirator and be trained in its use. You be trained in safe work practices and in the use of the equipment found on the job. You receive a medical examination. These things are to have been done at no cost to you. By signing this certification you are assuring the owner that your employer has met these obligations to you.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators, and informed of the type respirator to be used on the above referenced project. I have a copy of the written respiratory protection manual issued by my employer. I have been equipped at no cost with the respirator to be used on the above project.

TRAINING COURSE: I have been trained in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. The topics covered in the course included the following:

- Physical characteristics of asbestos
- Health hazards associated with asbestos
- Respiratory protection
- Use of protective equipment
- Negative pressure systems
- Work practices including hands on or on-job training
- Personal decontamination procedures
- Air monitoring, personal and area

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, pulmonary function tests and may have included an evaluation of a chest x-ray.

Signature _____

Printed Name _____

Social Security Number _____

Witness _____

## SECTION 01915

## WORK AREA CLEARANCE (PCM)

**PART 1 - GENERAL:** CLEARANCE AIR SAMPLES WILL BE COLLECTED DOWN WIND AND THE SAMPLES FROM THE WORK AREAS WILL BE ANALYZED USING PCM METHOD.

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division - 1 Specification sections, apply to work of this section.

### 1.02 CONTRACTOR RELEASE CRITERIA:

The work is complete when the work area is visually clean and airborne fiber levels have been reduced to the level specified below.

### 1.03 AIR MONITORING:

To determine if the elevated airborne fiber counts encountered during demolition operations have been reduced to the specified level, the Owner's Representative will secure samples and analyze them according to the following procedures.

Fibers Counted: "Fibers" referred to in this section shall be as defined in NIOSH Method 7400, Issue 2.

### 1.04 SAMPLING:

The type of sample to be collected will be determined by the CIH retained by the Owner. In the case of aggressive air sampling, the sampling techniques are as follows:

There are not standards available for flow rate of leaf blowers or large fans. However this information is not critical to the success of the procedure.

Before sampling pumps are started the exhaust from forced air equipment (leaf blower with at least 1 horsepower electric motor) will be swept against the abated area and all surfaces. This procedure will be continued for five (5) minutes per 10,000 cubic feet of room volume.

### 1.05 SCHEDULE OF AIR SAMPLES:

**GENERAL:** The number and volume of air samples taken and analytical methods used by the Owner will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used.

Visual Inspection: Required as a prerequisite of air testing, is set forth in section 01914.

Air Monitoring: Performed by the Owner during abatement work, is described in section 01906.

**If results of the first set of air samples show that the Contractor has not achieved clearance level, it is the Contractor's responsibility to perform the additional work required for clearance. In addition, the Contractor will be responsible for all costs involved with any additional air sampling to be performed (cost of analysis and collection).**

**PHASE CONTRAST MICROSCOPY (PCM):**

| LOCATION SAMPLED | NUMBER OF SAMPLES | FILTER MEDIA | DETECTION LIMIT (FIBERS/CC) | MINIMUM VOLUME (LITERS) | FLOW RATE LPM |
|---|---|---|---|---|---|
| Inside Affected Functional Space | 5 (minimum) | Mixed Cellulose Ester 0.80 Micron | 0.01 | 1500 | 2-10 |

Analysis: Fibers on each filter will be measured using PCM procedures in accordance with NIOSH 7400, Issue 2.

Release Criteria: Decontamination of the work site is complete when every work area sample is below or equal to 0.01 f/cc of air sampled or the baseline whichever is higher.

Phase Contract Microscopy: The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. A microscope and technician will be set up on site so that verbal results can be obtained immediately. If site conditions dictate that the testing laboratory cannot set up on site, verbal results shall be relayed to the Owner as well as the contractor within four hours of the collection of the clearance samples. A complete record certified by the testing laboratory of all air monitoring tests and results will be furnished to the Owner.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION (Not Applicable)**

**- END OF SECTION -**

# SECTION 01917

# DISPOSAL OF ASBESTOS-CONTAINING WASTE MATERIAL

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and Division-1 Specification sections, apply to work of this section.

### 1.02 DISPOSAL:

Friable asbestos-containing waste material and debris that is packaged in accordance with the provision of this specification may be disposed of at designated sanitary landfills when certain precautions are taken.

Notice to appropriate Environmental Protection Agency regional office.

Notice and permit from appropriate State and/or local Agencies.

See Section 01904 for agency locations and code.

Dispose of non-friable asbestos containing material in accordance with applicable regulations.

### 1.03 SUBMITTALS:

Submit copies of all manifest, including DOT shipping receipts, and landfill site receipts to Owner's Representative within 15 calendar days of project completion.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.01 GENERAL:

Carefully load containerized waste on sealed trucks or other appropriate vehicles for transport. Exercise care before and during transport, to insure that no unauthorized persons have access to the material.

Do not store disposal bagged material outside of the work area. Take bags from the work area directly to a sealed truck or dumpster. Label containers or bags with the name of the waste generator and the location at which the waste was generated.

Do not transport disposal bagged material on open trucks. The interior of the vehicle where bags are being transported shall be lined with 6 mil thich polyethylene. Double bagged material may be transported on open trucks if they are first loaded in sealed drums. Label drums with the same warning label as bags. Uncontaminated drums may be reused. Treat drums that have been contaminated as asbestos-containing waste and dispose of in accordance with the specification.

Advise the sanitary landfill operator at least twenty-four hours in advance of transport of the quantity of material to be delivered.

At the burial site, sealed plastic bags shall be carefully removed from the truck. If bags are broken or damaged in transit, leave in the truck and clean entire truck and contents using procedures set forth in Section 01914 Project Decontamination.

Retain receipts from landfill for material disposed of.

Final payment may be withheld by the Owner until all the properly executed manifests have been submitted to the Owner's Representative.

**- END OF SECTION -**

**SCOPE OF WORK**
**FOR**
**ASBESTOS ABATEMENT**
**ACTIVITIES**

**IN SUPPORT OF**

**WASTE WATER COLLECTION SYSTEM LINES**
**GROUP B LOCATION 4**
**NEAR BARRINGTON WAY**

**AUSTIN, TEXAS**

**BY**
**CITY OF AUSTIN**
**BUILDING SERVICES DEPARTMENT**
**AUSTIN, TEXAS 78702**
**(512) 974-7154**

**April 20, 2017**

## DIVISION 1 - GENERAL REQUIREMENTS


01901 Scope of Work - Asbestos Abatement
01902 Project Coordination - Asbestos Abatement
01904 Codes and Regulations - Asbestos Abatement
01910 Worker Protection - Asbestos Abatement
01911 Respiratory Protection _ Asbestos Abatement
01915 Work Area Clearance _ Asbestos Abatement
01917 Disposal of Asbestos Containing Waste Materials


C. Wade Mullin 4.20.17

C. Wade Mullin
Licensed Asbestos Consultant
License Number 10-5093
Expiration Date 2/7/2019

**SECTION 1901**

**SCOPE OF WORK**
**ASBESTOS ABATEMENT**

## PROJECT/WORK IDENTIFICATION

Project name is Asbestos Abatement in support of the **Waste Water Collection System Lines for Group B, Location 4 near Barrington Way.**

## PART 1 - GENERAL:

This project is to be conducted in accordance with the Texas Asbestos Health Protection Act, as amended, Chapter 1954, Texas Occupations Code, effective June 1 2003, formerly Texas Civil Statues, Article 4477-3a, 29 CFR 1910.1001, 29 CFR 1926.1101, 40 CFR part 763 subpart G and 40 CFR part 61 subpart M.

The location and approximate quantities of asbestos materials provided in these specifications are estimates only and do not include any hidden materials not identified. The Contractor is responsible to field verify for actual quantities which these plans and specifications represent. No additional compensation will be made to the Contractor(s) for differences between the estimated quantities and the actual quantities unless prior written approval is obtained from the Owner or his representative.

The Contractor's asbestos abatement workers shall have the appropriate certifications, licenses, and training for asbestos abatement work and supervision in the State of Texas.

### 1.01 Summary of Work:

Briefly and without force and effect upon the contract documents, the work of the contract can be summarized as follows:

The purpose of this item is to remove and dispose of asbestos containing materials (ACM) associated with asbestos containing (AC) transite pipe for the **Waste Water Collection System Lines Group B Location 4 on Barrington Way Project. The pipe to be removed is lined with a polymer U liner material that will need to be cut in order to allow removal of the AC pipe without breakage.**

The Contractor is required to assist the general contractor in removing **approximately 1150 linear feet of 8 inch diameter AC pipeline near Barrington Way. The asbestos contractor will assist with any connections, removal of segments and all taps and tie-ins to AC pipe. Any AC pipe scheduled to be abandoned will be properly grouted per CoA specifications. Also, the AC pipe to be removed is internally lined with a polymer U liner. In order to remove the pipe the U liner will need to be cut at appropriate lengths to allow removal of the AC pipe without breaking the pipe. The AC pipe can be disposed of with the U liner remaining inside the pipe sections.** The contractor will remove and dispose of as ACM all asbestos cement pipe and debris using the procedures as outlined below. In addition, the contractor is to assist with any connections to existing asbestos cement piping.

 CWalk 4-20.17

The Contractor shall conduct all abatement work in accordance with the current revisions to the Texas Department of Health Rules, T.A.H.P.R. dated March 2003.

Asbestos Superintendent: Provide a full-time Asbestos Superintendent on site who is licensed in accordance with Texas Civil Statutes, Article 4477-3a, paragraph 289.144, and all adoptions to Article 4477-3a, and experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by OSHA in 29 CFR 1926.1101 for the Contractor and is the Contractor's representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to asbestos containing materials.

Asbestos Workers: All workers actively involved in the removal and replacement of asbestos material will be Licensed Asbestos Workers with the State of Texas.

**Removal of AC Water and/or Wastewater Lines**

The Contractor shall establish a regulated area with caution tape surrounding the work area and place a drop cloth consisting of six mil thick sheet plastic below the pipe where it will be cut or otherwise disturbed. The Contractor can use a hammer and chisel to split the top and bottom of the couplings (collars) on each end so that an entire section of pipe can be removed. The couplings shall be kept wet with amended water (water to which a surfactant has been added) or a removal encapsulant while this is being done. Once this has been accomplished, the section of pipe and the couplings can be removed from the trench and wrapped in two layers of true six mil thick sheet plastic. Completely seal the sheet plastic with duct tape and duct tape any tears in the plastic. The Contractor is not allowed to use high speed saws to cut the pipe at any time. If needed, hand operated cutters or chain mounted snap cutters can be used as long as the area to be cut is kept wet with amended water or a removal encapsulant during this process. As stated above, if the Contractor chooses to use a hand operated cutter or chain mounted snap cutter, a drop cloth consisting of six mil thick sheet plastic shall be placed below the area to be cut. All debris collected on the drop cloth as well as the drop cloth itself, shall be kept wet during removal and promptly placed into a disposal bag and sealed using duct tape at the completion of the removal process. All visible debris located in the trench shall also be placed into a disposal bag. Once this has been accomplished, the disposal bag containing the debris and the drop cloths shall be placed into another disposal bag and sealed using duct tape. All protective clothing worn by the Contractor and their personnel shall also be placed in disposal bags. At the end of the project, the Contractor shall discard their respirator filters as ACM by disposing of them in disposal bags. The disposal bags used to contain all asbestos containing debris, drop cloths, protective clothing, and respirator filters shall adhere to the following guidelines:

Disposal Bags: Provide 6 mil thick leak-tight polyethylene bags labeled with three labels with text as follows:

First Label:

CAUTION
CONTAINS ASBESTOS FIBERS
AVOID OPENING OR BREAKING CONTAINER
BREATHING ASBESTOS IS HAZARDOUS TO YOUR HEALTH

Second Label: Provide in accordance with 29 CFR 1910.1200(f) of OSHA's



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Hazard Communication standard:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
BREATHING AIRBORNE ASBESTOS, TREMOLITE, ANTHOPHYLLITE, OR
ACTINOLITE FIBERS IS HAZARDOUS TO YOUR HEALTH

Third Label: Provide in accordance with U.S. Department of Transportation Regulation on hazardous waste marking. 49 CFR parts 171 and 172. Hazardous Substances: Final Rule:

RQ HAZARDOUS
SUBSTANCE,
CLASS 9,
NA2212, PG III
(ASBESTOS)

**All transporters of asbestos containing materials shall be licensed by the Department of State Health Services.**

**The Contractor shall label all piping wrapped in true six mil thick sheet plastic with the same type of labeling as the disposal bags.**

All equipment used on this project ( i.e. HEPA-vacuums ) shall be free of any visible debris and operational. The Owner's Representative along with the Contractor's designated supervisor shall inspect all equipment prior to it being brought into the work area. If any debris found on the equipment is suspected to be ACM, the equipment shall be wet wiped and decontaminated. **The decontamination of the equipment shall not take place on the project site.**

**If applicable, all taps to existing water lines are to be conducted using wet/pressure tapping. Once the taps are made the hydrants shall be flushed on both sides of the work area to help prevent contamination of the water supply. Installing a wastewater service in AC pipe shall be done by removing a full section of pipe and installing a "tee". Replace the remainder of pipe as specified.**

All removal work associated with the ACM piping shall be done using the appropriate worker protection and respiratory protection as stated below as a minimum:

**The minimum respiratory protection during removal will be half face dual cartridge respirators equipped with HEPA cartridges. The Contractor shall provide information to assure that the above respiratory protection is sufficient in accordance with 29 CFR 1926.1101 negative exposure assessment requirements.**

The abatement must comply with these Specifications, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), State of Texas and local regulations. Whenever there is a conflict or overlap of the above references, the most stringent provisions are applicable.



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The Contractor shall submit a work plan detailing the work procedures they will employ. This work plan shall be reviewed and approved by the Owner's Representative prior to any removal work.

The Contractor shall provide all workers working in the vicinity of active electrical sources with appropriate protective equipment including insulating gloves, boots, and non-conductive tools (while HEPA-Vacuuming).

The Contractor will inform the Owner and Owner's Representative of any hidden or unidentified conditions which may result in a change order or additional cost to the bid price of the contract. This notice will require written approval by the Owner's Representative prior to accomplishing the additional work.

The Contractor will be required to repair any damage to the facility or equipment of the Owner as the result of the abatement project. Any replacement items (paint, panels, etc.) will be of equal quality and color of the damaged items. This work shall be accomplished at the completion of the abatement project and prior to the Owner re-occupying the space. The project will not be considered complete until the repair work has been done and found acceptable by the Owner.

All asbestos containing materials shall be wetted with amended water or a removal encapsulant prior to and during the removal. The contractor can start the removal process after the Owner's Representative is satisfied that the ACM has been adequately wetted. The Owner's Representative has been given the authority to present the contractor with either a written or verbal Stop Work Order if they notice that any ACM is being removed without it being adequately wetted or if they become aware of any deviation from the project specifications or Department of State Health Services Regulations.

**Final clearance for asbestos abatement work shall be obtained by PCM method as outlined in Section 01915.** Upon successful completion of required work activities the Owner's Representative shall visually inspect the work area for final clearance. Downwind area air samples collected during abatement can be used as final clearance samples if they do not exceed 0.01 f/cc by Phase Contrast Microscopy analysis.

All equipment used on this project ( i.e. HEPA-vacuums, negative air machines ) shall be free of any visible debris and operational. The Owner's Representative along with the contractor's designated supervisor shall inspect all equipment prior to it being brought into the work area. If any debris found on the equipment is suspected to be ACM, the equipment shall be wet wiped and decontaminated. The decontamination of the equipment shall not take place on the project site.

The Contractor shall adequately staff this project such that it will be completed in accordance with the Contract Documents. If the project is not completed within this time frame, the Owner will backcharge the Contractor for any charges incurred by the Owner for additional Owner Representative services required to complete this project.

**The Contractor shall submit the names and resumes (including pertinent project experience) of at least two (2) properly licensed supervisors to be used to conduct this asbestos abatment project. If the supervisors submitted are approved by the Owner, the Contractor shall ensure that at least one of these project supervisors are on site throughout the project including final tear down operations. The Contractor shall not substitute an approved project supervisor without the prior approval of the Owner.**



4.20.17

All Contractor worker and supervisory personnel at the work site shall properly trained, equipped and possess valid and current Texas Department of State Health Services Asbestos Licenses and associated training certificates. During all phases of this project, the Contractor project site supervisor shall remain at the project site during all work activities.

The Contractor shall submit a work plan detailing the work procedures they will employ. This work plan shall be reviewed and approved by the Owner's Representative prior to any removal work.

The Contractor shall provide all workers working in the vicinity of active electrical sources with appropriate protective equipment including insulating gloves, boots, and non-conductive tools (while HEPA-Vacuuming).

The abatement must comply with these Specifications, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), State of Texas and local regulations. Whenever there is a conflict or overlap of the above references, the most stringent provisions are applicable.

The Contractor will inform the Owner and Owner's Representative of any hidden or unidentified conditions which may result in a change order or additional cost to the bid price of the contract.

This notice will require written approval by the Owner's Representative prior to accomplishing the additional work.

## ASBESTOS ABATEMENT

During the Work, the City or the City's Representative will provide a licensed asbestos inspector to oversee the Contractor's abatement work, collect area samples, and identify asbestos-containing materials. The Contractor shall coordinate the abatement schedule with the asbestos inspector such that the inspector can be present at key times during the abatement and identify asbestos-containing materials as soon as suspect material is encountered. The Contractor shall also accept all City Representative decisions regarding the presence of asbestos-containing materials. **The contractor shall conduct their own required employee monitoring for asbestos related activities in conformance with OSHA requirements.**

The Contractor shall notify the City's Representative asbestos inspector of any suspected asbestos-containing materials encountered during the work as soon as it is discovered.

The Contractor shall abate or contain for disposal all asbestos-containing materials encountered during the equipment dismantling work if abatement or containment is required to prevent asbestos release during dismantling.

Where asbestos-containing materials requiring abatement are encountered during the project, the Contractor shall stop work and abate the material or otherwise contain it for disposal as necessary. Until abatement can be performed, the Contractor shall take actions as necessary and feasible to protect workers from exposure to airborne asbestos and prevent disturbance of the material. The contractor will establish a regulated area until such time as the area or equipment can be abated.

The Contractor shall provide personnel to perform the surveillance of asbestos abatement



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containment areas 24 hours per day, 7 days per week during the operation of ventilation units. The duties of such personnel shall include maintenance of pressure differential containment and regular inspection of the work areas for fire prevention and prevention of incidents which could cause the release of materials.

## ASBESTOS CONTAINING MATERIALS

The following asbestos containing materials are known to be present at work sites near Barrington way, Austin Texas. If any other materials are found, which are suspected of containing asbestos notify immediately the Owner's Representative. The amount of ACM listed below are approximate. The Contractor shall field verify the quantities.

| LOCATION | ITEM | APPROXIMATE AMOUNT | TYPE OF ASBESTOS |
|---|---|---|---|
| Along road | AC Pipe | 1150 Linear feet | est 50% Chrysotile |

## 1.02 INSPECTION:

Prior to commencement of work, inspect all areas in which work will be performed. Prepare a listing of damage to structure, surfaces, equipment or of surrounding properties which could be misconstrued as damage resulting from the work. Photograph or video tape existing conditions as necessary to document conditions. Submit to Owner's Representative prior to starting work.

## 1.03 PLAN OF ACTION:

Submit a detailed plan of the procedures proposed for use in complying with the requirements of this Specification. Include in the plan the location and layout of decontamination areas, the sequencing of asbestos work, the interface of trades involved in the performance of work, methods to be used to assure the safety of building occupants and visitors to the site, disposal plan including location of approved disposal site, and a detailed description of the methods to be employed to control pollution. Expand upon the use of portable HEPA ventilation system, closing out of the area HVAC system, method of removal to prohibit visible emissions in work area, and packaging of removed asbestos debris. The plan must be approved by the Owner's Representative prior to commencement of work.

## 1.04 POTENTIAL ASBESTOS HAZARD:

The disturbance or dislocation of asbestos containing materials may cause asbestos fibers to be released into the building's atmosphere, thereby creating a potential health hazard to workmen and building occupants. Apprise all workers, supervisory personnel, subcontractors and consultants who will be at the jobsite of the seriousness of the hazard and of proper work procedures which must be followed.



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Where in the performance of the work, workers, supervisory personnel, subcontractors, or consultants may encounter, disturb, or otherwise function in the immediate vicinity of any identified asbestos containing materials, take appropriate continuous measures as necessary to protect the building from the contamination with airborne asbestos. Such measures shall include the procedures and methods described herein, and compliance with regulations of applicable federal, state and local agencies.

## 1.05 CONTRACTOR USE OF PREMISES:

General: The Contractor shall limit his use of the premises to the work indicated.

Use of the Site: Confine operations at the site to the areas permitted under the contract. Portions of the site beyond areas on which work is indicated are not to be disturbed. Conform to site rules and regulations affecting the work while engaged in project abatement.

Keep existing driveways, parking spaces and entrances serving the premises clear and available to the Owner and his employees at all times.

Do not unreasonably encumber the site with materials or equipment. Confine stockpiling of materials and location of storage to areas indicated at the pre-abatement meeting.

Lock automotive type vehicles, such as passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, so as to prevent unauthorized use. Do not leave such vehicles or equipment unattended with the motor running or the ignition key in place or accessible to unauthorized persons.

Use of existing toilets within the building by the Contractor and his personnel, will not be permitted.

Owner Occupancy: The building will not be occupied by the Owner during the asbestos abatement project.

## 1.06 SUBMITTALS

The Contractor shall prepare an Asbestos Abatement Plan and submit it to the City with the Contractor's Health and Safety Plan (HASP) prior to mobilization. The Asbestos Abatement Plan shall include the following information:

Discussion of the general plan for containment around equipment to be abated, decontamination plans, and waste management procedures.

Drawings showing general containment, decontamination, and bag out facility plans.

Contractor's work schedule, including a plan for sequencing work around areas or individual pieces of equipment that require asbestos abatement.

Waste containment plan, describing how the Contractor will abate particular pieces of equipment.

A plan for protecting the safety of workers and visitors in the surrounding areas.



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A fire and containment protection plan, including emergency procedures and contacts.

Current copies of all applicable permits, licenses, certifications, training documents, and regulatory notices.

List of asbestos abatement workers with social security numbers

Certificates of worker acknowledgement

Medical examination results

Before the Start of Work: Submit the following to the Owner and Owner's Representative for review. Do not begin work until these Submittals are returned with Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use or final-but-restricted use. ***Allow 3 days time for review of submittals.***

**A.** **Plan of Action:** Submit as a written report.

**B.** **Inspection:** Submit written report on inspection carried out as required by this section. Include copies of all photographs, videotapes, etc.

**C.** **Alternative Methods:** Submit, in writing, any alternative methods proposed to accomplish the work of this contract.

**D.** Submit copies of valid and current Texas Department of State Health Services Asbestos Licensing and associated training certificates for all worker and supervisory personnel at the work site. In addition, copies of the appropriate DOT certifications required for the manifesting and transporting of hazardous materials must be submitted.

## SPECIAL SPECIFICATIONS

***In addition to the work procedures outlined in the Master Specification which apply to the project described herein, the following Special Specifications apply:***

***The contractor shall conduct all abatement work in accordance with the current revisions to the Department of State Health Services Rules, T.A.H.P.R. dated March 2003.***

**END OF SECTION**



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## SECTION 01902

## PROJECT COORDINATION

### PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division-1 Specification sections, apply to work of this section.

### 1.02 ABATEMENT TIME:

The use of insufficient labor or equipment for abatement purposes or inadequate scheduling of materials or equipment will not be allowed as cause for delay. Extension of time or extra cost will not be allowed for failure to complete the project on time due to insufficient labor or equipment.

### 1.03 ADMINISTRATIVE AND SUPERVISORY PERSONNEL:

General Superintendent: Provide a full-time General Superintendent on site who is licensed in accordance with Texas Civil Statutes, Article 4477-3a, paragraph 289.144, and all adoptions to Article 4477-3A, and experienced in administration and supervision of asbestos abatement projects including work practices, protective measures for building and personnel, disposal procedures, etc. This person is the Competent Person as required by OSHA in 29 CFR 1926 for the Contractor and is the Contractor's representative responsible for compliance with all applicable federal, state and local regulations, particularly those relating to asbestos containing materials.

Asbestos Workers: All workers actively involved in the removal and replacement of asbestos material will be Licensed Asbestos Workers with the State of Texas.

### 1.04 PROGRESS MEETING

In addition to specific coordination and pre-construction meetings, and other regular project meetings held for other purposes, the Owner's Representative will hold general progress meetings as required. The meetings will be attended by a representative of the contractor authorized to make decisions for the contractor.

### 1.05 PRE-CONSTRUCTION CONFERENCE:

An initial progress meeting, recognized as the "Pre-Construction Conference" will be convened by the Owner and the Owner's Representative prior to the start of any work. The meeting will be attended by the general superintendent of the contractor, Owner's Representative(s), project administrator, and other entities concerned with the asbestos abatement work.

### 1.06 DAILY LOG

General: Maintain within the decontamination unit a daily log documenting the dates and time of, but not limited to, the following items:
Personnel, by name, entering and leaving the work area, air monitoring results, and any equipment/supplies decontaminated and brought out through the decontamination unit.

## 1.07 SPECIAL REPORTS:

General: Except as otherwise indicated, submit special reports directly to the Owner's Representative or the Owner within one day of occurrence requiring special report, with copy to others affected by occurrence.

Reporting Unusual Events: When an event of unusual and significant nature occurs at site (examples: failure of negative pressure system, rupture of temporary containments), prepare and submit a special report listing chain of events, persons participating, response by contractor's personnel, evaluation of results or effects, and similar pertinent information. When such events are known or predictable in advance, advise Owner in advance at earliest possible date.

Reporting Accidents: Prepare and submit reports of significant accidents, at site and anywhere else work is in progress. Record and document data and actions; comply with industry standards. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

## 1.08 CONTINGENCY PLAN:

Contingency Plan: Prepare a contingency plan for emergencies including fire, accident, power failure, negative air system failure, or any other event that may required modification or abridgment of decontamination or work area isolation procedures. Include in plan specific procedures for decontamination or work area isolation. Note that nothing in this specification should impede safe exiting or providing of adequate medical attention in the event of an emergency.

Post: In clean room of the personnel decontamination unit telephone numbers and locations of emergency services including but not limited to fire, ambulance, doctor, hospital, police, power company, telephone company.

## 1.09 NOTIFICATIONS

Notify other entities at the job site of the nature of the asbestos abatement activities, location of asbestos containing materials, requirements relative to asbestos set forth in these specifications and applicable regulations.

Notify Emergency Service Agencies including fire, police, ambulance or other agency that may service the abatement work site in case of an emergency. Notification is to include methods of entering work area, emergency entry and exit locations, and other information needed by agencies providing emergency services.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION (Not Applicable)

**- END OF SECTION -**

## SECTION 01904

## CODES AND REGULATIONS

### PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the contract, and other Division-1 Specification sections, apply to work of this section.

### 1.02 DESCRIPTION OF THE WORK:

This section sets forth governmental regulations and industry standards which are included and incorporated herein by reference and made a part of the specification. This section also sets forth those notices and permits which are known to the Owner and which either must be applied for and received, or which must be given to governmental agencies before start of work.

Requirements include adherence to work practices and procedures set forth in applicable codes, regulations and standards.

Requirements include obtaining permits, licenses, inspections, releases and similar documentation, as well as payments, statements and similar requirements associated with codes, regulations and standards.

### 1.03 CODES AND REGULATIONS:

General Applicability of Codes, Regulations and Standards: Except to the extent that more explicit or more stringent requirements are written directly into the contract documents, all applicable codes, regulations, and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.

Contractor Responsibility: The contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State, and local regulations pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying areas adjacent to the site. The contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by the applicable Federal, State and local regulations. The contractor shall hold the Owner and Owner's Representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of himself, his employees, or his subcontractors.

Federal Requirements: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

U.S. Department of Labor, Occupational Safety and Health Administration, (OSHA), including but not limited to:

Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite; Final rules, Title 29, Part 1910, section 1001 and part 1926, Section 1101 of the Code of Federal Regulations

Respiratory Protection; Title 29, Part 1910, Section 134 of the Code of Federal Regulations Construction Industry; Title 29, Part 1926, of the Code of Federal Regulations

Construction Industry
Title 29, Part 1926 of the Code of Federal Regulations

Access to Employee Exposure and Medical Records, Title 29, Part 1910, Section 2 of the Code of Federal Regulations

Hazard Communication; Title 29, Part 1910, Section 1200 of the Code of Federal Regulations

Specifications for Accident Prevention Sign and Tags; Title 29, Part 1910, Section 145 of the Code of Federal Regulations

U.S. Department of Transportation:

Hazardous Substances
Title 49, Part 171 and 172 of the Code of Federal Regulations

U.S. Environmental Protection Agency (EPA) including but not limited to:

Asbestos Abatement Projects Rule 40

40 CFR Part 763

CPTS 62044, FRL 2843-9

Title 34, Part 231, Appendix C, Procedures for Containing and Removing Building Materials Containing Asbestos

Title 40, Part 61, Sub-part A of the Code of Federal Regulations National Emission Standard for Asbestos

Title 40, Part 61, Sub-part M (Revised Sub-part B) of the Code of Federal Regulations

American National Standards Institute (ANSI) Publication:

Z9.2-79 Fundamentals Governing the Design and Operation of Local Exhaust Systems

American Society for Testing and Materials (ASTM) Publication:

E 849-82 Safety and Health Requirements relating to Occupational Exposure to Asbestos

State Requirements: Texas Civil Statues, Article 4477-3a, and all adoptions, (TAHPR) Asbestos Exposure in Public Buildings, requires licensure of persons engaged in the removal or encapsulation of asbestos, or other asbestos related activities in all buildings of public occupancy or access.

Local Requirements: Abide by all local requirements which govern asbestos abatement work or hauling and disposal of asbestos waste materials.

## 1.04 STANDARDS:

General Applicability of Standards: Except to the extent that more explicit or more stringent requirements are written directly into the Contract Documents, all applicable standards have the same force and effect (and are made a part of the Contract Documents by reference) as if copied directly into the Contract Documents, or as if published copies are bound herewith.

Contractor Responsibility: The Contractor shall assume full responsibility and liability for the compliance with all standards pertaining to work practices, hauling, disposal, and protection of workers, visitors to the site, and persons occupying area adjacent to the site. The Contractor shall hold the Owner and the Owner's Representative harmless for failure to comply with any applicable standard on the part of himself, his employees, or his sub-contractors.

Standards: Which govern asbestos abatement work or hauling and disposal of asbestos waste materials include but are not limited to the following:

American National Standards Institute (ANSI)
1430 Broadway
New York, New York 10018
(212) 354-3300

Fundamentals Governing the Design and Operation of Local Exhaust Systems Publication Z9.2-79

Practices for Respiratory Protection
Publication Z288.2-80

American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103
215/299-5400

Safety and Health Requirements Relating to Occupational Exposure to Asbestos E 849-82

Specification for Encapsulants for Friable Asbestos Containing Building Materials Proposal P-189

"Guide" Specification - 02080 Asbestos Removal AIA Service Corporation
1735 New York Avenue NW
Washington, DC

AWCI Guide Specifications for the abatement of asbestos release from spray-or trowel applied materials in buildings and other structural designs

U.S. Department of Commerce

National Institute of Standards & Technology

National Engineering Lab

Center for Building Technology

## 1.05 EPA GUIDANCE DOCUMENTS:

EPA Guidance Documents: Which discuss asbestos abatement work or hauling and disposal of asbestos waste materials are listed below for the Contractor's information only. These documents do not describe the work and are not a part of the work of this contract. EPA maintains an information number (800-334-8571), publications can be ordered from (800-424-9065) and (554-1404 in Washington, DC):

Asbestos-Containing Materials in School Buildings - A Guidance Document
Part 1 & 2 (Orange Books)
EPA C00090 (out of print)

Guidance for Controlling Asbestos-Containing Materials in Buildings
EPA 560/5-85-024 (Purple Book)

Friable Asbestos-Containing Materials in Schools: Identification and Notification Rule (40 CFR Part 763)

Evaluation of the EPA Asbestos-In-Schools Identification and Notification Rule
EPA 560/5-84-005

Asbestos in Buildings: National Survey of Asbestos-Containing Friable Materials
EPA 560/5-84-006

Asbestos in Buildings: Guidance for Service and Maintenance Personnel
EPA 560/5-85-018

Asbestos Waste Management Guidance
EPA 530-SW-85-007

Asbestos Fact Book
EPA Office of Public Affairs

Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials

Commercial Laboratories with Polarized Light Microscopy Capabilities for Bulk Asbestos Identification.

A Guide to Respiratory Protection for the Asbestos Abatement Industry
EPA-560-OPTS-86-001

Managing Asbestos In Place: A Building Owners Guide to Operations and Maintenance Programs for Asbestos Containing Materials
EPA 20T-2003 July 1990

## 1.06 NOTICES:

U.S. Environmental Protection Agency notification to the USEPA is mandated by the National Emission Standards for Hazardous Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M) for any project which involves the removal of asbestos containing materials. The Texas Department of State Health Services requires written notification no less than ten working days prior to any asbestos abatement activity, renovation or O&M activity affecting ACM, or any demolition in facilities or public buildings.

Written notification as required by USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) and the Texas Department of State Health Services shall be submitted by the Contractor to the following address:

Asbestos Notification Section
Department of State Health Services
PO Box 143538
Austin, Texas 78714-3538

Notification: The following information will be included in the notification sent to the NESHAP contact:

Name and address of owner or operator.

Description of the facility being demolished or renovated, including the size, age, and prior use of the facility.

Estimate of the approximate amount of friable asbestos material present in the facility in terms of linear feet of pipe, and surface area of other facility components.

Location of the facility being renovated.

Scheduled starting and completion dates of renovation.

Nature of planned renovation and method(s) to be used.

Procedures to be used to comply with the requirements of USEPA National Emission Standards for Hazardous Air Pollutants (NESHAPS) Asbestos Regulations (40 CFR 61, Subpart M).

Name and location of the waste disposal site where the friable asbestos waste material will be deposited.

Supplement information may be required on the Contractor's part to obtain approval. The Contractor will provide whatever information requested by the regulatory agencies.

## 1.07 NOTICES:

Submit notices required by federal, state and local regulations together with proof of timely transmittal to agency requiring the notice.

Permits: All asbestos waste is to be transported by an entity maintaining a current "Industrial Waste Hauler Permit" specifically for asbestos containing materials, as required for transporting of asbestos containing materials to a disposal site.

Licenses: Maintain current State Asbestos Abatement Contractor License or local jurisdiction for the removal, transporting, disposal or other regulated activity relative to the work of this contract.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION (Not Applicable)

**- END OF SECTION -**

## SECTION 01910

## WORKER PROTECTION

### PART 1 - GENERAL

THE MINIMUM RESPIRATORY PROTECTION DURING REMOVAL INSIDE CONTAINMENTS WILL BE POWERED AIR-PURIFYING RESPIRATORS. HALF FACE DUAL CARTRIDGE RESPIRATORS EQUIPPED WITH HEPA/ORGANIC CARTRIDGES CAN BE USED DURING THE REMOVAL OF FLOOR TILE MASTIC IF USING CHEMICAL SOLVENTS. THE CONTRACTOR SHALL PROVIDE INFORMATION TO ASSURE THAT THE ABOVE RESPIRATORY PROTECTION IS SUFFICIENT IN ACCORDANCE WITH 29 CFR 1926.1101 NEGATIVE EXPOSURE ASSESSMENT REQUIREMENTS.

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division-1 Specification sections, apply to work of this section.

### 1.02 DESCRIPTION OF WORK:

This section describes the equipment and procedures required for protecting workers against asbestos contamination and other workplace hazards except for respiratory protection.

### 1.03 RELATED WORK SPECIFIED ELSEWHERE:

Respiratory protection is specified in Section 01911.

### 1.04 WORKER TRAINING:

Train, in accordance with 29 CFR 1926 and 40 CFR part 763, all workers in the dangers inherent in handling asbestos and breathing asbestos dust and in proper work procedures and personal and area protective measures. Include but do not limit the topics covered in part 763 to the following:

Methods of recognizing asbestos.

Health effects associated with asbestos.

Relationship between smoking and asbestos in producing lung cancer.

Nature of operations that could result in exposure to asbestos.

Importance of and instruction in the use of necessary protective controls, practices and procedures to minimize exposure including:

Engineering controls
Work practices
Respirators
Housekeeping procedures
Hygiene facilities
Protective clothing
Decontamination procedures
Emergency procedures

Waste disposal procedures

Purpose, proper use, fitting, instructions, and limitations of respirators as required by 29 CFR 1910.134.

Appropriate work practices for the work.

Requirements of medical surveillance program.

Review of 29 CFR 1926.

Negative air systems.

Work practices including hands on or on-job training.

Personal decontamination procedures.

Air monitoring, personal and area.

## 1.05 MEDICAL EXAMINATIONS:

Provide medical examinations for all workers who may encounter an airborne fiber level of 0.1 f/cc or greater for an 8 hour time weighted average. In the absence of specific airborne fiber data, provide medical examination for all workers who will enter the work area for any reason. Examination shall, as a minimum, meet OSHA requirements as set forth in 29 CFR 1926. In addition, provide an evaluation of the individual's ability to work in environments capable of producing heat stress in the worker.

## 1.06 SUBMITTALS:

Before start of work: Submit the following to the Owner's Representative for review. Do not start work until these submittals are returned with Owner's Representative action stamp indicating that the submittal is returned for unrestricted use.

State and local License: Submit evidence that all workers have been trained, certified and accredited as required by state or local code or regulation.

Certificate Worker Acknowledgment: Submit an original signed copy of the Certificate of Worker's Acknowledgment found at the end of this section, for each worker who is to be at the job site or enter the work area.

Report from medical examination: Conducted within last 12 months as part of compliance with OSHA medical surveillance requirements for each worker who is to enter the work area. Submit, at a minimum, for each worker the following:

Name and Social Security Number

Physicians written opinion from examining physician including at a minimum the following:

Whether worker has any detected medical conditions that would place the worker at an increased risk of material health impairment from exposure to asbestos.

Any recommended limitations on the worker or on the use of personal protective equipment such as respirators.

Statement that the worker has been informed by the physician of the results of the medical examination and of any medical conditions that may result from asbestos exposure.

Copy of information that was provided to physician in compliance with 29 CFR 1926.

Statement that the worker is able to wear and use the type of respiratory protection proposed for the project, and is able to work safely in an environment capable of producing heat stress in the worker.

## PART 2 - EQUIPMENT

### 2.01 PROTECTIVE CLOTHING:

Coveralls: Provide disposable full-body coveralls and disposable head covers and require that they be worn by all workers in the work area. Provide a sufficient number for all required changes for all workers in the work area.

Hard Hats: Provide head protectives (hard hats) as required by OSHA for all workers and provide spares for use by Owner. Label hats with same warning labels as used on disposal bags. Require hard hats to be worn at all times that work is in progress that may potentially cause head injury. Provide hard hats of type with plastic strap type suspension. Require hats to remain in the work area throughout the work. Thoroughly clean, decontaminate and bag hats before removing them from work area at the end of the work.

Goggles: Provide eye protectives (goggles) as required by OSHA for all workers involved in scraping, spraying, or any other activity which may potentially cause eye injury.

Gloves: Provide work gloves to all workers and require that they be worn at all times in the work area. Do not remove gloves from work area, dispose of an asbestos contaminated waste at the end of the work.

### 2.02 ADDITIONAL PROTECTIVE EQUIPMENT:

New/unused respirators, disposable coveralls, head covers, and footwear covers shall be provided by the Contractor for the Owner and other authorized representatives. Provide two (2) respirators and six (6) complete coveralls and, where applicable, six (6) respirator filter changes per day.

## PART 3 - EXECUTION

### 3.01 GENERAL:

Provide worker protection as required by the most stringent OSHA and/or EPA standards applicable to the work. The following procedures are minimums to be adhered to regardless of fiber count in the work area.

Each time work area is entered, remove all street clothes in the changing room of the personnel decontamination unit and put on new disposable coverall, new head cover, and a clean respirator. Proceed through shower room to equipment room and put on work boots.

## 3.02 DECONTAMINATION PROCEDURES:

Require all workers to adhere to the following personal decontamination procedures whenever they leave the work area:

Type C Supplied Air or Powered Air-Purifying Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area:

When exiting area, remove disposable coveralls, disposable head covers, and disposable footwear covers or boots in the equipment room.

Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator to avoid asbestos fibers while showering. The following procedure is required as a minimum:

Thoroughly wet body including hair and face. If using a Powered Air-Purifying Respirator (PAPR), hold blower unit above head to keep canisters dry.

With respirator still in place, thoroughly wet body, hair, respirator face piece, and all parts of the respirator except the blower unit and battery pack on a PAPR. Pay particular attention to seal between face and respirator and under straps.

Take a deep breath, hold it and/or exhale slowly, completely wet hair, face, and respirator. While still holding breath, remove respirator and hold it away from face before starting to breath.

Carefully wash facepiece of respirator inside and out.

If using PAPR, shut down in the following sequence, first cap inlets to filter cartridges, then turn off blower unit (this sequence will help keep debris which has collected on the inlet side of filter from dislodging and contaminating the outside of the unit). Thoroughly wash blower unit and hoses. Carefully wash battery pack with wet rag. Be extremely cautious of getting water in battery pack as this will short out and destroy battery.

Shower completely with soap and water.

Rinse thoroughly.

Rinse shower room walls and floor prior to exit.

Proceed from shower to changing room and change into street clothes or into new disposable work items.

Air Purifying-Negative Pressure Respirators: Require that all workers use the following decontamination procedure as a minimum requirement whenever leaving the work area with a half or full face cartridge type respirator:

When exiting area, remove disposable coveralls, disposable headcovers, and disposable footwear covers or boots in the equipment room.

Still wearing respirators, proceed to showers. Showering is mandatory. Care must be taken to follow reasonable procedures in removing the respirator and filters to avoid asbestos fibers while showering. The following procedure is required as a minimum:

Thoroughly wet body from neck down.

Wet hair as thoroughly as possible without wetting the respirator filter if using an air purifying type respirator.

Take a deep breath, hold it and/or exhale slowly, complete wetting of hair, thoroughly wetting face, respirator and filter (air purifying respirator). While still holding breath, remove respirator and hold it away from face before starting to breath.

Dispose of wet filters from air purifying respirator.

Carefully wash facepiece of respirator inside and out.

Shower completely with soap and water.

Rinse thoroughly.

Rinse shower room walls and floor prior to exit.

Proceed from shower to changing room and change into street clothes or into new disposable work items.

Require that workers NOT eat, drink, smoke, chew gum or tobacco in the work area. To eat, chew, drink or smoke, workers shall follow the procedure described above, then dress in street clothes before entering the non-work areas of the building.

## 3.03 CERTIFICATE OF WORKER'S ACKNOWLEDGEMENT:

Following this section is a Certificate of Worker Training. After each worker has been included in the contractor's Respiratory Protection Program, completed the training program, and medical examination, secure a fully executed copy of this form.

**END OF SECTION -**

**CERTIFICADO DE CONOCIMIENTO DEL TRABAJADOR:**
**(CERTIFICATE OF WORKER'S ACKNOWLEDGMENT: Spanish Version)**

NOMBRE DEL PROJECTO _____ FECHA _____

DOMICILIO DEL PROJECTO _____

NOMBRE DEL CONTRACTISTA _____

TRABAJAR CON ASBESTOS PUEDE SER PELIGROSO. EL RESPIRAR FIBRAS DE ASBESTOS A SIDO ASOCIADO CON VARIOS TIPOS DE CANCER. SI TU FUMAS Y RESPIRAS FIBRAS DE ASBESTOS, LAS POSIBILIDADES DE DESARROLLAR CANCER EN LOS PULMONES SON MAYORES QUE EN LAS PERSONAS QUE NO FUMAN.

El contrato de trabajo de tu patron con el dueño de este projecto requiere que: se te debe proporcionar un respirador apropiado y se te enseñe como usarlo. Tu debes ser entrenado para trabajar con medidas de seguridad y se te enseñe a usar el equipo y herramienta que se requiere para trabajar. Que seas examinado por un medico. Estas cosas deben ser hechas sin costo alguno para ti. Al firmar este certificado tu estas asegurando al dueno del projecto que tus patrones ya cumplieron con estas obligaciones (de proporcionarte equipo adecuado, entrenarte en practicas de seguridad y pasar por un chequeo medico). Por lo que se esta de acuerdo en mantener al dueño del projecto, sus consejeros, laboratorio de analisis y sus representantes fuera de responsabilidad en todas y cada una de las quejas que puedan resultar de, o relacionadas con este projecto.

PROTECCION RESPIRATORIA: Yo he sido entrenado en el use apropiado de respiradores, y he sido informado del tipo de respirador que debe ser usado en este projecto. Yo tengo una copia escrita del manual de proteccion respiratoria proporcionado por mis patrones. Yo he sido equipado sin costo alguno para me con el respirador que debe ser usado en este projecto.

CURSO DE ENTRENAMIENTO: Yo he sido entrenado en los peligros relacionados con el manejo de asbestos y con el respirar polvo de asbestos y he sido entrenado en los procedimientos de trabajo adecuados y medidas de proteccion personales en el area de trabajo. Los temas vistos en el curso incluyen los siguientes:

Caracteristicas fisicas de asbestos
Peligros de salud asociado con asbestos
Uso de equipo de proteccion
Sistemas de aire negativos
Practicas de trabajo mientras se trabaja o se entrena
Procedimientos de descontaminacion personal
Muestreo del aire, personal y del area

EXAMEN MEDICO: Yo he sido examinado dentro de lost ultimos 12 meses el cual fue pagado por mis patrones. Esta examinacion incluye: historia de salud, pruebas de funcion pulmonares y podria tener incluida una evaluacion de rayos x del torax.

Firma: _____

Nombre Escrito: _____

Numero Del Seguro Social: _____

Testigo: _____

# SECTION 01911

# RESPIRATORY PROTECTION

**PART 1 - GENERAL** - THE MINIMUM RESPIRATORY PROTECTION DURING REMOVAL WILL BE HALF FACE DUAL CARTRIDGE RESPIRATORS EQUIPPED WITH HEPA CARTRIDGES. THE CONTRACTOR SHALL PROVIDE INFORMATION TO ASSURE THAT THE ABOVE RESPIRATORY PROTECTION IS SUFFICIENT IN ACCORDANCE WITH 29 CFR 1926.1101 NEGATIVE EXPOSURE ASSESSMENT REQUIREMENTS.

## 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division-1 Specification sections, apply to work of this section.

## 1.02 DESCRIPTION OF WORK:

Instruct and train each worker involved in asbestos abatement in proper respiratory use and require that each worker always wear a respirator, properly fitted on the face in the work area from the start of any operation which may cause airborne asbestos dust until the work area is completely decontaminated. Use respiratory protection appropriate for the dust level encountered in the work place or as required for other toxic or oxygen-deficient situations encountered.

## 1.03 STANDARDS:

Except to the extent that more stringent requirements are written directly into the contract documents, the following regulations and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents or as if published copies were bound herewith. Where there is a conflict in requirements set forth in these regulations and standards, meet the more stringent requirement.

## 1.04 SUBMITTALS:

Before start of work submit the following to the Owner's Representative for review. Do not begin work until these submittals are returned with the Owner's Representative's action stamp indicating that the submittal is returned for unrestricted use.

Product Data: Submit manufacturer's product information for each component used, including NIOSH and MSHA Certifications for each component in an assembly and/or for entire assembly.

System Diagram: When a Type "C" supplied air respiratory system is required by the work, submit drawing showing assembly of components into a complete supplied air respiratory system. Include diagram showing location of compressor, filter banks, backup air supply tanks, hose line connections in work area(s), routing of air lines to work area(s) from compressor.

Operating Instruction: Submit complete operating and maintenance instructions for all components and systems as a whole. Submittal is to be in bound manual form suitable for field use.

Respiratory Protection Program: Submit level of respiratory protection intended for each operation required by the project. Submit this information on a "Respiratory Protection Program" form.

Historic Airborne Fiber Data/Negative Initial Exposure Assessment: Submit airborne asbestos fiber count data calculated by an independent air monitoring firm within the last 12 months to substantiate selection of proposed respiratory protection. Data should include Negative Initial Exposure Assessment which means a demonstration by the employer/contractor, which complies with the criteria in the paragraph of this section; 29 CFR 1926.110 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PELs. Data submitted shall include at least the following for each procedure required by the work:

Date of Measurements

Employees Monitored

Operations Monitored and Control Methods Used

Sampling and Analytical Methods Used and Evidence of their Accuracy

Number, Duration, and Results of Samples Taken

## 1.05 AIR QUALITY FOR SUPPLIED AIR RESPIRATORY SYSTEMS:

If at any time, Type "C" supplied air respirator are used or required, provide air used for breathing in Type "C" supplied air respiratory systems that meets or exceeds standards set for C.G.A. Type 1 (Gaseous Air) Grade D.

## 1.06 ALLOWABLE CONTAMINANTS:

The following table sets for the quantity of any given contaminant allowed according to the referenced standards:

| | CGA TYPE 1 (Gaseous Air) | | | CSA |
|---|---|---|---|---|
| CONTAMINANT | Grade D | Grade E | Grade H | Z180.1 |
| Carbon Monoxide, PPM/V | 10 | 10 | 5 | 5 |
| Carbon Dioxide, PPM/V | 1000 | 500 | .5 | 500 |
| Condensed Hydrocarbons, (mg/cu meter) | 5 | 5 | --- | 1 |
| Gaseous Hydrocarbons - As Methane, PPM/V | --- | --- | 10 | 25 |
| Water Vapor - PPM/V | (1) | (1) | (1) | 27 |
| Dewpoint | -50F | -50F | -50F | -63F |
| Objectionable Odors | None | None | None | None |
| Nitrogen Dioxide, PPM/V | --- | --- | 0.5 | 0.2 |

| | | | | |
|---|---|---|---|---|
| Nitrous Oxide, PPM/V | --- | --- | --- | 5 |
| Sulfur Dioxide | --- | --- | 0.5 | --- |
| Halogenated solvents, PPM/V | --- | --- | 1 | --- |
| Other gaseous contaminants | --- | --- | --- | (2) |
| Inorganic particles, (mg/cu meter) | --- | --- | --- | 1 |
| Oxygen content (v/v) | 19.5 – 23.5% | | | |

NOTE:

Indicates that the standard shows no limiting characteristics:

(1) The CGA standards do not call out a specific moisture limit when the ambient temperature is above freezing. However, since a moisture content no greater than a -50 Degrees Fahrenheit dewpoint (66 PPM/V) is necessary for carbon monoxide elimination, the CO limits could not be met unless the air were dried to a -50 Degrees Fahrenheit dewpoint or better.

(2) Maximum allowable content of tricholotrifluorethane, dichlorodifluoromethane, and chlorodifluoromethane is 2 PPM/V for each. Unlisted contaminants shall not exceed one-tenth of the threshold limit values (TLV's) for chemical substances in workroom air adopted by the American Conference of Governmental Industrial Hygienists (ACGIH).

**1.07 DELIVERY:**

Deliver replacement parts, etc., not otherwise labeled by NIOSH or MSHA to job site in manufacturer's containers.

**PART 2 - EQUIPMENT**

**2.01 AIR PURIFYING RESPIRATORS:**

Respirator Bodies: Provide half face or full face type respirators. Equip full face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32 degrees Fahrenheit.

Filter Cartridges: Provide, at a minimum, HEPA type filters labeled with NIOSH certification for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge section may be added, if required, for solvents, etc., in use. In this case, provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH certification (P100).

Non-permitted respirators: Do not use single use, disposable or quarter face respirators.

## 2.02 SUPPLIED AIR RESPIRATOR SYSTEMS:

Provide equipment capable of producing air of the quality and volume required by the above reference standards applied to the job site conditions and crew size. Comply with provisions of this specification if more stringent than the governing standard.

Face Piece and Hose: Provide full face piece and hose by same manufacturer that has been certified by NIOSH as an approved Type "C" respirator assembly operating in pressure demand mode with a positive pressure face-piece.

Auxiliary backup system: In atmospheres which contain sufficient oxygen (greater than or equal to 10.5% oxygen) provide a pressure-demand full face piece supplied air respirator equipped with an emergency back up HEPA filter.

Escape air supply: In atmospheres which are oxygen deficient (less than 19.5% oxygen) provide a pressure-demand full face piece supplied air respirator incorporating an auxiliary self-contained breathing apparatus (SCBA) which automatically maintains an uninterrupted air supply in pressure demand mode with a positive pressure face piece.

Backup air supply: Provide a reservoir of compressed air located outside the work area which will automatically maintain a continuous uninterruptable source of air automatically available to each connected face piece and hose assembly in the event of compressor shut-down, contamination of air delivered by compressor, power loss or other failure. Provide sufficient capacity in the back-up air supply to allow a minimum escape time of one-half hour times the number of connections available to the work area. Air requirement at each connection is the air requirement of the respirators in use plus the air requirement of an average sized adult male engaged in moderately strenuous activity.

Warning-device: Provide a warning device that will operate independently of the building's power supply. Locate so that the alarm is clearly audible above the noise level produced by equipment and work procedures in use, in all parts of the work area and at the compressor. Connect alarm to warn of:

Compressor shut down or other fault requiring use of backup air supply, carbon monoxide (CO) levels in excess of 5 PPM/V.

Carbon Monoxide (CO) Monitor: Continuously monitor and record on a strip chart recorder carbon monoxide (CO) levels. Place monitors in the air line between compressor and back-up air supply and between backup air supply and workers. Connect monitors so that they also sound an alarm as specified under "Warning Devices".

Compressor Shut Down: Interconnect monitors, alarms and compressor so that compressor is automatically shut down and the alarms sounded if any of the following occur:

Carbon Monoxide (CO) concentrations exceed 5 PPM/V in the air line between the filter bank and backup air supply.

Compressor temperature exceeds normal operating range.

Compressor Motor: Provide a compressor driven by an electric motor. Do not use a gas or diesel engines to drive compressor. Insure that electrical supply available at the work site is adequate to energize motor.

Compressor Location: Locate compressor outside of building in location that will not impede access to the building, and that will not cause a nuisance by virtue of noise or fumes to occupied portions of the building.

Air Intake: Locate air intake remotely from any source of automobile exhaust or any exhaust from motors or buildings.

After Cooler: Provide an after cooler at entry to filter system which is capable of reducing temperatures to outside ambient air temperatures.

Self Contained Breathing Apparatus (SCBA): Configure system to permit the recharging of 1/2 hour 2260 PSI SCBA cylinders.

## PART 3 - EXECUTION

### 3.01 GENERAL:

Respiratory Protection Program: Comply with ANSI Z88.2 - 1980 "Practices for Respiratory Protection" and OSHA 29 CFR 1910 and 1926.

Require that respiratory protection be used at all times that there is any possibility of disturbance of asbestos-containing materials whether intentional or accidental.

Require that a respirator be worn by anyone in a work area at all times, regardless of activity, during a period that starts with any operation which could cause airborne dust until the area has been cleared for re-occupancy in accordance with Section 01915.

Regardless of airborne fiber levels: Require that the minimum level of respiratory protection used be powered air-purifying respirators with high efficiency filters for removal work inside containments and half face dual cartridge respirators equipped with organic/high efficiency filters for the removal of floor tile mastic using chemical solvents.

Do not allow the use of single-use, disposable, or quarter-face respirators for any purpose.

### 3.02 FIT TESTING:

Initial Fitting: Provide initial fitting of respiratory protection during a respiratory protection course of training set up and administered by a Certified Industrial Hygienist. Fit types of respirator to be actually worn by each individual. Allow an individual to use only those respirators for which he has been trained and fit.

On a weekly basis, check the fit of each worker's respirator by having irritant smoke blown onto the respirator from a smoke tube in accordance with the fit test procedures outlined in 29 CFR 1910.134 Appendix A.

Upon each wearing: Require that each time an air-purifying respirator is put on that it be checked for fit with a positive and negative pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980) and 29 CFR 1910.134.

## 3.03 TYPE OF RESPIRATORY PROTECTION REQUIRED:

Provide respiratory protection as indicated in paragraph below. Where paragraph below does not apply, determine the proper level of protection by dividing the expected or actual airborne fiber count in the work area by the "protection factors" given below. The level of respiratory protection which supplies an airborne fiber level inside the respirator, at the breathing zone of the wearer, at or below the permissible exposure limit (PEL) is the minimum level of protection allowed.

## 3.04 PERMISSIBLE EXPOSURE LIMIT (PEL):

8-Hour Time Weighted Average (TWA) of asbestos fibers to which any worker may be exposed shall not exceed the following.

Fibers: For purposes of this section, fibers are defined as all fibers regardless of composition as counted in the OSHA Reference Method (ORM), NIOSH 7400 procedure, or asbestos fibers of any size as counted using either a scanning or transmission electron microscope.

Time Weighted Average (TWA) - 0.1 fibers/cubic centimeter

Excursion Limit - 1.0 fiber/cubic centimeter over any thirty (30) minute sampling period.

## 3.05 RESPIRATORY PROTECTION FACTOR:

| RESPIRATOR TYPE | PROTECTION FACTOR |
|---|---|
| Air purifying:<br>Negative pressure respirator<br>High efficiency filter<br>Half facepiece | 10 |
| Air purifying:<br>Negative pressure respirator<br>High efficiency filter<br>Full facepiece | 50 |
| Powered-air purifying (PAPR):<br>Positive pressure respirator<br>High efficiency filter<br>Full facepiece | 1000 |
| Powered-air purifying (PAPR):<br>Positive pressure respirator<br>High efficiency filter<br>Half facepiece | 50 |
| Type C supplied air:<br>Positive pressure respirator<br>Continuous-flow<br>Half facepiece | 50 |

| | |
|---|---|
| Type C supplied air:<br>Positive pressure respirator<br>Continuous-flow<br>Full facepiece | 1000 |
| Type C supplied air:<br>Positive pressure respirator<br>Pressure demand<br>Half facepiece | 50 |
| Type C supplied air:<br>Positive pressure respirator<br>Pressure demand<br>Full facepiece | 1000 |
| Type C supplied air:<br>Positive pressure respirator<br>Demand mode<br>Half facepiece | 10 |
| Type C supplied air:<br>Positive pressure respirator<br>Demand mode<br>Full facepiece | 50 |
| Self-contained breathing apparatus (SCBA):<br>Demand mode<br>Half facepiece | 10 |
| Self-contained breathing apparatus (SCBA):<br>Demand mode<br>Full facepiece | 50 |
| Self-contained breathing apparatus (SCBA):<br>Pressure demand<br>Full facepiece | 10,000 |

## 3.06 AIR PURIFYING RESPIRATORS:

Negative pressure - half or full face mask: Supply a sufficient quantity of respirator filters approved for asbestos so that workers can change filters during the work day. Require that respirators be wet-rinsed and filters discarded each time a worker leaves the work area. Require that new filters be installed each time a worker re-enters the work area. Store respirators and filters at the job site in the changing room and protect totally from exposure to asbestos prior to their use.

Powered air purifying - half or full face mask: Supply a sufficient quantity of high efficiency respirator filters approved for asbestos dust so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. Require that regardless of flow, filter cartridges be replaced after 40 hours of use. Require that HEPA elements in filter cartridges be protected from wetting during showering. Require entire exterior housing of respirator including blower unit, filter cartridges, hoses, battery pack, face mask, belt, and cords to be washed each time a worker leaves the work area. Caution should be used to avoid shorting battery pack during washing. Provide an extra battery pack for each respirator so that one can be charging while one is in use.

## 3.07 TYPE "C" RESPIRATOR:

Air Systems Monitor: Continuously monitor the air system operation including compressor operation, filter system operation, backup air capacity and all warning and monitoring devices at all times that system is in operation. Assign an individual trained, by manufacturer of the equipment in use or by a Certified Industrial Hygienist, in the operation and maintenance of the system to provide this monitoring. Assign no other duties to this individual which will take him away from monitoring the air system.

## 3.08 RESPIRATORY PROTECTION PROGRAM:

Submit a completed "Respiratory Protection Program" form indicating type of respiratory protection proposed for each portion of the work.

**- END OF SECTION -**

## SECTION 01915

## WORK AREA CLEARANCE (PCM)

**PART 1 - GENERAL:** CLEARANCE AIR SAMPLES WILL BE COLLECTED DOWN WIND AND THE SAMPLES FROM THE WORK AREAS WILL BE ANALYZED USING PCM METHOD.

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and other Division - 1 Specification sections, apply to work of this section.

### 1.02 CONTRACTOR RELEASE CRITERIA:

The work is complete when the work area is visually clean and airborne fiber levels have been reduced to the level specified below.

### 1.03 AIR MONITORING:

To determine if the elevated airborne fiber counts encountered during demolition operations have been reduced to the specified level, the Owner's Representative will secure samples and analyze them according to the following procedures.

Fibers Counted: "Fibers" referred to in this section shall be as defined in NIOSH Method 7400, Issue 2.

### 1.04 SAMPLING:

The type of sample to be collected will be determined by the CIH retained by the Owner. In the case of aggressive air sampling, the sampling techniques are as follows:

There are not standards available for flow rate of leaf blowers or large fans. However this information is not critical to the success of the procedure.

Before sampling pumps are started the exhaust from forced air equipment (leaf blower with at least 1 horsepower electric motor) will be swept against the abated area and all surfaces. This procedure will be continued for five (5) minutes per 10,000 cubic feet of room volume.

### 1.05 SCHEDULE OF AIR SAMPLES:

**GENERAL:** The number and volume of air samples taken and analytical methods used by the Owner will be in accordance with the following schedule. Sample volumes given may vary depending upon the analytical instruments used.

Visual Inspection: Required as a prerequisite of air testing, is set forth in section 01914.

Air Monitoring: Performed by the Owner during abatement work, is described in section 01906.

**If results of the first set of air samples show that the Contractor has not achieved clearance level, it is the Contractor's responsibility to perform the additional work required for clearance. In addition, the Contractor will be responsible for all costs involved with any additional air sampling to be performed (cost of analysis and collection).**

**PHASE CONTRAST MICROSCOPY (PCM):**

| LOCATION SAMPLED | NUMBER OF SAMPLES | FILTER MEDIA | DETECTION LIMIT (FIBERS/CC) | MINIMUM VOLUME (LITERS) | FLOW RATE LPM |
|---|---|---|---|---|---|
| Inside Affected Functional Space | 5 (minimum) | Mixed Cellulose Ester 0.80 Micron | 0.01 | 1500 | 2-10 |

Analysis: Fibers on each filter will be measured using PCM procedures in accordance with NIOSH 7400, Issue 2.

Release Criteria: Decontamination of the work site is complete when every work area sample is below or equal to 0.01 f/cc of air sampled or the baseline whichever is higher.

Phase Contract Microscopy: The services of a testing laboratory will be employed by the Owner to perform laboratory analysis of the air samples. A microscope and technician will be set up on site so that verbal results can be obtained immediately. If site conditions dictate that the testing laboratory cannot set up on site, verbal results shall be relayed to the Owner as well as the contractor within four hours of the collection of the clearance samples. A complete record certified by the testing laboratory of all air monitoring tests and results will be furnished to the Owner.

**PART 2 - PRODUCTS (Not Applicable)**

**PART 3 - EXECUTION (Not Applicable)**

**- END OF SECTION -**

# SECTION 01917

# DISPOSAL OF ASBESTOS-CONTAINING WASTE MATERIAL

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS:

Drawings and general provisions of the Contract, and Division-1 Specification sections, apply to work of this section.

### 1.02 DISPOSAL:

Friable asbestos-containing waste material and debris that is packaged in accordance with the provision of this specification may be disposed of at designated sanitary landfills when certain precautions are taken.

Notice to appropriate Environmental Protection Agency regional office.

Notice and permit from appropriate State and/or local Agencies.

See Section 01904 for agency locations and code.

Dispose of non-friable asbestos containing material in accordance with applicable regulations.

### 1.03 SUBMITTALS:

Submit copies of all manifest, including DOT shipping receipts, and landfill site receipts to Owner's Representative within 15 calendar days of project completion.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.01 GENERAL:

Carefully load containerized waste on sealed trucks or other appropriate vehicles for transport. Exercise care before and during transport, to insure that no unauthorized persons have access to the material.

Do not store disposal bagged material outside of the work area. Take bags from the work area directly to a sealed truck or dumpster. Label containers or bags with the name of the waste generator and the location at which the waste was generated.

Do not transport disposal bagged material on open trucks. The interior of the vehicle where bags are being transported shall be lined with 6 mil thich polyethylene. Double bagged material may be transported on open trucks if they are first loaded in sealed drums. Label drums with the same warning label as bags. Uncontaminated drums may be reused. Treat drums that have been contaminated as asbestos-containing waste and dispose of in accordance with the specification.

Advise the sanitary landfill operator at least twenty-four hours in advance of transport of the quantity of material to be delivered.

At the burial site, sealed plastic bags shall be carefully removed from the truck. If bags are broken or damaged in transit, leave in the truck and clean entire truck and contents using procedures set forth in Section 01914 Project Decontamination.

Retain receipts from landfill for material disposed of.

Final payment may be withheld by the Owner until all the properly executed manifests have been submitted to the Owner's Representative.

**- END OF SECTION -**

**Item No. 101S**
**Preparing Right of Way**

## 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, Section 00700, "General Conditions" 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, Section 00700, "General Conditions" 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 403S, “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".

### 101S.5 Payment

The work and material 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 contract bid price for "Preparing Right of Way". This price shall include full compensation for 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 item, will be made under one of the following:

| | | |
|---|---|---|
| **Pay Item No. 101S-A:** | Preparing Right of Way - | Per Acre. |
| **Pay Item No. 101S-B:** | Preparing Right of Way - | Per 100 foot Station. |
| **Pay Item No. 101S-C:** | Preparing Right of Way - | Per Lump Sum. |

**End**

| **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. 403S | Concrete for Structures |
| Item No. 506S | Manholes |
| Item No. 610S | Preservation of Trees and Other Vegetation |

## 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, Section 00700, "General Conditions" 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. |

**End**

| **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

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 | Excavation Sequence and 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. 203S | 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 |

***RELATED*** CROSS REFERENCE MATERIALS-Continued

Specification 102S, “CLEARING AND GRUBBING”

City of Austin Standard Details

| Designation | Description |
|---|---|
| 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 |

**Item No. 104S**
**Removing Portland Cement Concrete**

## 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. 403S, “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 1/2 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. |

**End**

| ***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. 403S | Concrete for Structures |
| Item No. 610S | Preservation of Trees and Other Vegetation |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|

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 | Excavation Sequence and 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 |

| ***RELATED*** CROSS REFERENCE MATERIALS - Continued |
|---|
| Specification Item 104S, "REMOVING CONCRETE" |

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 |

**Item No. 111S**
**Excavation**

## 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 Section 00700, "General Conditions" 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, Department of Public Works and Transportation.

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 square meter is equal to 1.306 square 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 square meter is equal to 1.306 square 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. |

**End**

| ***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 |

City of Austin Standard Details

| Designation | Description |
|---|---|
| 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 14-11-181 | Permit Required |
| Article 14-11-189 | Conditions for Permit Issuance |
| Article 14-11-190 | Excavation Sequence and 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 |

**Item No. 315S**
**Milling Asphaltic Concrete Pavement and Non-Portland Cement Concrete Bases**

## 315S.1 Description

This item shall govern for the planing or the planing and texturing of existing asphaltic concrete pavement, asphalt stabilized and other non Portland cement Concrete base to depths indicated at the locations shown on the Drawings or as directed by the Engineer or designated representative. The item shall also include removal, and disposal or salvage/stockpiling the milled materials at the locations designated by the Engineer or designated representative.

When shown on the Drawings, the salvaged asphaltic concrete pavement and/or stabilized base, including any accompanying surface treatment, plant mix seal and micro-surfacing, may be allowed or required for use in other construction items of this project

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.

## 315S.2 Submittals

The submittal requirements of this specification item include:

A. Characteristics (i.e. manufacturer, power, stability, speed, etc.) and capabilities (depth of cut, dust control, etc.) of the proposed milling equipment.

B. Proposed plan for grade reference, control point spacing and support system.

C. Proposed dust control plans including proposed equipment (type street sweeper, loader, water trucks, sprayers, etc.).

## 315S.3 Equipment

The equipment for removing the pavement surface shall be a power operated planing machine or grinder with a minimum 2 feet (1.8 meter) cutting width. For detail work and cutting widths less than 2 feet (1.8 meter), equipment with less than 2 feet (1.8 meter) cutting width shall be allowed. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of removing in one pass, asphaltic concrete pavement of a thickness of 1 inch and any required thickness less than 1 inch (25 millimeters) in a minimum 3 foot (0.9 meters) width. Machines capable of removing, in one pass, a depth greater than 1 inch (25 millimeters) will be permitted.

The grade reference used by the Contractor may be of any type approved by the Engineer or designated representative. Control points, if required by the Drawings, shall be set at intervals not to exceed 50 feet (15 meters). The Contractor shall set the grade reference from the control points. The grade reference shall have sufficient support so that the maximum deflection shall not exceed two millimeters (1/16 inch) between supports.

The machine shall have a manual system providing for uniformly varying the depth of cut while the machine is in motion, thereby making it possible to cut flush to all inlets, manholes, or other obstructions within the paved area. The speed of the machine shall be variable in order to leave the desired grid pattern as specified in sections 315S.4 and 315S.5.

The machine shall be equipped with an integral loading and reclaiming means to immediately remove material being cut from the surface of the roadway and discharge the cuttings into a truck, all in one operation. The machine shall be equipped with means to control dust created by the cutting action. Adequate backup equipment (mechanical street sweepers, loaders, water truck, sprayers, brooms etc.) and personnel will also be provided to keep flying dust to a minimum and to insure that all cuttings are removed from the street surface daily. Stockpiling of planed material will not be permitted on the project site.

Various machines may be permitted to make trial runs to demonstrate the capabilities of that machine and to determine the acceptability of that machine to the Engineer or designated representative. Any machine that is incapable, in the opinion of the Engineer or designated representative, of meeting these requirements will not be permitted.

### 315S.4 Construction Methods

A. General.

The pavement surface shall be removed for the length, depth and width and to the typical section shown on the Drawings, and to the lines and grades established by the Engineer or designated representative. The planed surface shall provide a satisfactory riding surface free from gouges, continuous longitudinal grooves, ridges, oil film and other imperfections and shall have a uniform textured appearance.

When an existing asphaltic concrete pavement overlay is to be removed from an underlying Portland cement concrete pavement, all of the asphaltic concrete pavement shall be removed, leaving a uniform surface of Portland cement concrete, unless otherwise directed by the Engineer or designated representative.

B. Surface Milling.

Surface milling shall be taken to a minimum depth of 2 inches (50 mm) or deeper as may be dictated by delamination of asphalt layers during the milling operation, to a depth of 1 inch (25 millimeters) below the lip gutter transitioning to the existing surface in 3 feet (0.9 meter) or as indicated on the Drawings for resurfacing operations. The pavement surface shall be removed to the appropriate milling depths around all castings within the area to be milled. When milling is used for leveling without the addition of asphalt, the milled surface shall be free of ridges deeper than 3/16 inch (5 millimeters).

Pavement, which is adjacent to steep curbs, inlets, manholes or other obstructions and that is not removed by the planing machine, shall be removed by other methods, acceptable to the Engineer or designated representative.

The pavement and curb surfaces shall be swept with a street sweeper or other sweeping equipment approved by the Engineer or designated representative to remove all debris leaving a clean and presentable condition.

C. Edge Milling.

Edge milling at the gutter lip shall be taken to a minimum depth of 1/4 inch (6 mm) less than the overlay thickness and shall transition to the existing surface in a minimum of 6 feet (1.8 meters).

D. Spot Milling.

Milling for spot repairs shall be completed in successive passes to the depth specified. Ramping for spot repairs shall be minimized. "Transition milling required at the beginning and ending of the overlay shall be taken to a minimum depth of the overlay thickness and transition to the existing surface for the length specified in the plans.

E. Miscellaneous.

Unless otherwise specified, the milling material shall remain the property of the Contractor. Temporary stockpiling shall not be permitted on site. Temporary pavement markings shall conform to Item No. 864S, "Abbreviated Pavement Markings".

### 315S.5 Surface Texture (Temporary Traffic Only)

In those areas where traffic will temporarily be permitted, the texture produced shall be a grid pattern or any other pattern with discontinuous longitudinal striations that will provide, in the opinion of the Engineer, a satisfactory riding surface.

When the planed pavement will not be overlaid, the minimum texture depth resulting from the number of measurements directed by the Engineer shall not be less than 3/64 inch (1.25 millimeters), unless specified otherwise on the Drawings. When these texture requirements are not met, the Contractor shall cease operations until the Engineer is satisfied that changes in the texturing procedures will produce an acceptable texture.

The Contractor shall take care to prevent damage to armor joints, sealed expansion joints and/or other appurtenances.

The surface of the pavement, after planing, shall have a smooth riding quality and shall be true to the established line, grade and cross section.

### 315S.6 Measurement

Work prescribed by this item will be measured by the square yard (square meter: 1 square meter equals 1.196 square yards) of surface area for actual quantities based on the neat dimensions indicated for surface and transition milling, spot repairs and edge milling to the specified width. Ramping for spot repairs shall not be measured for payment. Surface milling for spot repairs shall be included in the unit price bid for the spot milling area measured.

Measurement will be made only one time regardless of the number of passes required by the machine to secure the depth desired.

### 315S.7 Payment

The work performed in accordance with this item and measured as provided under "Measurement", will be paid for at the unit bid price per square yard for "Milling Asphaltic Concrete Paving and Non-Portland Cement Bases". The price shall include full compensation for removal of all materials to the depth shown; minimizing the dust escaping to the atmosphere; loading, hauling, unloading and satisfactorily storing or disposing of the material; and for all labor, tools, equipment, manipulation, temporary pavement markings and incidentals to complete the work, including mobilization of the milling machine.

No payment will be made for work done by any machine on a trial run to demonstrate its ability to meet this specification unless the work performed is acceptable under this specification.

Payment will be made under the following:

| | | |
|---|---|---|
| **Pay Item No. 315S-A**: | Surface Milling | Per Square Yard. |
| **Pay Item No. 315S-B**: | Profile Milling | Per Square Yard. |
| **Pay Item No. 315S-C**: | Transition Milling | Per Square Yard. |
| **Pay Item No. 315S-D**: | Edge Milling | Per Square Yard. |
| **Pay Item No. 315S-E**: | Spot Milling | Per Square Yard. |

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item 315S "Milling Asphaltic Concrete" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 642S | Silt Fence (SF) |
| Item No. 864S | Abbreviated Pavement Markings |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 206S | Asphalt Stabilized Base |
| Item No. 210S | Flexible Base |
| 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. 311S | Emulsified Asphalt Repaving |
| Item No. 312S | Seal Coat |
| 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

| ***RELATED*** CROSS REFERENCE MATERIALS (Continued) |
|---|
| Specification Item 315S "Milling Asphaltic Concrete" |

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 354 | Planing and/or Texturing Pavement |

**Item No. 340S**
**Hot Mix Asphaltic Concrete Pavement**

## 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, II | 3 |
| **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 Standard 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 |
|---|---|---|---|---|---|
| 1-1/2" (37.5 mm) | 100 | | | | |
| 1-1/4" " (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 | | |
| 1/2" (12.5 mm) | 50-70 | | | 100 | |
| 3/8" (9.5 mm) | | 60-80 | 70-85 | 85-100 | 100 |
| 1/4" (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 µm) | 2-12 | 3-13 | 3-13 | 4-14 | 3-13 |
| 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) | 1-3/4" (45 mm) | 1" (25 mm) | 3/4" (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 (%) Min. | Laboratory Density (%) Max. | Stability |
|---|---|---|---|---|
| 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 1/2-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$^{o}$F (120$^{o}$C) and 350$^{o}$F (176$^{o}$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$^{o}$F (14$^{o}$C) from the target temperature for discharge from the mixer. HMA mixtures that are discharged from the mixer at a temperature exceeding 360$^{o}$F (182$^{o}$C) or a temperature more than 50$^{o}$F (28$^{o}$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.

### 340S10 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$^{o}$F (10$^{o}$C) and is falling, but it may be placed when the air temperature is above 40$^{o}$F (4$^{o}$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$^{o}$F (15$^{o}$C) and is falling, but it may be placed when the air temperature is 50$^{o}$F (10$^{o}$C) and is rising. An HMA layer with a thickness of 1-1/2 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$^{o}$F (10$^{o}$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$^{o}$F (28$^{o}$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$^{o}$F (80$^{o}$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$^{o}$F (80$^{o}$C).

Vibratory rollers shall not be allowed in the vibrating mode on layers with a plan thickness less than 1-1/2 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). Payment for this work will be measured and paid for as Mobilization (LS) and Crack Sealing (LF).

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). Payment for this Work will be measured and paid for as Mobilization (LS) and Crack Sealing (LF).

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<br>6.6± | ± 5.0<br>5.1± | 0<br>10 |
| Passing No. 200 (75 µm) | ± 3.9<br>4.0± | ± 3.0<br>3.1± | 0<br>5 |

**Asphalt Content Acceptance Schedule (TEX-210-F, PartII)**

| 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 | 1-1/2" (38 mm) Thickness or Greater | Less than 1-1/2" (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 | 1-1/2" (38 mm) Thickness or Greater | Less than 1-1/2" (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. |

**End**

| ***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 |

**Item No. 360S**
**Concrete Pavement**

## 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.

## 360S.2 Submittals

The submittal requirements of this specification item may include:

Mix design option(s) of the class of concrete required on the project,

The supplier of the concrete mix design(s) and type of mixing equipment, and

Type of admixtures to be used with the concrete mixes.

## 360S.3 Materials

A. Cementatious 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 five (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 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 1 3/4 inch (43.75 mm) sieve | 0% |
| Retained on 1 1/2 inch (37.5 mm) sieve | 0 to 5% |
| Retained on 3/4 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 1 1/2 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$^{o}$ F +/- 2 o F (25$^{o}$C +/- 1.1$^{o}$C), MIL-2-8802D, | |
| Sec 4.8.7, minutes | 60 |
| Cure time at 77°F (25oC), days | 7-14 |
| Full Adhesion, days | 14-21 |

As Cured - after 7 days at 77$^{o}$F (25$^{o}$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 (110oC) 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 1/2 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 3/4 inch in 3 1/2 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 1/2 inch (13 mm) of original horizontal plane of the mat. Mats with any portion of the wires out of vertical alignment more than 1/2 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 | Unit Weight | Diameter | Cross-Sectional Area, | Perimeter |
|---|---|---|---|---|
| Size No | Pounds Per Ft. (Kgs per Meter) | Inches (Centimeters) | Sq. inches (Sq, Centimeters) | Inches (Centimeters) |
| 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 1 1/2 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 beam 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 trans-angular finishing float adjustable to crown and grade and be satisfactory to the Engineer or designated representatve. 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. 403S, "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, 4 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 Day, psi | Tex-418-A | 4000 (27,600) |

| | | |
|---|---|---|
| (kPa) | | |
| Compressive Strength after 28 day, psi (kPa) | Tex-418-A | 4500 (31,000) |
| Maximum Concrete Mix Temperature $^{o}$F ($^{o}$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 (9.16 per cubic meter) |
| Coarse Aggregate Factor | | 0.65 min-0.85 max |
| Slump, inches (Centimeters) | Tex-415-A | 1/2 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, | Tex-418-A | 4,925 (34,000) |

| | | |
|---|---|---|
| psi (kPa) | | |
| Maximum Concrete Mix, Temperature oF (oC) | | 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, (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 | 1/2 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 l Strength, after 28 days, psi (kPa) | Tex-418-A | 4,925 (34,000) |
| Maximum Concrete Mix, Temperature, $^{o}$F ($^{o}$C) | | 100 (37.8) |
| Retarder, Regular Concrete Over 360S.7C, Minutes, Maximum | | 120 |

| Table 4: Over Design Required to Meet Compressive Strength Requirements1 | | | | | |
|---|---|---|---|---|---|
| Number Of Tests2,3 | 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 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.

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 beams.

The mix will be designed with the intention of producing concrete, which will have a slump of 1 1/2 inches (3.8 cms). The slump shall not be less than 1/2 inch (1.25 cms) nor more than 2 inches (5 cms).

D. Mix Design

The Contractor shall 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% 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 beams 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 beams.

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 Texas DOT 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 1 1/2 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 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 40oF (4.5oC) and falling but may be placed when the temperature is above 35oF (1.7oC) and rising, the temperature being taken in the shade and away from artificial heat.

When the temperature of the air is above 85oF (29.4oC), an approved retarding agent will be required in concrete. The maximum temperature of all regular concrete placed shall not exceed 95oF (35.0oC), 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 32oF (0oC) or below, before concrete has been placed 4 hours. Such protection shall remain in place during the period the temperature continues below 32oF (0oC) 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 1/2 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 3000 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 1/2 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 1/2 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 1/4 inch (6.3 mm)nor more than 1/2 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 180o F (82.2 oC). 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 1/2 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 (6350 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.

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 1000 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 1000 feet plus the fractional part of 1000 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 1000 feet in length and other areas designated by the Engineer or designated representative, units will be considered separately and are defined as 1000 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 1000-foot unit will be taken at intervals of not less than 300 feet. The 2 additional cores from any 1000 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 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.

For new Concrete Pavement roadways constructed in accordance with the plans and specifications, if cracks greater than or equal to 1/4 inch in width develop in the pavement surface within the one year warranty period, complete replacement of pavement sections as directed by the Engineer shall be performed by the Contractor at no additional expense to the City.

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 drawing, 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. |

**End**

| 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-424-A | Obtaining and Testing Drilled Cores of Concrete |
| Tex-436-A | Measurement of Texture Depth by the Sand Patch Method |
| Tex 418-A | Compressive Strength of Cylindrical Concrete |
| 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 |

**Item No. 402S**
**Controlled Low Strength Material**

## 402S.1 Description

This item governs Controlled Low Strength Material (CLSM) used for trench backfill and for filling abandoned culverts, pipes, other enclosures, and for other uses as indicated on the drawings, Standard Details or as approved by the Engineer or designated representative. CLSM is a low strength, self-compacting, flowable, cementitious material used in lieu of soil backfill. It is intentionally prepared at low strength to allow for future removal using conventional excavation equipment.

The CLSM shall be composed of Portland cement or fly ash, or both, filler aggregate and water. The CLSM, specified for use in filling abandoned culverts, pipes, or other enclosures, shall contain a settlement compensator, in addition to the other ingredients, to minimize settlement of the CLSM within the enclosure.

Normal Set CLSM shall be specified whenever the material will remain uncovered or will not be subjected to traffic or other loads within 24 hours after placement. Fast Set CLSM shall be specified whenever the material will be covered, subjected to traffic or other loads within 24 hours, or needed to expedite construction.

CLSM can be used for permanent subgrade repairs below the base layer, but shall not be used for permanent pavement repairs. For temporary traffic applications, a minimum 2 inch (50 mm) cap composed of Hot Mix-Cold Laid Asphaltic Concrete (TxDoT Standard Specification Item 334) shall be placed on the CLSM.

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.

## 402S.2 Submittals

The submittal requirements of this specification item include:

A. A mix design submittal including the results of unconfined compressive strength tests, air entrainment (if applicable), flow consistency, hardened unit weight, and timed Ball Drop and corresponding Penetrometer tests.

B. Certifications and test results for the cement fly ash, and admixtures.

C. Particle-size gradation and specific gravity tests on the filler aggregate.

## 402S.3 Materials

A. Cement.

Portland cement shall conform to ASTM C 150, Type I (General Purpose).

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.

B. Fly Ash

Fly ash shall conform to the requirements of Standard Specification Item No. 405, "Concrete Admixtures" and TxDOT Specification Item 437.

C. Filler Aggregate.

Filler aggregate shall consist of sand, stone screenings, pavement milling cuttings or other granular material that is compatible with the other mixture components. The filler aggregate shall be fine enough to stay in suspension to the extent required for proper flow without segregation, and, in the case of filling of enclosures, for minimal settlement. Filler aggregate shall have a Plasticity Index (TxDOT Test Method Tex-106-E) less than 15 and shall conform to the following gradation:

| Sieve Designation US | (SI) | Percent Passing |
|---|---|---|
| No. 200 | (75μm) | 0 - 10 |

D. Mixing Water.

Mixing water shall conform to the requirements of Standard Specification Item No. 403, "Concrete for Structures".

E. Settlement Compensator

An air entraining admixture with a higher than usual dosage, which meets the requirements of Standard Specification Item No. 405, "Concrete Admixtures", shall be used as a settlement compensator. The settlement compensator may be introduced to the CLSM at the job site by placement of prepackaged admixture in capsules or bags in the mixing drum in accordance with the admixture manufacturer's recommendations.

**402S.4 Mix Design**

The proportioning of CLSM shall be the responsibility of the Contractor. The Contractor shall furnish a mix design conforming to the requirements herein, for review and approval by the Engineer or designated representative. The mix design shall be prepared by a qualified commercial laboratory and then reviewed and signed by a registered Professional Engineer licensed in the State of Texas.

The Mix Design submittal must include:

A. Test results for unconfined compressive strength, air entrainment (if applicable), flow consistency, hardened unit weight, and timed Ball Drop (ASTM C-360) and corresponding Penetrometer tests (with a concrete pocket penetrometer),

B. Certifications and test results for the cement, fly ash, and admixtures, and

C. Results of particle-size gradation and specific gravity tests on the filler aggregate. The submittal shall include Penetrometer tests performed every thirty minutes

until the Ball Drop test shows a 2-inch (50 mm) indentation, as well as the predicted Penetrometer reading that corresponds to a 3-inch (75 mm) Ball Drop indentation. Particle-size gradation shall be determined using a series of sieves that gives no fewer than five uniformly spaced points for graphing the entire range of particle sizes larger than a No. 200 sieve (75-µm).

The Contractor shall perform the work required to substantiate the design at no cost to the City, including all testing. Approved mix designs shall be valid for one year, provided there are no changes in the type, source, or characteristics of the materials during that year.

At the end of one year, the mix design may be submitted for renewal, provided that:

A. field tests of the CLSM during the year have been satisfactory,
B. there have been no changes in type or source of the materials of the mix, and
C. the characteristics of the materials have not changed significantly since the original submittal.

The Contractor shall also submit certifications and test results for the cement, fly ash and admixtures, and particle-size gradation and specific gravity test results for the filler aggregate. The Contractor shall compare results of tests made on the filler aggregate at the end of the year to the results of tests reported in the original submittal. Gradation changes less than ten percent in percent passing any sieve and specific gravity changes less than five percent shall not be considered significant.

### 402S.5 Strength

The CLSM mix designs shall meet the unconfined compressive strength requirements outlined in the table below. The compression tests shall be conducted in accordance with TxDOT Method Tex-418-A, using approved unbonded caps on specimens with four-inch (100 mm) diameter and eight-inch (200 mm) height [or three-inch (75 mm) diameter by six-inch (150 mm) high specimens if a smaller capacity loading device gives more accurate results].

| Unconfined Compressive Strength, psi (mPa) | | |
|---|---|---|
| Age | Normal Set CLSM | Fast Set CLSM |
| 3 hours | — | 35 (0.24) minimum |
| 24 hours | 35 (0.24) minimum | — |
| 28 days | 300 (2.1) maximum | 300 (2.1) maximum |

### 402S.6 Flow Consistency

Flow consistency shall be established in tests involving the use of a six-inch (150 mm) length by three-inch (75 mm) diameter open-ended straight tubing made of steel, plastic or other non-absorbent material that is non-reactive with cement or fly ash. The tube shall be placed with one end on a horizontal flat surface and held in a vertical position. The tube shall then be filled to the top with CLSM. The top surface shall be struck off with a suitable straight edge and any spillage shall be removed from the base of the tube. Within five seconds thereafter the tube shall be raised carefully, using a steady

upward lift with no lateral or torsional motion. The entire test, from the start of filling until removal of the tube, shall be completed within 1½ minutes without interruption.

After removal of the tube, the spread of the CLSM shall be measured immediately along two diameters that are perpendicular to one another. The average of those two measurements is defined as the flow consistency of the mix. The flow consistency of the CLSM shall be considered satisfactory if a circular-type spread of the mix occurs without segregation and a flow consistency (average diameter of spread) of 8 inches (200 mm) or more is achieved.

### 402S.7 Air Entrainment

Air entraining admixture shall be added as a settlement compensator, whenever the CLSM will be used to fill an enclosure (Section 402S-1). The dosage shall be sufficient to result in an air content of 15 to 25 percent (as determined by TxDOT Method Tex-416-A) at the time of placement of the CLSM.

### 402S.8 Field Strength Tests

Ball Drop or Penetrometer tests shall be used to determine, when the CLSM has developed sufficient strength to be covered or subjected to traffic or other loads as approved by the Engineer or designated representative.

The Ball Drop test shall be performed according to the latest version of ASTM C-360. An indentation diameter of three inches (75 mm) or less, and the absence of a sheen or any visible surface water in the indentation area shall indicate that the CLSM has achieved the desired strength. Because trench width and depth may affect the test results, the Contractor may perform this test on a control sample of CLSM in a two-foot (600 mm) square by six-inch (150 mm) deep container.

Penetrometer tests using a hand-held, spring reaction-type device commonly called a concrete pocket penetrometer, shall be performed on the surface of the CLMS. A Penetrometer reading, equal to or greater than the value established in the mix design (Section 402S.4) for a Ball Drop test indentation of 3-inches (75 mm), shall indicate that the CLSM has achieved the desired strength.

### 402S.9 Construction Methods

A. General

The height of free fall placement of the CLSM shall not exceed four feet (1.2 meters). Since CLSM is considered to be self-compacting, a vibrator shall not be allowed. The CLSM shall not be covered with any overlying materials or subjected to traffic or other loads until the Ball Drop test or the Penetrometer test shows acceptable results (Section 402S.8) or until the CLSM has been in place a minimum of 24 hours for Normal Set CLSM and a minimum of 3 hours for Fast Set CLSM. Curing of the CLSM will not be required.

B. Utility Line Backfill

After the utility pipe has been placed and the proper bedding material placed in accordance with the details on the drawings, the trench may be immediately backfilled with the CLSM to the subgrade level shown on the drawings, Standard Details 1100S-6A, B, C & D, 430S-4, 511S-13A and 511S-13B or as directed by the Engineer or designated representative.

C. Culvert Backfill

Care shall be taken to prevent movement of the structure. If the pipe or structure moves either horizontally or vertically, the CLSM and the structure shall be immediately removed and the pipe or structure re-laid to proper line and grade.

D. Other Backfill

CLSM may be used for backfill material in lieu of soil as shown on the drawings, Standard Details or as approved by the Engineer or designated representative.

E. Filling Abandoned Culverts, Pipe, or other Enclosures

The CLSM shall be placed in a manner that allows all air or water, or both, to be displaced readily as the CLSM fills the enclosure.

### 402S.10 Acceptance Testing During Construction

The Engineer or designated representative may perform flow consistency, air entrainment, and unconfined compressive strength tests to determine if the CLSM meets the specification requirements. The number and frequency of acceptance tests will be determined by the Engineer or designated representative.

### 402S.11 Measurement and 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 "Controlled Low Strength Material". The bid prices 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 will be made under the following:

Pay Item No. 402S-A: Controlled Low Strength Material Per Cubic Yard.

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Standard Specification Item 402S, “Controlled Low Strength Material” |

City of Austin Standard Details

| Designation | Description |
|---|---|
| 430S-4 | Concrete Backfill Under Curb & Gutter |
| 506S-14 | Control or Mini Manhole |
| 511S-13A | Water Valve Box Adjustment to Grade W/ Full Depth Concrete |
| 511S-13B | Water Valve Box Adjustment to Grade W/ Concrete and H.M.A.C. |

| | |
|---|---|
| 1100S-6A | Narrow Excavation Next to C&G - Trench Width 0.3 M (12") & Less |
| 1100S-6B | Narrow Excavations - Trench Width 0.3 M (12") & Less |
| 1100S-6C | Excavation Next to C&G - Trench Width Greater than 0.3 M (12") |
| 1100S-6D | Excavations - Trench Width Greater than 0.3 M (12") |

City of Austin Standard Specification Items

| Designation | Description |
|---|---|
| Item No 403S | Concrete for Structures |
| Item No 405S | Concrete Admixtures |

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

| Designation | Description |
|---|---|
| Item No. 334 | Hot Mix-Cold Laid Asphaltic Concrete Pavement |
| Item No. 420 | Concrete Structures |
| Item No. 421 | Portland Cement Concrete |
| Item No. 437 | Concrete Admixtures |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Standard Specification Item 402S, “Controlled Low Strength Material” |

Texas Department of Transportation: Manual of Testing Procedures

| Designation | Description |
|---|---|
| Tex-106-E | Method Of Calculating the Plasticity Index of Soils |
| Tex-416-A | Air Content of Freshly Mixed Concrete By The Pressure Method |
| Tex-418-A | Compressive Strength of Cylindrical Concrete |

American Society for Testing and Materials (ASTM)

| Designation | Description |
|---|---|
| ASTM C 150 | Portland Cement |
| ASTM C 360 | Ball Penetration in Fresh Portland Cement Concrete |
| ASTM C 403 | Time of Setting of Concrete Mixtures by Penetration Resistance |

City of Austin Standard Specification Items

| Designation | Description |
|---|---|
| Item No. 504S | Adjusting Structures |
| Item No. 506S | Manholes |
| Item No. 508S | Miscellaneous Structures and Appurtenances |
| Item No. 510 | Pipe |

**Item No. 403S**
**Concrete for Structures**

## 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:

Mix design option(s) of the class of concrete required on the project,

The supplier of the concrete mix design(s) and type of mixing equipment, and

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 60oF (15.6oC). 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)<br>Prestressed concrete<br>Bridge decks & superstructure<br>All other concrete | ASTM D-512 | <br>500<br>500<br>1,000 |
| Sulfate (SO4) | ASTM D-516 | 1,000 |
| Alkalies (NA2O + 0.658 K2O) | 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 | 2-1/2" (62.5 mm) | 2" (50 mm) | 1 ½" (37.5 mm) | 1" (25 mm) | 3/4" (19 mm) | 1/2" (12.5 mm) | 3/8" (9.5 mm) | No. 4 (4.75 mm) | No. 8 (2.36 mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2" (50 mm) | 100 | 80-100 | 50-85 | | 20-40 | | | 0-5 | |
| 2 (467)* | 1 1/2" (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)* | 3/4” (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 Chart1 (Grade 1 - Percent Passing)

| 3/8 (9.5 mm) | No. 4 (4.75 mm) | No. 8 (2.36 mm) | No. 16 (1.18 mm) | 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 hydraulic 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;entained in accordance with Table 8. If the air content is more than 1-1/2 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 1-1/2 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 n 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

| | Slump1, 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 | 6 ½ (165) | 4 (100) |
| Prestressed Concrete Members1 | 6 ½ (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 | 6 ½ (165) | 4 (100) |
| Pavements, Slip-form | 3 (75 ) | 1-½ (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 | 8 ½ (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 + 1-1/2 percentage points of the mix design requirements.

Unless otherwise specified or indicated on the drawings, concrete mix temperature shall not exceed 90°F (32oC) except in mixes with high range water reducers where a maximum mix temperature of 100°F (38oC) 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 Ratio1 | Coarse Aggr. Grade 2,3,4 | Air Entrain. |
|---|---|---|---|---|---|---|
| | | 28 Days | 7 Days | | | |
| A | 5.0 (280 kg/m3) | 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 |
| C5 | 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 |
| H5 | 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 |
| S5 | 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 | 1,390 |

| | | | | | |
|---|---|---|---|---|---|
| | | | | (7.71) | (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 |
| C5 | 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 |
| H5 | Prestressed concrete beams, boxes, piling and precast concrete traffic barrier |
| J | Utility trench repair |
| S5 | 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 | 7-1/2 |
| 1/2 (12.5)- Grades 6 | 5-1/2 | 7 |
| 3/4 (19)- Grades 5 | 5 | 6 |
| 1 (25)- Grades 4 | 4-1/2 | 6 |
| 1-1/2 (37.5)- Grades 2 & 3 | 4-1/2 | 5-1/2 |
| 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 enroute 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.

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.

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.

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.12, 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 |
| DMS-4610 | Fly Ash |
| DMS-4620 | Ground Granulated Blast-Furnace Slag |
| DMS-4630 | Silica Fume |
| DMS-4635 | Metakaolin |

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 |

| **SPECIFIC CROSS REFERENCE MATERIALS (Continued)** |
|---|
| **Standard Specification Item 403S, "Concrete For Structures"** |

Texas Department of Transportation: Publications

| Designation | Description |
|---|---|
| Bulletin C-11 | Construction Bulletin |

| **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 |

## 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, 3/4 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 3/4 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, 1/2 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 1/2 inch (12.5 mm) nor less than 1/4 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-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. |

**End**

| ***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. 360S | Concrete Pavement |
| Section 360S.4 of Item 360S | Proportioning of Concrete |
| Section 360S.6 of Item 360S | 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 |

**Item No. 432S**
**Portland Cement Concrete Sidewalks**

## 432S.1 Description

This item shall govern the construction of Portland cement concrete sidewalks (Standard Detail No. 432S-1), as herein specified, on an approved subgrade and in conformance with the lines, grades 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 inch-pound units are given preference followed by SI units shown within parentheses.

## 432S.2 Submittals

The submittal requirements of this specification item include:

A. Class A portland cement (p.c). concrete mix design,

B. Type of Installation (i.e. 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.

D. Number, manufacturer, model, construction, finish and installation details of streetscape appurtenances of bicycle racks, benches, chairs, trash receptacles, streetlights, tree wells and above grade tree planters [for sidewalks, 12 feet (3.66 meters) or wider].

## 432S.3 Materials

A. Portland Cement Concrete

Portland cement concrete shall be Class A conforming to Specification Item No. 403S, "Concrete for Structures" or Specification Item No. 407S, "Fibrous Concrete".

B. Reinforcement

Reinforcement shall conform to Specification Item No. 406S, "Reinforcing Steel" or Specification Item No. 407S, "Fibrous Concrete".

C. Expansion Joint Materials

Expansion joint materials shall conform to Specification Item No. 408S, "Expansion Joint Materials".

D. Membrane Curing Compound

Membrane curing compound shall conform to Specification Item No. 409S, "Membrane Curing".

## 432S.4 Construction Methods

The subgrade shall be excavated in accordance with Specification Item No. 111S, “Excavation”, prepared in accordance with Specification Item No. 201S, “Subgrade Preparation”, shaped to the lines, grades and cross section as indicated on the Drawings or as directed by the Engineer or designated representative and thoroughly compacted in accordance with Specification Item No. 201S. A granular cushion of a minimum thickness of 2 inches (50 mm) but maximum thickness of 5 inches (125 mm), composed of crusher screenings, gravel and sand, crushed rock or coarse sand,

shall be spread, wetted thoroughly, tamped and leveled. The granular cushion shall be moist at the time the Portland cement concrete is placed.

If the subgrade is undercut by more than 4 inches (100 mm) or the elevation of the natural ground is more than 4 inches (100 mm) below "top of subgrade", then a necessary backfill/embankment layer of an approved material shall be placed and compacted with a mechanical tamper. Hand tamping will not be permitted.

Where the subgrade is rock or gravel, 70 percent of which is rock; the 2-inch (50 mm) cushion need not be used. The Engineer or designated representative will determine if the subgrade meets the above requirements.

Sidewalk forms shall be constructed of metal or well-seasoned wood not less than 2 inches (50 mm) in thickness, with a section satisfactory to the Engineer or designated representative. The forms shall be clean, straight, and free from warp with 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 deposition of Portland cement concrete. Before p.c. concrete is placed, the forms shall be thoroughly oiled with a light form oil.

Expansion joint material 3/4 inch (19 mm) thick, shall be provided where the new construction abuts an existing structure, sidewalk or driveway. Similar expansion material shall be placed around all obstructions protruding through the sidewalk. The expansion joint material shall be placed vertically and shall extend the full depth of the p.c. concrete. Maximum spacing of expansion joints shall be 40 feet (12 meters) as indicated on the Drawings or as directed by the Engineer or designated representative. Weakened plane joints shall be spaced at 5 feet (1.5 meters) on center. Normal dimensions of the weakened plane joints shall be 1/4 inch wide and 3/4 inch deep (6 mm wide and 19 mm deep). All joints shall be constructed perpendicular (90 degrees) to the centerline of walk and shall match any previously placed concrete joints. For sidewalks with widths exceeding 6 feet (1.83 meters) longitudinal weakened-plane tooled joints shall be provided as indicated on the Drawings or as directed by the Engineer or designated representative.

Reinforcement for sidewalks shall consist either of polypropylene fibrillated fibers or 6” x 6” x W1.4 x W1.4 (150mm x 150mm x MW9 x MW9) welded wire fabric or one layer #3 (10M) reinforcing bars, placed no more than 18 inches (450 mm) on center both directions. 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 steel at 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 insure 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.

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 #3 (10M) bars shall have a minimum lap of 12 inches (300 mm).

Where driveways cross sidewalks, additional reinforcing shall be placed in the sidewalk as indicated on the Drawings.

Portland cement concrete shall be placed in the forms and spaded, tamped and thoroughly consolidated until it covers the entire surface with 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 indicated otherwise on the Drawings or as directed by the Engineer or designated representative. The outer edges and joints shall be rounded with approved tools to a

1/4-inch (6 mm) radius. Care will be exercised to prevent loss of dummy joints or rounded edges when applying the brush finish.

Portland cement concrete sidewalk ramps shall be formed to produce a finished surface with detectable warnings (Standard Detail 432S-2A) in accordance with the requirements of the American Disabilities Act and Texas Accessibility Standards (TAS), including Sections 4.29.2 and A4.29.2. The p.c. concrete sidewalk ramps shall be constructed in accordance with appropriate City of Austin Standard Details (Standard Details 432S-3, 432S-3A through 432S-3H, 432S-5, 432S-5A, 432S-5B, etc.).

Detectable warning for the ramps shall consist of raised truncated domes with a diameter of nominal 0.9 inch (23 mm), a height of nominal 0.2 inch (5 mm) and center-to-center spacing of nominal 2.35 inches (60 mm) and shall contrast visually with adjoining surfaces, either light on dark or dark-on-light. The material used to provide contrast shall be an integral part of the walking surface.

When indicated on the Drawings or as directed by the Engineer or designated representative, the construction of the sidewalk ramp shall include the installation of interlocking concrete paving units (Standard Specification Item No. 480S, "Concrete Paving Units"). The concrete paving units shall be constructed in accordance in accordance with Standard Specification Item No. 485S, "Concrete Paving Units for Sidewalk Ramps) and appropriate City of Austin Standard Details (Standard Details 432S-2A, 432S-3, 432S-3A through 432S-3H, 432S-5, 432S-5A and 432S-5B).

At the proper time after finishing, the surface shall be protected by a membrane, compound curing agent or by wetted cotton or burlap mats, conforming to Item No.409S, "Membrane Curing". The sides of the p.c. concrete shall be cured in the forms. If the forms are removed during the curing process, the curing shall be continued by the placement of fill against the exposed concrete edges or by other procedures conforming to Item No. 410S, "Concrete Structures". The top 4 inches (100 mm) of fill shall be clean topsoil conforming to Item No. 604S, "Seeding for Erosion Control".

Existing sidewalk that is scheduled for removal and replacement shall be removed and the underlying material shaped to the lines, grades and cross section as indicated in the drawings or as directed by the Engineer or designated representative. The removal and/or relocation of obstructions, including but not limited to signs, trash cans and benches on concrete pads, abandoned manholes, sprinkler control valves and landscaping, shall be performed, as indicated on the drawings, in a manner acceptable to the Engineer or designated representative. Removal and/or relocation of obstructions will be considered incidental work to this item and will not be paid for directly.

Existing PVC pipe drains in and behind curb shall be removed and replaced as required in new sidewalk and/or curb and gutter. In areas of proposed sidewalk construction, where curb and gutter is to remain in place, existing PVC pipe shall be cut far enough behind the back of curb to allow sufficient room for joint fittings to connect to new or salvaged PVC pipe.

The Contractor shall be responsible for removing and replacing mailboxes that are located in the construction area, while assuring that mail delivery will not be interrupted as a result of the construction activities. Mailboxes shall not be laid on the ground.

All necessary excavation, filling and grading of the slopes adjacent to the completed concrete sidewalks 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 in a manner acceptable to the Engineer or designated representative.

## 432S.5 Streetscape Furniture Installation Requirements

A. General General

Bicycle racks, benches and chairs, trash receptacles, tree wells and above grade tree wells and planters shall only be installed in sidewalks that are 12 feet (3.66 meters) or wider. When installation is indicated on the Drawings or directed by the Engineer or designated representative, these items shall be permanently installed as indicated in Standard Details 710S-4 and 710S-5; 432S-9B; 432S-7C, and 432S-7F; and 432S-8B. Above grade tree wells shall be installed in conformance with Standard Detail 432S-7E, while above grade tree planters shall be installed in conformance with Standard Detail Nos. 432S-7D and 432S-7G.

B. Location Requirements

1. Benches.

   Benches shall be placed either perpendicular to the curb with the center of the bench on line with trees and light poles and facing toward the building entry, or parallel to the building and within 6” (150 mm) of the building wall, facing out to the street.

   Bench siting shall be in conformance with Standard Detail No. 432S-9C in 12’ (3.6 M) or wider sidewalks and Standard Detail No. 432S-9D in sidewalks of width between 12’ (3.6 M) and 18’ (5.4 M).

2. Bike Racks.

   Bike racks are to be placed perpendicular to the curb with the centerline of the rack on line with trees and light poles.

   Bike rack siting shall be in conformance with Standard Detail No. 710S-6A in 12’ (3.6 M) or wider sidewalks and Standard Detail No. 710S-6B in sidewalks of width between 12’ (3.6 M) and 18’ (5.4 M).

3. Trash Receptacles.

   Trash receptacles shall either be placed along the curb, with the center line of the receptacle on line with the trees and light poles, or shall be located at the building entry in alignment with the structural bay system of the building. If located at the entry there shall be no more than 1 foot (300 mm) clearance between the receptacle and the building wall.

   Trash receptacle siting adjacent to curb ramps within an intersection shall be in conformance with Standard Detail No. 432S-8C in 12’ (3.6 M) or wider sidewalks.

## P432S.6 Pedestrian Railing

When a pedestrian railing installation is required along sidewalks for pedestrian protection as indicated on the Drawings or directed by the Engineer or designated representative, this type of pedestrian railing shall be permanently installed in conformance with one of the following designated Standard Details: 707S-1, 707S-2, 707S-3 or 707S-4.

When a pedestrian railing installation is required along portions of sidewalks identified as ‘ramps’ for ADA accessibility purposes as indicated on the Drawings or directed by the Engineer or designated representative, this type of pedestrian railing shall be permanently installed in conformance with one of the following designated Standard Details: 707S-2, 707S-3 or 707S-4.

## 432S.7 Measurement

Accepted work performed as prescribed by this item will be measured by the square foot (square meter: 1 square meter is equal to 10.764 square feet) of surface area of "Concrete Sidewalk".

Accepted work performed as prescribed by "Sidewalk Ramps" will be measured per each for the type of ramp indicated on the Drawings.

Accepted work performed as prescribed by "Streetscape Appurtenances" will be measured per each for the type of appurtenance indicated on the Drawings.

Accepted work performed as prescribed by "Pedestrian Railing" will be measured per lineal foot of the type of railing indicated on the Drawings.

**432S.8 Payment**

The work performed as prescribed by this item for concrete sidewalk will be paid for at the unit bid price per square foot for "Concrete Sidewalk" and/or "Sidewalks Reconstruction"; per each for "Concrete Sidewalk Ramps" and "Streetscape Appurtenances" or per lineal foot for "Pedestrian Railing".

The unit bid price for new sidewalk shall include full compensation for excavating and/or removal and/or relocating obstructions, vegetating adjacent areas disturbed by sidewalk construction, preparing the subgrade; for furnishing and placing all materials including cushion material, all reinforcement, bar supports, joints, expansion joint materials, and for any other materials, manipulations, labor, tools, equipment, finishing, curing and incidentals necessary to complete the work.

The unit bid price for sidewalk reconstruction shall include full compensation for excavating and/or removal of existing sidewalk and other obstructions, relocating obstructions, replacing PVC drain pipe, re-vegetating adjacent areas disturbed by sidewalk construction, preparing the subgrade; for furnishing and placing all materials including cushion material, all reinforcement, bar supports, joints, expansion joint materials, and for any other materials, manipulations, labor, tools, equipment, finishing, curing and incidentals necessary to complete the work.

The unit bid price for ramps shall include full compensation for preparing the subgrade when not included as a separate item; for furnishing and placing all materials, manipulation, labor, tools, equipment and incidentals necessary to complete the work. All necessary excavation, filling and grading of the slopes adjacent to the completed concrete paver units will be included in the unit price bid for the item of construction in which this item is used, unless included as a separate pay item in the Contract bid form.

The unit bid price for streetscape appurtenances shall include full compensation for the individual item (i.e. bench, chair, bicycle rack, trash receptacle, street light or above grade tree planter), as well as the removal of existing sidewalk, preparation of footings, furnishing and placing all materials, manipulation and finishing, labor, tools, equipment and incidentals necessary to complete the work.

The unit bid price for pedestrian railing shall include full compensation for the complete installation of the specific pedestrian railing including but not limited to preparation of footings or curb, furnishing and placing all materials, manipulation and finishing, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under one of the following:

**New Sidewalks**

| | | |
|---|---|---|
| **Pay Item 432S-4:** | New P.C. Concrete Sidewalks, 4 Inch thickness | Per Square Foot. |
| **Pay Item 432S-5:** | New P.C. Concrete Sidewalks, 5 Inch thickness | Per Square Foot. |
| **Pay Item 432S-6:** | New P.C. Concrete Sidewalks, 6 Inch thickness | Per Square Foot. |
| **Pay Item 432S-7:** | New P.C. Concrete Sidewalks, 7 Inch thickness | Per Square Foot. |

**Sidewalks Reconstruction**

| | | |
|---|---|---|
| **Pay Item 432SR-4:** | Reconstruct Concrete Sidewalks to 4 Inch thickness, including removal of existing sidewalk | Per Square Foot. |
| **Pay Item 432SR-5:** | Reconstruct Concrete Sidewalks to 5 Inch thickness, including removal of existing sidewalk | Per Square Foot. |
| **Pay Item 432SR-6:** | Reconstruct Concrete Sidewalks to 6 Inch thickness, including removal of existing sidewalk | Per Square Foot. |
| **Pay Item 432SR-7:** | Reconstruct Concrete Sidewalks to 7 Inch thickness, including removal of existing sidewalk | Per Square Foot. |

**Ramps**

| | | |
|---|---|---|
| **Pay Item 432S - RP-1:** | P.C. Sidewalk Curb Ramp with Pavers (Type I) | Per Each. |
| **Pay Item 432S-RP-1A:** | P.C. Sidewalk Curb Ramp with Pavers (Type IA) | Per Each. |
| **Pay Item 432S-RP-1B:** | P.C. Sidewalk Curb Ramp with Pavers (Type IB) | Per Each. |

**Streetscape Appurtenances**

| | | |
|---|---|---|
| **Pay Item 432S-SAC-1** | Streetscape Bench (____ inches in length) | Per Each. |
| **Pay Item 432S-SAC-2** | Streetscape Chair | Per Each. |
| **Pay Item 432S-SAC-3** | Streetscape Bicycle Rack | Per Each. |
| **Pay Item 432S-SAC-4** | Streetscape Trash Receptacle | Per Each. |
| **Pay Item 432S-SAC-5** | Streetscape Street Light | Per Each. |
| **Pay Item 432S-SAC-7C** | Streetscape Tree Well for Concrete Sidewalks | Per Each. |
| **Pay Item 432S-SAC-7D** | Streetscape Above Grade Tree Planters with Bench | Per Each. |
| **Pay Item 432S-SAC-7E** | Streetscape Above Grade Tree Well with Seat | Per Each. |
| **Pay Item 432S-SAC-7F** | Streetscape Tree Well without Grate | Per Each. |
| **Pay Item 432S-SAC-7G** | Streetscape Above Grade Galvanized Steel Tree Planters | Per Each |

**Pedestrian Railing**

| | | |
|---|---|---|
| **Pay Item 432S-PRC-1** | Pedestrian Railing (Standard 707S-1) | Per LF. |
| **Pay Item 432S-PRC-2** | Pedestrian ADA Railing – Option 1 (Standard 707S-2) | Per LF. |
| **Pay Item 432S-PRC-3** | Pedestrian ADA Railing – Option 2 (Standard 707S-3) | Per LF. |
| **Pay Item 432S-PRC-4** | Pedestrian ADA Railing – Option 3 (Standard 707S-4) | Per LF. |

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification 432S, “P. C. Concrete Sidewalks” |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 111S | Excavation |
| Item No. 201S | Subgrade Preparation |
| Item No. 403S | Concrete for Structures |
| Item No. 406S | Reinforcing Steel |
| Item No. 407S | Fibrous Concrete |
| Item No. 408S | Expansion Joint Materials |
| Item No. 409S | Membrane Curing |
| Item No. 410S | Concrete Structures |
| Item No. 480S | Concrete Paving Unit |
| Item No. 485S | Concrete Paving Units for Sidewalk Ramps |
| Item No. 604S | Seeding for Erosion Control |

City of Austin Standard Details

| Designation | Description |
|---|---|
| 432S-1 | Sidewalk |
| 432S-2A | Detectable Warning-Paver |
| 432S-3 | Type I Curb Ramps-Full Intersection |
| 432S-3A | Type I Curb Ramps-T Intersection |
| 432S-3B | Type IA/IB Curb Ramps-Full Intersection |
| 432S-3C | Type IA/IB Curb Ramps-T Intersection |
| 432S-3D | Combined Curb Ramps-Full Intersection |
| 432S-3E | Combined Curb Ramps-T Intersection |
| 432S-3F | Combined Sidewalk Curb Ramp with Pavers |
| 432S-3G | Combined Sidewalk Curb Ramp with Pavers within Limited ROW |
| 432S-3H | Type I Curb Ramps within PC/PT of Curb and Gutter |
| 432S-5 | Type I Sidewalk Curb Ramp |
| 432S-5A | Type IA Sidewalk Curb Ramp |
| 432S-7C | Tree Well for New Trees Planted Within Concrete Sidewalk 3.6 M (12') or Greater |
| 432S-7D | Above Grade Tree Planters |
| 432S-7E | Above Grade Tree Well with Bench |
| 432S-7F | Tree Well Without Grate |
| 432S-7G | Above Grade Galvanized Steel Tree Planters |
| 432S-8B | Trash Receptacle Installation in Concrete Sidewalk |
| 432A-8C | Furnishing Location in 12' (3.6 M) or greater Trash Receptacle Siting |
| 432S-9B | Bench/Chair Installation in Sidewalks |
| 432S-9C | Furnishing Location in 12' (3.6 M) or greater Sidewalks-Bench Siting |
| 432S-9D | Furnishing Location in Greater than 12' (3.6 M) or Less than 18' (5.4 M) Sidewalks-Bench Siting |
| 707S-1 | Pedestrian Railing |
| 707S-2 | Pedestrian ADA Railing – Option 1 |
| 707S-3 | Pedestrian ADA Railing – Option 2 |
| 707S-4 | Pedestrian ADA Railing – Option 3 |
| 710S-4 | Bicycle Rack Installation in Concrete Sidewalks (Alternate 1) |
| 710S-5 | Bicycle Rack Installation in Concrete Sidewalks (Alternate 2) |

| | |
|---|---|
| 710S-6A | Furnishing Location in 12' (3.6 M) or greater Sidewalks-Bicycle Rack Siting |
| 710S-6B | Furnishing Location in Greater than 12' (3.6 M) or Less than 18' (5.4 M) Sidewalks-Bicycle Rack Siting |

American Disabilities Act, Federal Register; Volume 56, No. 144; July 26, 1991
ADA Accessibility Guidelines For Building And Facilities

| Designation | Description |
|---|---|
| Section 4.29 | Detectable Warnings on Walking Surfaces |
| Section A4.29.2 | Detectable Warnings on Walking Surfaces |

Architectural Barriers; Texas Civil Statutes, Article 9102; June 14, 1995
Texas Accessibility Standards (TAS)

| Designation | Description |
|---|---|
| Section 4.29 | Detectable Warnings on Walking Surfaces |
| Section A4.29.2 | Detectable Warnings on Walking Surfaces |

***RELATED*** CROSS REFERENCE MATERIALS

City of Austin Standard Contract Documents

| Designation | Description |
|---|---|
| 00700 | General Conditions |
| 01500 | Temporary Facilities |
| 01550 | Public Safety and Convenience |

City of Austin Utilities Criteria Manual

| Designation | Description |
|---|---|
| Section 5.2.3 | Utility Adjustments For Roadway Construction Projects |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 102S | Clearing and Grubbing |
| Item No. 104S | Removing Portland Cement Concrete |
| Item No. 110S | Street Excavation |
| Item No. 132S | Embankment |
| 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) |
| Item No. 232S | Rolling (Pneumatic Tire) |
| Item No. 234S | Rolling (Tamping) |
| Item No. 236S | Rolling (Proof) |
| Item No. 360S | Concrete Pavement |
| Item No. 402S | Controlled Low Strength Material |
| Item No. 404S | Pneumatically Placed Concrete |
| Item No. 405S | Concrete Admixtures |
| Item No. 411S | Surface Finishes for Concrete |

## 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-1A 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.4(2) 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, 3/4 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 1/4-inch (6.25-mm) wide and 3/4 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 layer of No. 4 (13M) 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 insure 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 loose 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 (13M) 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 1/4-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. |

**End**

| ***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. 360S | Concrete Pavement |
| Item No. 403S | Concrete for Structures, Section 403S.7 |
| Item No. 403S | Concrete for Structures, 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 |

**Item No. 436S**
**P.C. Concrete Valley Gutters**

## 436S.1 Description

This item shall govern the construction of Portland cement (p. c.) concrete valley gutters on an approved subgrade in conformity to the lines, grades, Standard Detail No. 436S-2 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.

## 436S.2 Submittals

The submittal requirements of this specification item include:

A. Class A p. c. concrete mix design,

B. Construction details (i.e., reinforcing steel, curing membrane, etc.),

## 436S.3 Materials

A. Portland Cement Concrete

The Portland cement concrete shall be 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

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".

## 436S.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

Where a stabilized subbase is not provided, the subgrade shall be excavated in accordance with Standard Specification Index No. 111S, "Excavation" to remove all unstable or otherwise objectionable material and all holes, ruts and depressions shall be filled with approved material.

Rolling shall be performed in accordance with Standard Specification Item No. 230S or 232S, to the extent indicated on the Drawings or directed by the Engineer or designated representative. The roadbed shall be completed to the plane of the typical sections indicated on the Drawings and the lines and/or grades established by the Engineer or designated representative. All work shall conform to Standard Specification Item No. 201S, "Subgrade Preparation".

If the subgrade is dry, the valley gutter area shall be sprinkled lightly immediately before the Portland cement concrete is placed.

Unless otherwise specified on the Drawings, all necessary excavation, filling and grading of the subgrade will be considered incidental work pertaining to this item, and will not be paid for directly.

B. Forms

Forms shall be of metal, well-seasoned wood or other approved material. Wood forms for straight sections shall be not less than 2 inches (50 mm) nominal thickness. 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 concrete and, if necessary, forms shall be oiled with a light form oil, prior to placement of p.c. concrete.

C. Reinforcing Steel

Reinforcement for Portland cement concrete valley gutters shall conform to Standard Detail No. 436S-2; details indicated on the Drawings or as directed by the Engineer or designated representative. Care shall be exercised to keep the reinforcement in its proper position during the placement of Portland cement concrete.

D. Joints

Joints shall be of the type and spacing shown on the Drawings. Expansion joint material 3/4 inch (19 mm) thick shall be provided as indicated on the Drawings 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 Portland cement concrete. Weakened plane joints shall be provided on 10 foot (3 meter) centers or as directed by the Engineer or designated representative. Normal dimensions of the weakened plane joints shall be 1/4 inch (6.3 mm) wide and 3/4 inch (19 mm) deep.

E. Placement and Finishing

The Portland cement concrete shall be placed in the forms and properly consolidated until it entirely covers the surface and has a monolithic finish. The top surface shall be screeded and floated to a uniform smooth surface, then finished with a wood float to a gritty texture. The outer edges shall be rounded with approved tools to a 1/4-inch (6.3 mm) radius.

F. Curing

At the proper time after finishing, the surface shall be protected by a membrane-curing compound conforming to 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 securely barricaded from using the Portland cement concrete valley gutter for a minimum of 4 days after initial placement and may be opened to traffic only with the approval of the Engineer or designated representative.

### 436S.5 Measurement

Accepted work performed 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 Portland cement concrete placed. The square foot measurement shall include the reinforced monolithic curb placed at the ends of the valley gutter.

### 436S.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 Valley Gutters". The unit bid price shall include full compensation for preparation the subgrade; furnishing and placing all materials, including reinforcing steel and expansion joint materials; any other materials, manipulations, labor, tools, equipment, barricading and all incidentals necessary to complete the work.

Payment will be made under:

**Pay Item No. 436S:** P. C. Concrete Valley Gutters Per Square Foot.

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 436S, "P.C. Concrete Valley Gutters" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 111S | Excavation |
| Item No. 201S | Subgrade Preparation |
| Item No. 230S | Rolling (Flat Wheel) |
| Item No. 232S | Rolling (Pneumatic) |
| Item No. 403S | Concrete for Structures |
| Section 403S.7; 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. 410S | Concrete Structures |

City of Austin Standard Details

| Designation | Description |
|---|---|
| 436S-2 | P. C. Concrete Valley Gutter |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 436S, "P.C. Concrete Valley Gutters" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 110S | Street Excavation |
| Item No. 130S | Borrow |
| Item No. 236S | Proof Rolling |
| Item No. 360 | Concrete Pavement |
| Item No. 405S | Concrete Admixtures |
| Item No. 430S | P.C. Concrete Curb and Gutter |
| Item No. 431S | Machine Laid PCC Curb and Gutter |

**Item No. 501S**
**Jacking or Boring Pipe**

## 501S.1 Description

This item shall govern furnishing and installing of encasement pipe by methods of jacking or boring as indicated on the Drawings and in conformity with this specification. This item shall also include, but not be limited to other constructions activities such as traffic control measures, excavation, removal of all materials encountered in jacking or boring pipe operations, disposal of all material not required in the work, grouting, end seal installation, backfilling and re-vegetation.

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.

## 501S.2 Submittals

The submittal requirements for this specification item shall include:

A. Shop drawings identifying proposed jacking or boring method complete in assembled position

B. Excavation Safety Plan including pits, trenches and sheeting or bracing if necessary,

C. Design for jacking or boring head,

D. Installation of jacking or boring supports or back stop,

E. Arrangement and position of jacks and pipe guides, and

F. Grouting plan,

## 501S.3 Materials

A. Pipe

Carrier pipe and encasement pipe shall conform to Standard Specification Item Nos. 505S, "Concrete Encasement and Encasement Pipe" and 510, "Pipe" and shall be size, type materials, thickness and class indicated on the Drawings, unless otherwise specified.

B. Grout

Grout for void areas shall consist of 1 part Portland cement and 4 parts fine, clean sand mixed with water.

## 501S.4 Construction Methods

A. General

The Contractor is responsible for:

1. Adequacy of jacking and boring operations,
2. Installation of support systems as indicated on the Drawings,
3. Provision of encasement and carrier pipe, and
4. Execution of work involving the jacking operation, the wet or dry method of boring and the installation of encasement pipe simultaneously.

The Contractor shall have sole responsibility for the safety of the jacking and boring operations and for persons engaged in the work. The Contractor's attention is directed to the Construction Industry Occupational Safety and Health Administration (OSHA) Standards (29 FR 1926/1920) as published in U.S. Department of Labor publication OSHA 2207, latest revision, with particular attention to Subpart S. The Contractor shall conform to the requirements in accordance with Standard Specification Item 509S, "Excavation Safety System" and shall provide an appropriate Trench Safety Plan.

When the grade of the pipe at the jacking or boring end is below the ground surface, suitable pits or trenches shall be excavated to provide sufficient room to conduct the jacking or boring operations and for placement of end joints of the pipe. In order to provide a safe and stable work area, the excavated area shall be securely sheeted and braced to prevent earth caving in accordance with the Trench Safety Plan.

The location of the work pit and associated traffic control measures required for the jacking or boring operations shall conform to the requirements of the City of Austin Transportation Criteria Manual and TxDoT Manual on Uniform Traffic Control Devices.

Where installation of pipe is required under railroad embankments, highways, streets, or other facilities by jacking or boring methods, construction shall be undertaken in such a manner that it will not interfere with operation of any railroad, street, highway, utility or other facility and shall not weaken or damage any embankment or structure. All appropriate permits shall be acquired prior to the initiation of the work.

During construction operations, and until the work pits are backfilled and fill material compacted, traffic barricades and warning lights to safeguard traffic and pedestrians shall be furnished and maintained by the Contractor. The Contractor shall submit the proposed pit location and traffic control plan for review by the Engineer or designated representative. The Review by the Engineer or designated representative, however, will not relieve the Contractor of the responsibility to obtain specified results in a safe, professional manner.

When grade of pipe at jacking or boring end is below ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking or boring operations and for joining pipe. Work shall be securely sheeted and braced as indicated on the Excavation Safety Plan to prevent earth caving and to provide a safe and stable work area.

The pipe shall be jacked or bored from the low or downstream end, if possible. Minor lateral or vertical variation in the final position of pipe from line and grade established by Engineer or designated representative will be permitted at the

discretion of Engineer or designated representative provided that such variation is regular and occurs only in one direction and that the final grade of the flow line conforms to the specified direction.

When conforming to details indicated on the drawings, but the bottom of the work pit is unstable or excessively wet or the installation of water and wastewater pipe will result in less than 30 inches (750 mm) of cover, the Contractor shall notify the Engineer or designated representative. The Engineer or designated representative may require the Contractor to install a concrete seal, cradle, cap or encasement or other appropriate action.

Immediately after jacking or boring is complete and the encasement pipe is accurately positioned and approved for line and grade, the clear space between the pipe and the surrounding excavated material shall be completely filled by pressure grouting for entire length of installation if the encasement pipe is 36 inches or larger in diameter.

After placement of the carrier pipe is complete, the ends of the encasement pipe shall be sealed with end seals meeting SPL WW-575A.

As soon as possible after the carrier pipe(s) and end seals are completed, the work pits or trenches, which are excavated to facilitate these operations, shall be backfilled. The backfill in the street ROW shall be compacted to not less than 95 percent of the maximum density conforming to TxDOT Test Method Tex-114-E, “Laboratory Compaction Characteristics & Moisture-Density Relationship of Subgrade & Embankment Soil”. Field density measurements will be made in accordance with TxDOT Test Method Tex-115-E, “Field Method for Determination of In-Place Density of Soils and Base Materials”.

Where the characteristics of soil, size or size of proposed pipe dictate that tunneling is more satisfactory than jacking or boring, a tunneling method may be submitted for acceptance by Engineer or designated representative

B. Jacking

Heavy duty jacks suitable for forcing the pipe through the embankment shall be provided. In operating the jacks, an even pressure shall be applied to all jacks used so that the pressure will be applied to the pipe uniformly around the ring of the pipe. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides properly braced together, to support the section of the pipe and to direct it in the proper line and grade. The complete jacking assembly shall be placed in order to line up with the direction and grade of the pipe. In general, the embankment material shall be excavated just ahead of the pipe, the material removed through the pipe and the pipe forced through embankment by jacking, into the space thus provided.

The excavation for the underside of the pipe, for at least 1/3 of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of no more than 2 inches (50 mm) may be provided for the upper half of the pipe. This clearance shall be tapered to zero at the point where excavation conforms to contour of pipe.

The distance that excavation shall extend beyond the end of the pipe depends on the character of material encountered, but it shall not exceed 2 feet (0.6 meter) in any case. This distance shall be decreased, when directed by the Engineer or designated representative, if the character of the material being excavated makes it desirable to keep the advance closer to the end of the pipe.

The Contractor may use a cutting edge of steel plate around head end of the pipe extending a short distance beyond the end of pipe with inside angles or lugs to keep cutting edge from slipping back onto the pipe.

When jacking of the pipe is begun, all operations shall be carried on without interruption, insofar as practical, to prevent the pipe from becoming firmly set in the embankment.

Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at its entire expense.

C. Boring

The boring shall proceed from a work pit provided for the boring equipment and workers. Excavation for the work pits and the installation of shoring shall be as outlined in the Trench Safety Plan. The location of the pit shall be approved by the Engineer or designated representative. The boring shall be done mechanically using either a pilot hole or the augur method.

In the pilot hole method an approximate 2 inch (50 mm) pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.

When the augur method is used, a steel encasement pipe of the appropriate diameter equipped with a cutter head to mechanically perform the excavation shall be used. Augurs shall be of sufficient diameter to convey the excavated material to the work pit.

Excavated material will be removed from the working pit and disposed of properly. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Water jetting will not be permitted.

In unstable soil formations, a gel-forming colloidal drilling fluid, that consists of at least 10 percent of high grade carefully processed bentonite, may be used to consolidate the drill cuttings, seal the walls of the hole and furnish lubrication to facilitate removal of the cuttings from the bore.

D. Tunneling

Where the characteristics of the soil, the size of the proposed pipe, or the use of monolithic sewer would make the use of tunneling more satisfactory than jacking or boring; or when indicated on the drawings, a tunneling method may be used, with the approval of the Engineer or designated representative.

E. Joints
If reinforced concrete pipe is used, the joints shall be in accordance with TxDOT Specification Item 464, “Reinforced Concrete Pipe”.

**501S.5 Measurement**

Jacking or boring pipe will be measured by the linear foot (meter: 1 meter equals 3.281 feet) of pipe complete in place. Such measurement will be made between the ends of the pipe along the central axis as installed.

**501S.6 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 bid price per linear foot for "Jacking or Boring Pipe" as the case may be, of type, size and class of encasement pipe indicated on the Drawings. The price shall include full compensation for furnishing, preparing, hauling and installing required materials, encasement pipe, end seals, for grouting and for labor, tools, equipment and incidentals necessary to complete work, including excavation, backfilling and disposal of surplus material.

The Carrier pipe shall be paid at the unit price bid for Standard Specification Item 510, "Pipe".

Payment when included as a contract pay item, will be made under one of the following:

**Pay Item No. 501S:** Jacking or Boring __ In. Pipe, Class ___ Per Linear Foot.

**End**

| ***SPECIFIC*** Cross Reference Materials |
|---|
| Specification Item 501S, "Jacking or Boring Pipe" |

City of Austin Standard Specification Items

| Designation | Description |
|---|---|
| Item No. 505S | Concrete Encasement and Encasement Pipe |
| Item No. 509S | Excavation Safety Systems |
| Item No. 510 | Pipe |

TxDOT Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges

| Designation | Description |
|---|---|
| Item 464 | Reinforced Concrete Pipe |

TxDOT Testing Procedures

| Designation | Description |
|---|---|
| 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 and Base Materials |

TxDOT Manual on Uniform Traffic Control Devices (MUTCD)

| Designation | Description |
|---|---|
| MUTCD Part VI | Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations |
| MUTCD Section 6C | Channelizing Devices |
| MUTCD Section 6C-8 | Barricade Design |
| MUTCD Section 6C-9 | Barricade Application |
| MUTCD Section 6E | Lighting Devices |
| MUTCD Section 6F | Control of Traffic Through Work Areas |

City of Austin Transportation Criteria Manual

| Designation | Description |
|---|---|
| Section 8 | Traffic Control |
| Section 8.5.5.E | Typical Applications/Bore Pits |

| ***RELATED*** Cross Reference Materials |
|---|
| Specification Item 501S, "Jacking or Boring Pipe" |

City of Austin Standard Details

| Designation | Description |
|---|---|
| Detail 501S-1 | Encasement Detail w/ Casing Spacers |

TxDOT Standard Specifications

| Designation | Description |
|---|---|
| Item 476 | Jacking, Boring or Tunneling Pipe |
| Item 502 | Barricades, Signs and Traffic Handling |

**Item No. 505S**
**Concrete Encasement and Encasement Pipe**

## 505S.1 Description

This item shall govern the furnishing of materials and the methods of constructing a Portland cement concrete encasement or encasement pipe in a trench.

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.

## 505S.2 Submittals

The submittal requirements of this specification item include:

A. Type, of pipe, construction methods and sequence,

B. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix,

C. Proposed proportioning of materials for the mortar mix.

## 505S.3 Materials

A. Portland Cement Concrete

The Portland cement concrete shall conform to Class D Concrete, Item No. 403S, "Concrete for Structures".

B. Pipe

Portland Cement concrete pipe shall conform to ASTM C-76, Class III or better.

Corrugated Metal Pipe (CMP) shall conform to Section 510.2 (8) (o) of the City of Austin Standard Specification Item No. 510, "Pipe".

Steel Pipe shall conform to ASTM A134 with a minimum thickness of 3/8 inch (9.5 mm) for pipe with a diameter of 16 inches (400 mm) and greater.

C. Grout

Grout shall consist of not less than 6 sacks Portland cement per cubic yard (335 kilograms Portland cement per cubic meter) and clean washed sand mixed with water. The grout shall have a consistency such that the grout will flow into and completely fill all voids. If allowed by the Engineer or designated representative, an air entraining admixture may be added to facilitate placement.

## 505S.4 Construction Methods

When indicated on the Drawings or acceptable to Engineer or designated representative, concrete encasement shall be placed to protect the pipe. Pipe or bedding shall not be placed where:

(a) the top of the pipe would have less than 30 inches (750 mm) of cover from finish grade,

(b) the ground water invades the trench, or

(c) the trench bottom is of unstable material.

If either of these conditions is encountered, the Engineer or designated representative shall be notified and may direct the Contractor to:

(a) encase the pipe with concrete,

(b) change pipe material, or

(c) use a higher strength class of pipe.

Concrete encasement shall extend from 6 inches (150 mm) below to 6 inches (150 mm) above the outer projections of the pipe over the entire width of the trench in accordance with the City of Austin Standard Detail 501S-1," Encasement Detail w/ Casing Spacers".

The ends of the encasement pipe shall be bulkheaded (Standard Specification Item No. 507S) with concrete blocks, bricks or stones, dry-stacked without mortar, sufficient to prevent the intrusion of trench backfill material into the encasement, but fitted loosely enough to facilitate the escape of water from the encasement should carrier pipe leakage or failure occur.

**505S. 5 Measurement**

Concrete encasement will be measured by the lineal foot (meter: 1 meter equals 3.281 feet), for size of pipe being encased, complete in place. The measurement will be made between ends of the encasement, along the central axis as installed.

Encasement pipe installed by open cut will be measured by size of encasement installed, complete in place. The measurement will be made between the ends of the pipe, along the central axis as installed.

**505S.6 Payment**

Work performed and materials furnished as prescribed by this item will be included in a unit price bid item from Standard Specification Item No. 510, "Pipe" unless included as a separate pay item in the contract.

When included for payment, it shall be measured as provided under "Measurement" and will be paid at the unit bid price per lineal foot for "Concrete Encasement" or "Encasement Pipe" of the size indicated on the Drawings. The unit bid price shall include full compensation for furnishing all materials, pipe for all preparation, hauling, installation and for all labor, tools, equipment and incidentals necessary to complete the work, including bench excavation and disposal of surplus material.

Payment, when included as a contract Pay Item, will be made under one of the following:

| | | |
|---|---|---|
| **Pay Item No. 505*S*-A**: | Concrete Encasement for ___ Dia. Pipe - | Per Lineal Foot. |
| **Pay Item No. 505*S*-B:** | Encasement Pipe ___ Dia., Type ___, - | Per Lineal Foot. |

**End**

| ***SPECIFIC*** Cross Reference Materials |
|---|
| Standard Specification Item No. 505S, “Encasement and Encasement Pipe" |

City of Austin Standard Specification Items

| Designation | Description |
|---|---|
| Item 403S | Concrete For Structures |
| Item 507S | Bulkheads |
| Item 510 | Pipe |
| Section 510.2(8)(o) | Corrugated Metal Pipe (CMP) |

City of Austin Standard Details

| Designation | Description |
|---|---|
| Detail 501S-1 | Encasement Detail w/ Casing Spacers |

American Society for Testing and Materials (ASTM)

| Designation | Description |
|---|---|
| A-134 | Specification for Pipe, Steel, Electric-Fusion (Arc)-Welded (Sizes NPS 16 and Over) |
| C-76/C-76M | Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe |

| ***RELATED*** Cross Reference Materials |
|---|
| Standard Specification Item No. 505S, “Encasement and Encasement Pipe" |

TxDOT Specifications

| Designation | Description |
|---|---|
| Item 421 | Portland Cement Concrete |
| Section 421.9 | Quality of Concrete |
| Section 421.2(8) | Mortar and Grout |

City of Austin Standard Specification Items

| Designation | Description |
|---|---|
| Item No. 501S | Jacking or Boring Pipe |
| Item No. 506 | Manholes |
| Section 510.2(8)(c) | Concrete pipe |
| Section 510.2(8)(m) | Steel Pipe |
| Item No. 593S | Concrete Retards |

**Item No. 506**
**Manholes**

## 506.1 Description

This item governs construction of pre-cast and cast-in-place wastewater manholes, storm water manholes, storm water junction boxes and cast-in-place wastewater junction boxes, complete in place, including excavation, installation, backfilling and surface restoration; required items including rings, covers, coatings, and appurtenances; and incidental work such as pumping and drainage necessary to complete the work. Contractor-performed acceptance testing is required for wastewater manholes.

## 506.2 Qualifications

Applicators of coatings to the interior surfaces of wastewater manholes, as specified in 506S.4.R and 506S.5.J, shall be listed on Standard Products List WW-511.

## 506.3 Project Submittals

A. Products and Materials

The Contractor shall submit descriptive information and evidence that the materials the Contractor proposes for incorporation in the Work are of the kind and quality that satisfy the requirements in the Contract Documents. The City of Austin Water Utility Standard Products Lists are considered a part of the Specifications for the Work. The Contractor shall use products from the SPLs for all water and wastewater construction unless alternative products are shown on the Drawings; called for in the specifications; or specified in the Bidding Requirements, Contract Forms and Conditions of the Contract.

The products included in the Standard Products Lists current at the time of plan approval shall govern; unless a specific product or products on the lists have subsequently been removed from those SPLs because of quality or performance issues. Products and materials that are not covered by SPLs shall meet the requirements in the contract documents.

Submittals for the products and materials covered by this specification shall include manufacturer catalog sheets, technical data sheets, shop drawings, product or material test results, requirements listed below, and any other information needed to adequately describe the product or material. For products covered by SPLs, the submittal shall include a copy of the applicable SPL with the proposed product identified. An SPL by itself is not considered an adequate submittal.

The submittal requirements of this specification item include:

1. For pre-cast manholes and junction boxes: shop drawings for each structure showing, at a minimum, the Project and Contractor's name: manufacturer's name and plant location; applicable specifications; list of materials (such as adjusting rings, boots, gaskets, and pre-cast sections) by type and quantity; elevation view showing diameter or size, ring and cover size and elevation, ring type (bolted or unbolted, flared top or flared bottom) wall thickness,

elevations of transitions from large diameter sections to smaller diameter sections, base width and thickness, total depth, size of openings, reinforcement, and length of each pre-cast section; structure identification number and station location; pipe line identification; pipe material and size; pipe flowline elevations; plan view showing azimuthal orientation (based on 360 degrees clockwise) of the pipes relative to the outflow pipe; technical data sheets covering pipe-to-manhole or pipe-to-junction box connectors, and gaskets

2. For cast-in-place manholes and junction boxes: formwork drawings sealed by a registered Professional Engineer licensed in the State of Texas with documented experience in formwork design for wall pours that exceed 4 feet in height and slabs that are not ground supported

3. For hydraulic cement concrete; mix components and proportions, material sources, materials test results

4. For mortar: mix components and proportions, material sources, materials test results

5. For non-shrink grout: technical data sheet indicating ASTM type and containing instructions on surface preparation, mixing, placing, and curing procedures

6. For wastewater manhole coatings and linings: technical data sheets that include instructions on surface preparation, mixing, placing, and curing procedures

B. Acceptance Test Records

Submittal of acceptance test records is required for wastewater manholes and shall include as a minimum the following items:

Name of the manhole manufacturer

Interior surface coating type and application method

Model and manufacturer of vacuum tester

Date tested/date re-tested

Indication of whether test passed or failed and statement of corrective action taken if test failed

Test Method Used

Location/station of manhole

Type of base: Precast/cast-in-place

Type of repairs made to the joints

The test records shall also be included as part of the Project records turned in with the acceptance package.

**506.4 Materials**

A. Concrete

All cast-in-place concrete shall conform to City of Austin Standard Specification Item No. 403S, "Concrete for Structures." Cast in place concrete shall be Class A or as specified on the Drawings. Concrete used in precast concrete manhole base sections, riser sections and appurtenances shall conform to the requirements of Texas Department of Transportation Item 421, Hydraulic Cement Concrete. Concrete for backfill of over-excavated areas shall be City of Austin Class A, or Class J (City of Austin Standard Specification Item 403S, Concrete For Structures) or Controlled Low Strength Material (City of Austin Standard Specification Item 402S) as indicated on the Drawings.

B. Mortar

Mortar shall be composed of one part Portland cement, one part masonry cement (or 1/4 part hydrated lime), and sand equal to 2-1/2 to 3 times the sum of the volumes of the cements and lime used. The sand shall meet the requirements for "Fine Aggregate" as given in Standard Specification Item No. 403S "Concrete For Structures." Mortar shall not be used for any purpose on the inside of wastewater manholes.

C. Grout

Grout shall be the non-shrink type conforming to ASTM C 1107, Packaged, Dry, Hydraulic Cement Grout (Nonshrink), Grade C. Grout shall be used as packaged, with the mixed ingredients requiring only the addition of water.

D. Reinforcement

The reinforcing steel shall conform to the requirements of Standard Specification Item No. 406S, "Reinforcing Steel." Secondary, non-structural steel in cast-in-place stormwater manholes may be replaced by collated fibrillated polypropylene fibers, if approved by the Engineer or designated representative.

E. Brick

The brick for ring adjustment courses and for stormwater manholes shall be of first quality, sound, hard burned, perfectly shaped brick conforming to the requirements of ASTM C 62, Grade SW, or concrete brick meeting the requirements of ASTM C 55, Grade N-1.

F. Rings and Covers

Rings and covers shall conform to the requirements of City of Austin Standard Specification Item No. 503S, "Frames, Grates, Rings and Covers."

1. Replacement Rings and Covers, 24 in Diameter Lids

   This ring and cover shall be used for the replacement of broken rings and covers, minor manhole adjustment, or as otherwise directed by the Engineer or designated representative.

2. Rings and Covers, 32 in. Diameter Lids

This ring and cover shall be used for all new manhole construction, except as otherwise directed by the Engineer or designated representative.

G. Bulkheads

Bulkheads shall meet the requirements of City of Austin Standard Specification Item No. 507S "Bulkheads."

H. Precast Base Sections, Riser Sections, Flat-top Slabs and Cones

Precast concrete base sections, riser sections, flat-top slabs, and cones shall conform to the requirements of ASTM C 478. The width of the invert shall be specifically sized for the connecting pipes. Inverts shall be "U" shaped channels. The channel depth at the point where a pipe connects to the manhole wall, for pipes 24 inches in diameter and smaller, shall be a minimum of three fourths of the diameter of the pipe, with the top of the channel being a smooth transition between the inlet and outlet pipe connection points. For manholes connecting to pipes larger than 24 inches in diameter, the channel depth at the point where a pipe connects to the manhole wall shall be at least equal to the full pipe diameter. Changes in flow direction in the inverts of manholes shall be made by constructing smooth, long-radius sweeps to minimize splashing, turbulence, and eddies. The manhole invert grade shall 1) be a continuation of the inlet and outlet pipe grades carried through to the centerline of the manhole, or 2) have a minimum slope of 2.5 percent between the inlet and outlet pipe inverts, or 3) have a minimum difference of 0.10 feet between the inlet and outlet pipe inverts, whichever provides the maximum difference in invert elevation between the inlet and outlet pipes. In all cases, the bottom(s) of the channel(s) shall provide a smooth transition between the inlet and outlet pipes. Where wastewater lines enter a manhole above the flowline of the outlet, the invert shall be filleted to prevent splashing and solids deposition.

Joints for wastewater base sections, riser sections, and cones shall conform to the requirements of ASTM C 443. Additionally, joint dimensions for 48-inch inside diameter wastewater manhole sections and cones shall comply with City of Austin Standard No. 506S-13, "Wedge Seal Joint Detail, Precast Manhole Section." Joint dimensions for wastewater manhole sections and cones larger than 48-inch inside diameter shall comply with City of Austin Standard No. 506S-12, " O-Ring Joint Detail Precast Manhole Section" or City of Austin Standard No. 506S-13, "Wedge Seal Joint Detail, Precast Manhole Section". Precast bases for 48 inch inside diameter manholes shall have preformed inverts. Inserts acceptable to the Engineer or designated representative shall be embedded in the concrete wall of the manhole sections to facilitate handling; however, through-wall holes for lifting will not be permitted.

I. Precast Junction Boxes

Precast junction boxes shall be allowed only where indicated on the Drawings or acceptable to the Engineer or designated representative.

J. Pipe-to-Manhole and Pipe-to-Junction-Box Connectors

Resilient connectors, ring waterstops, and seals at connections of wastewater pipes to pre-cast and cast-in-place manholes and junction boxes shall be watertight, flexible, resilient and non-corrosive, conforming to ASTM C 923.

Metallic mechanical devices for securing the connectors, ring waterstops, and seals in place shall be Type 304 stainless steel.

K. Precast Flat-Slab Transition/Junction Box Lids

Precast slab transitions and lids shall be designed to safely resist pressures resulting from loads which might result from any combination of forces imposed by an HS-20 loading as defined by the American Association of State Highway and Transportation Officials (AASHTO). The joints of precast slab transitions and of lids for wastewater applications shall conform to the requirements of ASTM C443.

L. Precast-Prefabricated Tee Manholes

Tee manholes shall be allowed only where indicated on the Drawings or as directed by the Engineer or designated representative. The main pipe section shall conform to the requirements of City of Austin Standard Specification Item No. 510, "Pipe." The vertical manhole portion (tee) above the main pipe shall conform to the requirements of the precast components.

The manhole tee shall have a minimum inside diameter of 48 inches and shall rise vertically centered or tangent to the main pipe, as indicated on the Drawings or as directed by the Engineer or designated representative. An access hole less than 48-inches in diameter shall be cut into the main pipe to allow a ledge for support of access ladders. Unless otherwise specified on the Drawings, the main pipe portion of the tee manhole shall be included in the unit price bid for the unit tee manhole price.

M. Precast Grade Rings

Rings shall be reinforced Class A concrete

1. Precast Grade Rings, 24-1/2 inches Inside Diameter

   This adjustment ring shall be used only for adjusting existing manholes with 24 inch diameter lids and for Wastewater Access Device. Inside to outside diameter dimension of ring shall be 6 inches with a thickness of 3 inches to 6 inches.

2. Precast Grade Rings, 35 inches Inside Diameter

   This adjustment ring shall be used for all new manhole construction with 32 inch diameter lids. Inside to outside diameter dimension of ring shall be 6 inches with a thickness of 2 inches to 6 inches.

N. High Density Polyethylene Grade Rings

Plastic grade (adjusting) rings shall be injection molded from high density polyethylene identified according to ASTM D4976. Reprocessable and recyclable ethylene plastic materials are allowed. Manufacturers of HDPE adjusting rings shall be listed on SPL WW-703.

O. Controlled Low Strength Material

Controlled low strength material (CLSM) shall meet Standard Specification Item 402S, Controlled Low Strength Material.

P. Cement Stabilized Sand

Cement stabilized sand for bedding or backfilling shall contain 2 bags of Portland cement per cubic yard. The sand shall meet the requirements for "Fine Aggregate" in Standard Specification Item 403S, Concrete for Structures.

Q. Waterproofing Joint Materials

O-rings and wedge seals for the joints of all wastewater manholes, and for stormwater manholes when indicated on the Drawings, shall conform to the requirements of ASTM C443. Cold applied preformed plastic gaskets for stormwater manholes shall be as specified in City of Austin Standard Specification Item No. 510, “Pipe.” Plastic seals wrapped around manholes at joints, and hydrophillic waterstops installed in joints, shall be listed on SPL WW-146A. PVC waterstops installed in joints and waterproofing compounds applied to the exterior surfaces of manholes and junction boxes shall be as specified in the Contract Documents.

R. Interior Surface Coatings for Wastewater Manholes

Interior surface coatings for wastewater manholes shall be either: as specified on the Drawings, as designated in writing by the Engineer or designated representative, or as included on SPL WW-511, which lists acceptable products, uses and applicators.

S. Structural Lining Systems for Wastewater Manholes

Structural lining systems for wastewater manholes shall be either: as specified on the Drawings, as designated in writing by the Engineer or designated representative, or as included on SPL WW-511A.

## 506.5 Construction

A. General

A minimum horizontal separation of 12 inches shall be maintained between adjacent pipes inside and outside a manhole or junction box. Pipe ends within the base section or junction box walls shall not be relied upon to support overlying manhole dead and live load weights. All wastewater branch connections to new or existing mains shall be made at manholes, with the branch pipe crown installed at an elevation no lower than the elevation of the effluent pipe crown. Changes in flow direction in the inverts shall be made by constructing smooth, long-radius sweeps to minimize splashing, turbulence, and eddies. Where wastewater lines enter the manhole up to 24 inches above the flowline of the outlet, the invert shall be sloped upward in a U-shaped channel three-fourths of the diameter of the incoming pipe to receive the flow, thus preventing splashing or solids deposition. A drop pipe shall be provided for a wastewater pipe entering a manhole whenever the invert cannot be constructed to prevent splashing and solids deposition. Construction of extensions to existing systems shall require placement of bulkheads at locations indicated or directed by the Engineer or designated representative.

Unless otherwise indicated on the Drawings, stormwater manholes shall have eccentric cones and wastewater manholes shall have concentric cones, except on manholes over large mains where an eccentric cone shall be situated to provide access to an invert ledge. Eccentric cones may be used where conflicts with other

utilities dictate. Flat-slab tops may be used only where clearance problems are encountered or where specified on the Drawings. Cast-in-place wastewater junction boxes shall be allowed only where indicated on the Drawings or where accepted by the Engineer or designated representative.

B. Foundation Support

Manholes shall be founded at the established elevations on uniformly stable subgrade. Unstable subgrade shall be over-excavated a minimum of 12 inches and replaced with a material acceptable to the Engineer or designated representative. Precast base units shall be founded and leveled on a 6 inch thick layer of coarse aggregate bedding. A pipe section with a prefabricated tee manhole and half the length of the adjoining pipe sections on each side shall be founded on a minimum of 6 inch thick layer of unreinforced Class A concrete (City of Austin Standard Specification Item No. 403S, “Concrete For Structures”). The cast-in-place concrete cradle shall be placed against undisturbed trench walls up to the pipe’s springline.

C. Cast-in-Place Concrete

Structural concrete work shall conform to Standard Specification Item No. 410S, Concrete for Structures. Forms shall be used for all slabs that are not ground supported and for all vertical surfaces above the foundation level. Formwork shall be designed according to American Concrete Institute ACI 347, Guide to Formwork for Concrete. Outside forms on vertical surfaces may be omitted where concrete can be cast against the surrounding earthen material that can be trimmed to a smooth vertical face.

D. Manhole Bases

Pre-cast bases shall conform to requirements in 506.4.H.

Cast-in-place bases shall have a minimum thickness of 12 inches at the invert flowline. The widths of all manhole inverts shall be specifically sized for the connecting pipes. Inverts shall be “U” shaped channels. The channel depth at the point where a pipe connects to the manhole wall, for pipes 24 inches in diameter and smaller, shall be a minimum of three-fourths of the pipe diameter, with the top of the channel being a smooth transition between the inlet and outlet pipe connection points. For manholes connecting to pipes greater than 24 inches in diameter, the channel depth at the point where a pipe connects to the manhole wall shall be equal to the full pipe diameter. The manhole invert grade shall

1) be a continuation of the inlet and outlet pipe grades carried through to the centerline of the manhole, or
2) have a minimum slope of 2.5 percent between the inlet and outlet pipe inverts, or
3) have a minimum difference of 0.10 feet between the inlet and outlet pipe inverts,

whichever provides the maximum difference in invert elevation between the inlet and outlet pipes. In all cases, the bottom(s) of the channel(s) shall provide a smooth transition between the inlet and outlet pipes. Changes in flow direction in the inverts of manholes shall be made by constructing smooth, large-radius sweeps to prevent splashing, turbulence, and eddies. The lowermost riser section

may be set in the Portland cement concrete, while still plastic, after which the base shall be cured a minimum of 24 hours prior to proceeding with construction of the manhole up to 12 feet in depth. The base shall be cured an additional 24 hours prior to continuing construction above the 12-foot level.

Wastewater manholes having cast-in-place bases may be constructed over existing wastewater pipes and the top half of the pipe removed to facilitate invert construction, except where the existing pipe is PVC, in which case, the entire pipe shall be removed from inside the manhole. The manhole floor shall rise outwardly from the springline elevation of the pipe, approximately one inch for each 12 inch of run (8 percent slope). The floors of stormwater manholes, also, shall rise outwardly from the springline elevation of the pipe, approximately one inch for each 12 inches of run (8 percent slope).

Wastewater manholes with lines larger than 18 inches shall require pre-cast bases; manholes constructed over in-service mains however, may be built on cast-in-place bases if the flow cannot be interrupted.

E. Pipe Connections to Manholes and Junctions Boxes

Wastewater pipe connections to manholes and junction boxes shall be made using flexible, resilient, and non-corrosive watertight boot connectors or ring waterstops acceptable to the Engineer and conforming to the requirements of ASTM C-923. Any voids in the annular space between the pipe and boot connector or ring waterstop and the inside of the manhole wall shall be filled with non-shrink grout to prevent solids collection.

F. Pipe Connections to Existing Manholes and Junction Boxes

Wastewater pipe connections to existing manholes and junction boxes shall be made by removing the wall section by coring or alternative method approved by the Engineer or designated representative; installing flexible, resilient, and non-corrosive boot connectors or ring waterstops acceptable to the Engineer or designated representative and conforming to the requirements of ASTM C-923; filling any voids in the annular space between the pipe and boot connector or ring waterstop and the inside of the manhole or junction box wall with non-shrink grout; rebuilding the invert to conform to Section 506S.5.D; rehabilitating the interior walls with structural lining material listed on SPL WW-511A, and coating the interior of the manhole with material listed on SPL WW-511.

G. Waterproofing

PVC waterstops, hydrophillic waterstops, joint wrapping, and waterproofing compounds shall be installed as specified. Material wrapped around manholes at joints shall be listed on SPL WW-146A regardless of whether installation of the material is required by the Contract for waterproofing or is volunteered by the Contractor for ensuring acceptance of the manhole joints.

H. Backfilling

Backfilling of manholes shall conform to the density requirements of City of Austin Standard Specification Item No.510, Pipe. Manhole construction in roadways may be staged to facilitate pavement base construction. Manholes constructed to interim elevations to facilitate interim construction shall be covered with steel plates

that conform to the requirements of City of Austin Standard 804S-4, sheets 5, 6 and 7, Steel Plating. Steel plates on wastewater manholes shall be set in mortar to minimize inflow of storm water runoff. Manholes shall be completed to finish elevation prior to placement of the roadway's finish surface except on pavement reconstruction projects, where castings may be adjusted after paving is completed. The excavation for completion of manhole construction shall be backfilled in accordance with City of Austin Standards for Trench Repair.

I. Height Adjustment of Manholes

1. General

All adjustments shall be completed prior to the placement of the final roadway surface except on pavement reconstruction projects, where castings may be adjusted after paving is completed.

Brick shall not be used in making height adjustments to wastewater manholes. Mortar shall not be used for any purpose on the inside of wastewater manholes.

Manhole components to be reused 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 expense.

If the adjustment involves lowering the top of a manhole, a sufficient depth of pre-cast concrete rings or brick courses shall be removed to permit reconstruction. Existing mortar shall be cleaned from the top surface remaining in place and from all brick or concrete rings to be reused and the manhole rebuilt to the required elevation. The manhole ring and cover shall then be installed with the top surface conforming to the proposed grade.

If the adjustment involves raising the elevation of the top of the manhole in accordance with Minor Manhole Height Adjustment," the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings or bricks and the ring and cover installed with the top surface conforming to the proposed grade.

After rings and covers are set to grade, the inside and outside of the precast concrete grade rings shall be wiped with non-shrink grout to form a durable surface and water-tight joints. The grouted surface shall be smooth and even with the manhole cone section. Grout shall not be placed when the atmospheric temperature is at or below 40F. If a sudden drop in temperature below 40F occurs or tempartures below 40F are predicted, the grouted surfaces shall be protected against freezing for at least 24 hours.

2. Minor Manhole Height Adjustment (New and Existing Manholes)

Minor manhole height adjustments shall be performed as indicated on City of Austin Standard 506S-4, "Minor Manhole Height Adjustment", and shall consist of adding precast reinforced concrete rings to adjust new and existing manholes to final grade. Brick shall not be used in making height adjustments to wastewater manholes.

If the adjustment involves raising the elevation of the top of the manhole, the top of brick or concrete ring shall be cleaned and built up vertically to the new elevation, using new or salvaged concrete rings or bricks and the ring and cover installed with the top surface conforming to the proposed grade.

For new manhole construction, the maximum allowable throat or chimney height, including the depth of the ring casting, shall be limited to 21 inches of vertical face on the interior surface. For adjustments of existing manholes that fall within the limits of overlay and street reconstruction projects, the maximum vertical allowable height, including the depth of the ring casting, shall be limited to 27 inches of vertical face on the interior surface. All other existing manholes shall have a maximum allowable throat or chimney height adjustment, including the depth of the ring casting, of 12 inches of vertical face on the interior surface. Any adjustment that will exceed these requirements shall be accomplished as indicated on City of Austin Standard 506S-2, Major Manhole Height Adjustment and as described below. Manholes not located in paved areas shall have bolted covers. Manholes located within paved areas (street right of way only) shall be standard non-bolted unless otherwise noted on the drawings.

3. Major Manhole Height Adjustment (Existing Manholes Only)

Any adjustment that exceeds the requirements of Minor Manhole Adjustments, shall be accomplished as indicated on City of Austin Standard 506S-2, Major Manhole Height Adjustment, and shall consist of any combination of removing the concrete rings, and/or the manhole cone section, and/or the straight riser section of the manhole in order to bring the manhole to final grade. Major manhole adjustments shall apply only to existing manholes. Manholes not located in paved areas shall have bolted covers. Manholes located within paved areas (street right of way only) shall be standard non-bolted unless otherwise noted on the drawings.

J. Interior Coatings of Wastewater Manholes and Junction Boxes

The interior surfaces of all Portland cement concrete wastewater manholes and junction boxes shall be coated with products specified either on the Drawings, designated in writing by the Engineer or representative, or listed on SPL WW-511. Product selection shall conform to usage described in that SPL. Surface preparation shall follow the product manufacturer's recommended procedures contained in technical data sheets unless otherwise specified in the contract documents. The Contractor shall measure the coating thickness according to ASTM D 6132, Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Over Concrete Using an Ultrasonic Gage. Thickness measures shall be made at locations designated by the Engineer or designated representative. All thickness measurements shall be witnessed by the Engineer or designated representative.

K. Structural Linings of Existing Wastewater Manholes

The interior surfaces of existing wastewater manholes and junction boxes at locations shown in the Drawings or as designated by the Engineer shall be strengthened by application of structural lining systems either as specified on the Drawings, directed in writing by the Engineer or designated representative, or listed

on SPL WW-511A. Selection of products for coating the interior of existing manholes shall be based on the condition of the manholes. Surface preparation shall follow the product manufacturer's recommended procedures contained in technical data sheets unless otherwise specified in the contract documents.

L. Abandonment of Existing Manholes

Manholes designated on the Drawings for abandonment, shall be removed to a level not less than four feet below grade. Two-foot long sections of the inlet and outlet pipes shall be cut and removed on the outside of the manhole, the ends of the remaining pipe and the pipe sections penetrating the manhole wall shall be securely plugged, and the structure filled with material in accordance with Standard 506S-15 or as directed by the Engineer or designated representative.

## 506.6 Acceptance Testing of Wastewater Manholes

Manholes shall be tested separately and independently of the wastewater lines.

A. Test by the Vacuum Method

A vacuum test shall be performed by the Contractor prior to backfilling those manholes that fall within the right-of-way that require detouring of vehicular traffic. A second vacuum test will not be required after backfilling and compaction is complete unless there is evidence that the manhole has been damaged or disturbed subsequent to the initial vacuum test.

For manhole installations which do not require detouring of vehicular traffic, the vacuum method is recommended and may be used by the Contractor prior to backfilling the manhole to insure proper installation so that defects may be located and repaired; however, a vacuum test shall be performed after backfilling, and compaction are complete. Testing after backfill and compaction are complete will be the basis for acceptance of the manhole.

1. Equipment

   a) The manhole vacuum tester shall be a device approved for use by the Engineer or designated representative.

   b) Pipe sealing plugs shall have a load resisting capacity equal to or greater than that required for the size of the connected pipe to be sealed.

2. Procedures - applicable to new 48-inch diameter manholes

   a) Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before installation or unless it is applied at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints. Tests shall be performed before grouting the invert or around pipe penetrations and before coating the interior surfaces of the manhole or junction box.

b) After cleaning the interior surfaces of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer. Plugs and the ends of pipes connected by flexible boots shall be blocked to prevent their movement during the vacuum test.

c) The vacuum test head shall be placed on the top of the cone section or, inside of the top of the manhole cone section, and the compression seal band inflated to the pressure recommended by its manufacturer. The vacuum pump shall be connected to the outlet port with the valve open. When a vacuum of 10 inches of mercury (-5 psig) has been attained, the valve shall be closed and the time noted. Tampering with the test equipment will not be allowed.

d) The manhole shall have passed the test if the vacuum does not drop below 9 inches of mercury (-4.5 psig) within 3 minutes of the time the valve was closed. The actual vacuum shall be recorded at the end of the 3 minutes during which the valve was closed.

e) When the standard vacuum test cannot be performed because of design or material constraints (examples: T-Type manholes, T-Lock Liners, or other reasons acceptable to the Engineer or designated representative), testing of individual joints shall be performed as directed by the Engineer or designated representative.

B. Test by the Exfiltration Method

At the discretion of the Engineer or designated representative, the Contractor may substitute the Exfiltration Method of testing for the Vacuum test described in Section 506.6. A. above. This method may only be used when ground water is not present. If ground water is present a Vacuum Test shall be used unless otherwise directed by the Engineer or designated representative. All backfilling and compaction shall be completed prior to the commencement of testing.

The procedures for the test shall include the following:

1. Manhole section interiors shall be carefully inspected; units found to have through-wall lift holes, or any penetration of the interior surface by inserts provided to facilitate handling, will not be accepted. Coating shall be applied after the testing unless coating is applied before field assembly, or at the factory. All lift holes and exterior joints shall be plugged with an acceptable non-shrink grout. No grout shall be placed in horizontal joints. Tests shall be performed before grouting the invert or around pipe penetrations and before coating the interior surfaces of the manhole or junction box.

2. After cleaning the interior surface of the manhole, the Contractor shall place and inflate pneumatic plugs in all of the connecting pipes to isolate the manhole; sealing pressure within the plugs shall be as recommended by the plug manufacturer.

3. Concrete manholes shall be filled with water or otherwise thoroughly wetted for a period of 24 hours prior to testing.

4. At the start of the test, the manhole shall be filled to the top with water. The test time shall be 1 hour. The Construction Inspector must be present for observation during the entire time of the test. Permissible loss of water in the 1-hour test time is 0.025 gallons per diameter foot, per foot of manhole depth. For a 4-foot diameter manhole, this quantity converts to a maximum permissible drop in the water level (from the top of the manhole cone) of 0.1 inches per foot of manhole depth or 1.0 inches for a 10-foot deep manhole.

C. Failure to Pass the Test – Records of Tests

If the manhole fails to pass the initial test method as described in (A) Test by the Vacuum Method and, if allowed, (B) Test by the Exfiltration Method, or if visible groundwater leakage into the manhole is observed, the Contractor shall locate the leak, if necessary by disassembly of the manhole. The Contractor shall check the gaskets and replace them if necessary. The Contractor may re-lubricate the joints and re-assemble the manhole, or the Contractor may install an acceptable exterior joint sealing product (see City of Austin Standard Products List Item SPL WW-146A) on all joints and then retest the manhole. If any manhole fails the vacuum and/or exfiltration test twice, the Contractor shall consider replacing that manhole. If the Contractor chooses to attempt to repair that manhole, the manhole must be retested until it passes. In no case shall cold applied preformed plastic gaskets be used for repair. Records of all manhole testing shall be made available to the Engineer or designated representative at the close of each working day, or as otherwise directed by the Engineer or designated representative. Any damaged or visually defective products, or any products out of acceptable tolerance shall be removed from the site.

D. Inspection

The Engineer or designated representative shall make a visual inspection of each manhole after it has passed the testing requirements and is considered to be in its final condition. The inspection shall determine the completeness of the manhole; any defects shall be corrected to the satisfaction of Engineer or designated representative.

**506.7 Measurement**

A "Junction Box" and "Box Manholes" will be measured by each structure of the indicated size regardless of depth.

A "Standard Pre-cast Manhole with Pre-cast Base", "Standard Pre-cast Manhole with Cast-in-Place (CIP) Base", “Special Manhole", "Drop Manhole with Pre-cast Base", "Drop Manhole with Cast-in-Place (CIP) Base”, "Centered Tee Manhole", or "Tangent Tee Manhole" will be measured by each structure of the indicated size for the first 8 feet of depth.

An "Extra Depth Manhole" will be measured by linear vertical foot of Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole, Centered Tee Manhole, or Tangent Tee Manhole of the indicated size in excess of eight feet of depth.

Manhole depth will be measured from the invert flow line to the finished surface elevation.

"Minor Manhole Height Adjustment" and "Major Manhole Height Adjustment" will be measured by each unit for the indicated size. Only existing manholes will be measured for minor or major manhole height adjustment.

"Connection to Existing Manhole or Junction Box" will be measured per each for the indicated type of structure and location.

"Structural Lining" will be measured by the linear vertical foot for the indicated structure.

New manholes constructed to interim elevations to facilitate stage construction shall be measured as one unit regardless of the number of interim elevations constructed. All labor, materials and other expenses necessary for the stage construction shall be included in the unit price bid for the completed unit. Cost of abandonment of existing manholes shall be included in the unit price bid for the completed unit, unless Pay Item No. 506 AB is indicated on the Drawings and identified in Standard Contract Bid Form 00300U.

**506.8 Payment**

Payment for completed junction boxes and manholes of the type indicated on the Drawings shall be made at the appropriate unit bid price. The unit bid price shall include all labor, equipment, materials, (including but not limited to frames and grates, rings and covers, adjusting rings, cone sections, riser sections, gaskets, drop piping and fittings, bases, pipe-to-manhole connectors, concrete, reinforcing steel, non-shrink grout, mortar, joint wrap where specified, and, for wastewater manholes, interior coatings), time and incidentals necessary to complete the work.

Payment for a "Junction Box" and "Box Manhole" will be made at the unit price bid for the indicated size, complete in place.

Payment for the first 8 feet of a "Standard Pre-cast Manhole with Pre-cast Base", "Standard Pre-cast Manhole with Cast-in-Place (CIP) Base", "Special Manhole", "Drop Manhole with Pre-cast Base", "Drop Manhole with Cast-in-Place (CIP) Base","Centered Tee Manhole", or "Tangent Tee Manhole" will be made at the unit price bid for the indicated type and size, complete in place.

Payment for that portion of a Standard Pre-cast Manhole with Pre-cast Base, Standard Pre-cast Manhole with CIP Base, Drop Manhole with Pre-cast Base, Drop Manhole with CIP Base, Special Manhole, Centered Tee Manhole, or Tangent Tee Manhole in excess of 8 feet in depth will be made at the unit price bid for "Extra Depth Manhole" of the indicated type and size, complete in place.

Payment for "Minor Manhole Height Adjustment" and "Major Manhole Height Adjustment" will be made at the unit bid price, complete in place.

Payment for "Structural Lining" will be made at the unit price per linear vertical foot, which will include surface preparation, environmental adjustments, lining application, and curing, as required.

Payment for "Connection to Existing Manhole or Junction Box" shall be made at the unit price per connection and will include removing the wall section by coring or alternative method approved by the Engineer or designated representative, rehabilitating the interior walls, rebuilding the invert, and preparing and coating the interior surfaces of the structure.

When indicated in the Drawings, abandonment of existing manholes shall be made at the unit price for abandonment.

The intended use of each item shall be designated by a two-letter code (Wastewater = WW; Stormwater = SW) in the spaces provided after the pay item number:

| | | |
|---|---|---|
| **Pay Item No. 506S M__:** | Standard Pre-cast Manhole w/Pre-cast Base, ___ Dia. | Per Each. |
| **Pay Item No. 506S M1__:** | Standard Pre-Cast Manhole w/CIP Base, ___ Dia. | Per Each. |
| **Pay Item No. 506S S__:** | Special Manhole, ___ Dia. | Per Each. |
| **Pay Item No. 506S D__:** | Drop Manhole w/Pre-cast Base, ___ Dia. | Per Each. |
| **Pay Item No. 506S D1__:** | Drop Manhole w/CIP Base, ___ Dia. | Per Each. |
| **Pay Item No. 506S C__:** | Centered Tee Manhole, __ Dia. x ___ Dia. | Per Each. |
| **Pay Item No. 506S T__:** | Tangent Tee Manhole, ___ Dia. x ___ Dia. | Per Each. |
| **Pay Item No. 506S J__:** | Junction Box, ___ Ft. x ___ Ft. | Per Each. |
| **Pay Item No. 506S B__:** | Box Manhole ___ Ft. x ___ Ft. | Per Each. |
| **Pay Item No. 506S 2__:** | Major Manhole Height Adjustment, ___ Dia. | Per Each. |
| **Pay Item No. 506S 4__:** | Minor Manhole Height Adjustment, ___ Dia. | Per Each. |
| **Pay Item No. 506S AB__:** | Abandonment of existing Manholes: | Per Each. |
| **Pay Item No. 506S EDM__** | Extra Depth of Manhole, ___ Dia. | Per Linear Vert. Foot. |
| **Pay Item No. 506S SL__:** | Structural Lining of _____: | Per Linear Vert. Foot. |
| **Pay Item No. 506S CN__:** | Connection to Existing _____: | Per Each. |

**End**

| ***SPECIFIC* CROSS REFERENCE MATERIALS** |
|---|
| Standard Specification Item No. 506, "Manholes" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item 403S | Concrete For Structures |
| Item 406S | Reinforcing Steel |
| Item 402S | Controlled Low Strength Material |
| Item 410S | Concrete Structures |
| Item 503S | Frames, Grates, Rings and Covers |
| Item 504S | Adjusting Structures |
| Item 507S | Bulkheads |
| Item 510 | Pipe |

Texas Department of Transportation Standard Specifications
For Construction and Maintenance of Highways, Streets and Bridges

| Designation | Description |
|---|---|
| Item 421 | Hydraulic Cement Concrete |

City of Austin Utilities Criteria Manual

| Designation | Description |
|---|---|
| Section 2.8.0 | Abandonment of Facilities |
| Subsection 2.8.2 | Manholes |

City of Austin Water Utility Documents

| Designation | Description |
|---|---|
| SPL WW-146A | Manhole Seals, Plastic, Watertight |
| SPL WW-511 | Lining System for Wastewater Manholes |
| SPL WW-511A | Structural Lining System for Wastewater Manholes |
| SPL WW-703 | Adjusting (grade) rings for manhole chimney sections |

City of Austin Standard

| Designation | Description |
|---|---|
| 506S-2 | Major Manhole Height Adjustment |
| 506S-4 | Minor Manhole Height Adjustment |
| 506S-15 | Abandoned Manhole |
| 506S-12 | O-Ring Joint Detail, Precast Manhole Section |
| 506S-13 | Wedge Seal Joint Detail, Precast Manhole Section Adjustment |
| 506S-15 | Abandoned Manhole |
| 804S-4, 5, 6 and 7 of 9 | Steel Plating |

City of Austin Standard Contract

| Designation | Description |
|---|---|
| 00300U | Bid Form (Unit Prices) |

American Society for Testing and Materials (ASTM)

| Designation | Description |
|---|---|
| ASTM C 55 | Specification for Concrete Building Brick |
| ASTM C 62 | Specification for Building Brick Solid Masonry Units Made from Clay of Shale |
| ASTM C478/C478M | Standard Specification for Precast Concrete Manhole |
| ASTM C443/C443M | Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets |
| ASTM C923/C923M | Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures Pipes |
| ASTM C1107 | Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) |
| ASTM D6132 | Specification for Polyethylene Plastics Molding and Extrusion Materials |
| D4976 | Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coating Over Concrete Using an Ultrasonic Gage |

American Concrete Institute

| Designation | Description |
|---|---|

| | |
|---|---|
| Item 347 | Guide to Formwork for Concrete |

| ***RELATED* CROSS REFERENCE MATERIALS** |
|---|
| Standard Specification Item No. 506, "Manholes" |

City of Austin Utilities Criteria Manual

| Designation | Description |
|---|---|
| Section 2 | Water and Wastewater Design Criteria |

City of Austin Standards

| Designation | Description |
|---|---|
| 1100S-1 | Casting Adjustments |
| 503S-4S | Storm Sewer Manhole Ring and 32" Cover |
| 503S-4W | Sanitary Sewer Manhole Ring and 32" Cover |
| 503S-5S | Bolted Storm Sewer Manhole Ring and 32" Cover |
| 503S-5W | Watertight Manhole Ring and 32" Cover (W&WW) |
| 506S-1 | Manhole Invert Plan |
| 506S-5 | Typical Box Manhole 30" and Larger Pipe |
| 506S-7 | Precast Manhole with Drop Inlet on Cast in Place Foundation |
| 506S-8 | Precast Manhole with Drop Inlet on Precast Base |
| 506S-9 | Precast Manhole On Cast-In-Place Foundation |
| 506S-10 | Wastewater Manhole on Precast Base |
| 506S-11 | Storm Sewer Manhole Details |

American Association of State Highway and Transportation Officials (AASHTO)

| Designation | Description |
|---|---|
| M306 | Standard Specifications for Drainage Structure Castings |

## 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, tieback or braced sheeting, tieback slurry walls, soil nailing, rock bolting, tieback 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 width of a trench (measured at the bottom) shall not be greater 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 Submittals

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

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 tieback or braced sheeting, tieback 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 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 onsite 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.

**END**

| ***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 |

**Item No. 510**
**Pipe**

## 510.1 Description

This item governs the furnishing and installing of 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 |
|---|---|
| 1-1/2" | 0 |
| 1" | 0-10 |
| 1/2" | 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 |
| 1/4" | 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 |
|---|---|
| 3/4" | 0 |
| 1/2" | 0-25 |
| 1/4" | 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 (3/4 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 map).

-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 2 inches 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 1/2 inch for 16-inch pipe and 3/4 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 D 2737; 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 (DR) 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 3/4” 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, 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 14, 200 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 D 3034"

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 1/2 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 1/2 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:

10 1/2 inches wide for 2 2/3 inches x 1/2-inch corrugations.

12 inches wide for 3 inches x 1 inch or 5 inches x 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.

16 1/4 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 1/2-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 1/2 inch ± annular space between pipe ends when joined together.

Bands shall be drawn together by two 1/2 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 1/4 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 Contractor. 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 Engineer at least six copies of a detailed pipe laying schedule for review and approval. The laying schedule shall list all types of pipe, fittings, valves, hydrants, flanged outlets, and other appurtenances required for construction. The Contractor shall submit the laying schedule at least 30 days in advance of construction on the project. The Engineer will forward review comments to the Contractor for revisions. The Contractor shall make revisions and forward to

the Engineer for review. Prior to start of construction on the Project, the Engineer will send a reviewed final laying schedule marked for construction to the Contractor. 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.

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 3/4" to 2-1/2" | | 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. 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 22-1/2 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 1/4 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 4 1/2 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 E/A's field representative on the job at least 72 hours prior to the desired time for any shutoff. The E/A's field representative will notify any affected utility customers at least 48 hours prior to the shutoff. The Water Utility 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 the Water Utility. The operation of the valve is to be conducted under the immediate supervision of the E/A's field 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 Water Potable or Reclaimed 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 Austin Water Utility Inspector must be present. "Size on size" taps will not be permitted, unless made by use of an approved full circle gasket 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 3/4 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 E/A may approve any of the following well graded materials:

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 E/A 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 required density using any method, type and size of equipment, which will give the required compaction without damaging the pipe or bedding. Placement of backfill greater than 2 feet beyond structures in Right of Way shall be conform to (g) below. The depth of layers, 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 layer shall be brought to the moisture content necessary to obtain the required density and shall be kept level to insure uniform compaction over the entire layer. Testing for density shall be in accordance with Test Method Tex-114-E and Test Method Tex-115-E.

Each layer of backfill must provide the density as required herein. Swelling soils (soils with plasticity index of 20 or more) 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 (soils with plasticity index less than 20) shall be sprinkled as required 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 layer of backfill is complete, tests may be made by the E/A. 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 E/A may order proof rolling to test the uniformity of compaction of the backfill layers. All irregularities, depressions, weak or soft spots that develop shall be corrected immediately by the Contractor.

Should the backfill, due to any reason, lose the required 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 indicated. The remainder of the street backfill shall be Flexible Base, Concrete or Hot Mix Asphalt Concrete as indicated or to replaced in kind to the surface removed to construct 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 element 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 24-inch diameter shall be air tested between manholes. Wastewater lines 30-inch in diameter shall be air tested between manholes or at pipe joints. Wastewater lines 36-inch diameter and larger shall be air tested at 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 backpressure of any ground water 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 backpressure 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:

$T = (0.0850 \times D \times K) \div Q$, where

T = time for pressure to drop 1.0 pounds per square inch gauge in seconds;

$K = 0.000419 \times D \times L$, 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 Austin Water Utility maintenance personnel.

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.

Lines that are 36 inches or larger inside diameter must be air tested at each joint. Lines that are 30-inch diameter may be air tested at each joint. 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 and the hydrant valve seats closed and 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:

Allowable leakage (gal / hr) = [L × D] ÷ 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 $265.00, plus $50.00 for each hour over four hours. 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

(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

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. Backflow prevention in the form of a reduced pressure backflow assembly must 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 50 mg/liter available chlorine.

The disinfecting solution shall be retained in the piping for at least 24 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 25 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 until the chlorine concentration is no higher than the residual generally prevailing in the existing distribution system. Proper planning and appropriate preparations in handling, diluting, if necessary, and disposing of this strong chlorine solution 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. 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 the Austin Water Utility. 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 Austin Water Utility Dispatch office.

(e) Bacteriological Testing

After final flushing of the strong disinfecting solution, two (2) sets of water samples from the line, that are taken at least twenty-four (24) hours apart, 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 and additional samples that are collected at intervals of not more than 1000 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.

## 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.

**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:

clearing

constructing any necessary embankment

excavation

disposal of surplus or unusable excavated material

furnishing, hauling and placing pipe

field constructed joints, collars, temporary plugs, caps or bulkheads

all necessary lugs, rods or braces

pipe coatings and protection

connections to existing systems or structures, concrete blocking and thrust blocks and restrained joints

preparing, shaping, pumping for dewatering, and shoring of trenches

bedding materials

backfill materials

hauling, placing and preparing bedding materials

particle migration measures

hauling, moving, placing and compacting backfill materials

temporary pavement repairs and maintenance

temporary and permanent removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction

cleanup

vertical stack on deep wastewater services

all other incidentals necessary to complete the pipe installation as indicated.

pipe joint restraint devices, where specified or allowed, meeting Standard Products Lists 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 including 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 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.

**End**

Applicable References:

Standard Specifications Manual: Item Nos. Ref: 102S, 210S, 402S, 403S, 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.

**Item No. 602S**
**Sodding for Erosion Control**

## 602S.1 Description

This item shall govern planting of Bermuda grass; St. Augustine or other acceptable grass sod at locations indicated on the Drawings or as directed by the Engineer or designated representative in accordance with this Standard Specification Item.

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.

## 602S.2 Submittals

The submittal requirements for this specification item shall include the identification of the type and source of sodding, the type of mulch, type of tacking agent and type and rate of application of fertilizer.

## 602S.3 Materials

A. Block and Mulch Sod

The sod shall consist of live, growing Bermuda Grass, St. Augustine grass, when shown on the Drawings, or other acceptable grass sod indicated on the Drawings secured from sources that are approved by the Engineer or designated representative. Bermuda Grass sod, St. Augustine sod or other grass sod as shown on the Drawings shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for a minimum thickness of 1 inch (25 millimeters). The thickness measure does not include grass. The sod shall be cut in rectangular pieces with its shortest side not less than 12 inches (300 mm). The Contractor shall not use sod from areas where the grass is thinned out nor where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted.

The sod shall be substantially free from noxious weeds, Johnson grass or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardiness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and raked to remove all weeds and long standing stems. Sources from which sod is to be secured shall be approved by the Engineer or designated representative.

Care shall be taken at all times to retain the native soil of the roots of the sod during the process of excavating, hauling and planting. Sod material shall be kept moist from the time it is dug until it is planted. The sod existing at the source shall be watered to the extent required by the Engineer or designated representative prior to excavating.

B. Fertilizer

Fertilizer and the rate of application shall conform to the requirements of Standard Specification Item No. 606S, "Fertilizer".

C. Mulch

Straw mulch shall be oat, wheat or rice straw. Hay mulch may be substituted for straw mulch and shall be Prairie Grass; Bermuda grass or other hay approved by the Engineer or designated representative. The hay or straw mulch shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted.

D. Water

Water shall be furnished by the Contractor and shall be clean and free of industrial wastes and other substances harmful to the growth of sod or to the area irrigated.

E. Tacking Agents

Tacking agents for straw or hay mulch shall be as shown on the Drawings.

**602S.4 Planting Season**

All planting shall be done between April and November except as specifically authorized in writing by the Engineer or designated representative.

**602S.5 Construction Methods**

A. General

After the designated areas have been completed to the lines, grade and cross sections indicated on the Drawings, the surface shall be worked to a depth of not less than 4 inches (100 mm) with a disc, tiller or other equipment approved by the Engineer or designated representative. Fertilizer nutrients shall be applied and tilled. Areas that become crusted shall be reworked to an acceptable condition before sodding. Sodding of the type specified shall conform to the requirements of this Specification Item. The Contractor shall give continuous care to the sodded area until the sod is accepted.

B. Placement

The sod shall be placed on the prepared surface with the edges in close contact and alternate courses staggered. In ditches the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground. The exposed edges of sod shall be buried flush with the adjacent soil. On slopes exceeding 3:1 or where the sod may be displaced, the sod shall be pegged with not less than 4 stakes or ground staples per square yard (square meter) with at least 1 stake or ground staple for each piece of sod.

Pegs shall be of wood lath or similar material, pointed and driven with the flat side against the slope, 6 inches (150 mm) into the ground, leaving approximately 1/2 inch (12.5 mm) of the top above the ground. Ground staples shall not be less than

13 inches (330 mm) in length and shall be constructed of No. 11 gage (3 mm) wire that is bent to form a "U" approximately 1 inch (25 mm) in width.

C. Watering

Immediately after the area is sodded, it shall be watered with a minimum of 5 gallons of water per square yard (22.5 liters per square meter) and at 10 day intervals as needed and as directed by the Engineer or designated representative. Subsequent to the initial application water shall be applied at a minimum rate of 3 gallons per square yard (13.5 liters per square meter), as required on the Drawings or as directed by the Engineer or designated representative until final acceptance by the City or until the grass uniformly reaches a height of 2 1/2 inches (62.5 mm).

Availability of water from the Austin Water Utility will be limited as stated under the Water Conservation Standard, City of Austin Land Development Code Chapter 6-2, Article II, " Water Use Management Plan Established".

The use of potable water will be restricted as stated in City of Austin Land Development Code Sections 6-4-73, 6-4-54, 6-4-63, 6-4-64, 6-4-65, 6-4-81, 6-4-92, 15-9-37(D) and 15-9-101(B).

D. Finishing

Where applicable, the shoulders, slopes and ditches shall be smoothed after planting has been completed and shaped to conform to the desired cross sections shown on the Drawings. Any excess soil from planting operations shall be spread uniformly over adjacent areas or disposed of as directed by the Engineer or designated representative so that the completed surfaces will present a neat appearance. All sodded areas shall be rolled after the initial watering application, when sufficiently dry.

### 602S.6 Block Sodding

At locations indicated on the Drawings or where directed by the Engineer or designated representative, sod blocks shall be carefully placed on the prepared areas. The fertilizer shall then be applied in accordance with the applicable provisions of Item No. 606S, "Fertilizer" and thoroughly watered. When sufficiently dry, the sodded area shall be rolled or tamped to form a thoroughly compacted, solid mat. Any voids left in the block sodding shall be filled with additional sod and tamped. Surfaces of block sod which, in the opinion of the Engineer or designated representative may slide due to the height and slope of the surface or nature of the soil, shall be pegged with wooden pegs driven through the sod blocks into firm earth sufficiently close to hold the block sod firmly in place. Edges along curbs and drives, walkways, etc., shall be carefully trimmed and maintained until the sodding is accepted.

### 602S.7 Mulch Sodding

The sod source shall be disked in 2 directions cutting the sod thoroughly to a depth of not less than 4 inches (100 mm). Sod material shall be excavated to a depth of not more than 2 inches (50 mm) below the existing root system, being careful to avoid having soil containing no grass roots. The disked sod may be windrowed or otherwise

handled in a manner satisfactory to the Engineer or designated representative. The material shall be rejected if not kept in a moist condition.

Prior to placement of mulch sod, the cut slopes shall be scarified by plowing furrows 4 inches (100 mm) to 6 inches (150 mm) deep along horizontal slope lines at 2 foot (600 mm) vertical intervals. Excavated material from the furrows shall not protrude more than 3 inches (75 mm) above the original surface of the cut. Fertilizer shall be distributed uniformly over the area in accordance with the applicable provisions of Item No. 606S, "Fertilizer". The sod shall then be deposited upon the prepared area and spread uniformly to the thickness indicated on the Drawings.

Any section that is not true to lines and cross sections shall be remedied by the addition of sod material or by reshaping the material to meet the requirements of "Finishing"[Section 602S.5 (4)]. After the sod material has been spread and shaped, it shall be thoroughly wetted and compacted with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour.

### 602S.8 Measurement

Work and acceptable material for "Sodding for Erosion Control" will be measured by the square yard (square meter: 1 square meter is equal to 1.196 square yards) complete in place with a minimum of 95 percent growth with a 2 1/2 inch (62.5 mm) stand of grass.

### 602S.9 Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price for Bermuda Block Sodding", "St. Augustine Block Sodding", "Bermuda Mulch Sodding" or "Other Approved Grass Sodding". The prices shall each represent full compensation for completion of the work including all water applications, rolling, pegging and fertilizer as indicated on the Drawings.

Payment will be made under one of the following:

| | | |
|---|---|---|
| **Pay Item No. 602S-A:** | Bermuda Block Sodding - | Per Square Yard. |
| **Pay Item No. 602S-B:** | St. Augustine Block Sodding - | Per Square Yard. |
| **Pay Item No. 602S-C:** | Bermuda Mulch Sodding - | Per Square Yard. |
| **Pay Item No. 602S-D***:* | Grass Sodding - | Per Square Yard. |

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification 602S, “Sodding for Erosion Control” |

*City of Austin Land Development Code*

| *Designation* | *Description* |
|---|---|
| Chapter 4-2, Article II | Emergency and Peak Day Water Use Management |

*City of Austin Standard Specification Items*

| *Designation* | *Description* |
|---|---|
| Item No. 606S | Fertilizer |

*City of Austin Land Development Code*

| *Designation* | *Description* |
|---|---|
| Section 6-4-52 | Water Use Management Plan Established |
| Section 6-4-53 | Applicability |
| Section 6-4-54 | Compliance Required |
| Section 6-4-63 | Permanent Water Use Restrictions |
| Section 6-4-64 | Water Conservation Stage One Regulations |
| Section 6-4-65 | Water Conservation Stage Two Regulations |
| Section 6-4-81 | Variance |
| Section 6-4-92 | Penalty |
| Section 15-9-37(D) | Customer's Responsibilities |
| Section 15-9-101(B) | Basis for Termination of Service |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification 602S, "Sodding for Erosion Control" |

*City of Austin Standard Specification Items*

| *Designation* | *Description* |
|---|---|
| Item No. 110S | Street Excavation |
| Item No. 111S | Excavation |
| Item No. 120S | Channel Excavation |
| Item No. 132S | Embankment |
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 604S | Seeding for Erosion Control |
| Item No. 608S | Planting |
| Item No. 610S | Preservation of Trees and Other Vegetation |

*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. 160 | Furnishing and Placing Topsoil |
| Item No. 162 | Sodding for Erosion Control |
| Item No. 164 | Seeding for Erosion Control |
| Item No. 166 | Fertilizer |
| Item No. 168 | Vegetative Watering |
| Item No. 204 | Sprinkling |

**Item No. 604S**
**Seeding for Erosion Control**

## 604S.1 Description

This item shall govern the preparation of a seed bed for temporary or permanent erosion control; sowing of seeds; fertilizing; mulching with straw, cellulose fiber wood chips, and recycled paper mulch; and other management practices along and across such areas as indicated in the Drawings or as directed by the Landscape Architect, 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 with SI units shown within parentheses.

## 604S.2 Submittals

The following submittal items are required in writing during construction:

A. Identification of the seed species, source, mixture, and PLS of the seed as listed on the analysis tags and certification tags from all seed bags. Seed calculation worksheet per Table 7. PLS is the percentage of seed purity multiplied by the percentage of germination plus dormant seed. The analysis tag, required on all seed sold in Texas, includes information on quality: kind and variety of seed, lot number, percent pure live seed, percent other crop seed, percent inert matter, percent weed seeds, germination percentage, and date of test. The certification tag also verifies seed quality, an assurance of seed variety and attesting to standards for germination and purity, Information provided includes class of certification, kind of crop, variety, lot number, and name and address of the owner

B. If fertilizer is proposed, results of a recent soil test (6 months old or less) of the area to be seeded, before fertilization. Soil samples shall be collected after final grading, when topsoil has been placed. The test results must include soil lab recommended additions of Nitrogen (N), Phosphorus (P), and Potassium (K) for the type of vegetation proposed, as well as soil organic matter percentage and textural class.

C. Fertilizer formulation and release rate based on a soil test (see B above).

D. For hydromulch applications, proposed application rate of seed, type of mulch and tacking agent, and other relevant information. An example of the required documentation is in Table 1.

E. Type of hydraulic seeding equipment and nozzles proposed for use.

F. If pesticide use is proposed, an IPM plan for pest removal including pesticide label, proposed application rate and timing, and MSDS sheets.

G. One gallon sample of proposed vegetative mulch.

The following submittal items are required before Substantial Completion:

A. For hydromulch applications, the complete hydromulch application log, including date, time and quantity of product units placed in the slurry tank. An example of an

application log is provided in Table 2. This log may be requested at any time during construction by the Landscape Architect, Engineer, or authorized inspector.

B. Pesticide application tracking log. As of January 1, 2012, documentation of all outdoor pesticide use on city-owned properties is required to demonstrate compliance with the EPA/TCEQ mandated Municipal Stormwater Permit, the TPDES General Pesticide Permit, City Code, and the IPM program.

Table 1: Example of proposed hydromulch application rates

| | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|
| Hydro Mix | Sheet No. | Seed Mix | Acres | Seed (Bags/ ac) | Tackifier (Buckets/ ac) | Mulch (Bales/ ac) | Fertilizer (Bags/ ac) | Addl. Amendments (Bags/ac) |
| 1 | L2 | A | 1.0 | 1 | 100 | 1000 | 50 | 5 |
| F2 | L3 | A | 0.5 | 2 | 200 | 1500 | 50 | 5 |
| 3 | L5 | B | 3.0 | 3 | 300 | 3000 | 50 | 5 |

Table 2: Example of hydromulch application log

| | | | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Start Time | Finish Time | AC/ Tank | Water (gal) | Seed Mix | Seed (Bags/ ac) | Tackifier (Buckets /ac) | Mulch (Bales /ac) | Fertilizer (Bags/ ac) | Addl. Amend-ments (Bags/ac) |
| 4/13 | 10:30 | 11:15 | 1.0 | 330 | A | 1 | 100 | 1000 | 50 | 5 |
| 4/17 | 2:00 | 2:30 | 0.5 | 330 | A | 2 | 200 | 1500 | 50 | 5 |
| 5/20 | 8:30 | 10:00 | 1.2 | 330 | B | 3 | 300 | 3000 | 50 | 5 |
| | | | | | Totals | 6 | 600 | 5500 | 127 | 15 |

**604S.3. Materials**

A. Seed. All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing pure live seed (PLS), name and type of seed and all other required elements of the Analysis and Certification Tags.

The seed furnished shall be of the previous season's crop and the date of analysis, shown on each bag, shall be within twelve (12) months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers, unless a specific mix is proposed for use. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Landscape Architect, Engineer or designated representative.

The amount of seed planted square yard (0.84 square meters) or per acre (hectare) shall be of the type specified in sections 604S.5 and 604S.6.

B. Water. Water shall be clean and free of industrial wastes and other substances harmful to the growth of plant material or the area irrigated.

C. Top soil. Top soil shall conform to Item No. 601S.3(A).

D. Fertilizer. The fertilizer shall conform to Item No. 606S, "Fertilizer". The type and rate of fertilizer should be based on chemical tests of recent (no older than 6 months before application) representative site soil samples. Fertilizer should be applied only when plants can take them up for growth, during: 1) seed germination and plant establishment and 2) after plant establishment. Fertilizer shall not be applied within 48 hours of a potential rain event.

E. Straw Mulch or Hay Mulch. Straw Mulch shall be oat, wheat or rice straw. Hay mulch shall be prairie grass, or other hay approved by the Landscape Architect, Engineer or designated representative. The straw or hay shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be moldy or rotted.

F. Tackifier. The tackifier shall be a biodegradable tacking agent, approved by the Landscape Architect, Engineer or designated representative.

G. Cellulose Fiber Mulch (Natural Wood). Cellulose Fiber Mulch shall be natural cellulose fiber mulch produced from grinding clean whole wood chips. The mulch shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such, that when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder.

H Recycled Paper Mulch. Recycled paper mulch shall be specifically manufactured from post-consumer paper and shall contain a minimum of 85% recycled paper content by weight, shall contain no more than 15% moisture and 1.6% ash, and shall contain no growth inhibiting material or weed seeds. The recycled paper mulch shall be mixed with grass seed and fertilizer (see “fertilizer” above) for hydro-seeding/mulching, erosion control, and a binder over straw mulch. The mulch, when applied, shall form a strong, moisture-retaining mat of a green color without the need of an asphalt binder.

I. Mulch. Mulches, acting as seed coverings, can enhance seed germination and seedling establishment. Characteristics of ideal mulches for seeding are those that protect seeds from wind (drying), excessive solar radiation, high evapotranspiration rates, and erosion, while allowing germination and growth. Relatively coarsely shredded, weed-free vegetative mulch should be used on seed installations, especially in open, sunny areas. These materials shall be clean, free of foreign matter, and dry enough to spread evenly.

J. Pesticide. A least toxic, integrated pest management (IPM) approach shall be used to control weeds. A written request for approval of weed control products and materials shall be submitted to the City of Austin Watershed Protection Department (ERM) IPM program coordinator for approval. Additional information can be found at http://www.austintexas.gov/ipm.

**604S.4 Construction Methods**

A. General. The Contractor shall limit preparation of the seedbed to areas that will be seeded immediately. When seeding for permanent erosion control, weed species listed in Table 3

shall be managed by application of an appropriate herbicide and/or by physical removal by the roots before the seeding operation. The goal of weed management is to facilitate establishment of the permanent vegetative cover. Additionally, the Owner may require removal of any plant species that appears to be out-competing seeded or planted species during the construction period.

**Table 3: Weed List**

| Weed Type | Botanical Name | Common Name |
|---|---|---|
| Annual Grass | Cenchrus spp. | Sandbur |
| Herb | Cnidoscolus texanus | Bull Nettle |
| Herb | Urtica spp. | Stinging Nettle |
| Vine | Toxicodendron radicans | Poison Ivy |
| Perennial Grass | Sorghum halapense | Johnson Grass |
| Perennial Grass | Arundo donax | Giant Cane |
| Perennial Grass | Phyllostachys aurea | Golden Bamboo |
| Summer Annual Herb | Ambrosia trifida | Ragweed |
| Winter Annual Herb | Rapistrum rugosum | Bastard Cabbage |
| Winter Annual Herb | Bromus arvensis | Japanese Brome |
| Winter Annual Herb | Lolium multiflorum | Annual Ryegrass |

B. Preparing Seed Bed. After the designated areas have been rough graded to the lines, grades and typical sections indicated in the Drawings or as provided for in other items of this contract and for any other soil area disturbed by the construction, a suitable seedbed shall be prepared. The seedbed shall consist of a minimum of either 6 inches (150 millimeters) of approved topsoil or 6 inches (150 millimeters) of approved salvaged topsoil.

The topsoil or growing medium must be prepared so that compaction is appropriate for plant growth, and to achieve acceptable bulk density or hydrologic function. Rippers and subsoilers may be used to loosen compacted soil and roughen the surface. Disks, plows and excavator attachments are good for compaction reduction, roughening and incorporating amendments. If tracked machinery is used in seedbed preparation, cleat marks should run with the contour to prevent rills. The optimum depth for seeding shall be 1/8 to 1/4 inch (3 to 6 millimeters).

Water shall be gently applied as required to prepare the seedbed prior to the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements described below.

C. Watering. All watering shall comply with City Code Chapter 6-4 (Water Conservation). All seeded areas regardless of seed type and method of seeding (e.g., broadcast, hydroseed) shall be watered immediately after installation. For seed germination and establishment it is important to keep the seedbed in a moist condition favorable for the growth of plant materials.

Watering applications shall constantly maintain the seedbed in a moist condition favorable for the growth of plant materials. Watering shall continue until the plant material is at least

1-1/2 inches (40 mm) in height and accepted by the Engineer or designated representative. Supplemental watering can be postponed immediately after a half- inch (12.5 mm) or greater rainfall on the site but shall be resumed before the soil dries out.

D. Cool Season Cover Crop. From September 15 to March 1, non-native and native seeding shall include a cool season cover crop at the rate specified in Table 6. Cool season cover crops are not permanent erosion control. If installed separately from the permanently erosion control seed mix, the cool season cover crops shall be mowed to a height of less than one (1) inch after March 1, and the area shall be re-seeded at the specified seeding rate for non-native or native warm-season species (March 1 to September 15).

**604S.5 Non-Native Seeding**

A. Method A - Broadcast Seeding. The seed or seed mixture in the quantity specified shall be uniformly distributed over the prepared seed bed areas indicated on the Drawings or where directed by the Engineer or designated representative. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall be sown in two directions at right angles to each other. If mechanical equipment is used, all varieties of seed, as well as fertilizer (if required), may be distributed at the same time, provided that each component is uniformly applied at the specified rate. After planting, the planted area shall be rolled with a corrugated roller of the "Cultipacker" type. All rolling of the slope areas shall be on the contour.

Seed Mixture and Rate of Application for Broadcast Seeding:

From March 1 to September 15, seeding shall be with hulled Bermuda Grass at a rate of 45 lbs/ac (5.0 kilograms per hectare) with a minimum PLS = 0.83. Fertilizer shall be applied if warranted by a soil test, and shall conform to Item No. 606S, "Fertilizer". Bermuda grass is a warm-season grass and is therefore considered permanent erosion control once established.

Method B - Hydraulic Planting. The seedbed shall be prepared as specified above and hydraulic planting equipment, which is capable of placing all materials in a single operation, shall be used. Information about hydromulching for temporary and permanent vegetation stabilization is in the Environmental Criteria Manual (ECM) Section 1.4.7.

Hydroseeding equipment shall be clean and free of all previous seeds, fertilizer, mulch, or any hydroseeding products used on prior jobs.

<u>March 1 to September 15</u>

Hydraulic planting mixture and minimum rate of application pounds per acre or square yard (kilograms per ha):

| Hulled Bermuda Seed (min. PLS=0.83) | Fiber Mulch | | Soil Tackifier |
|---|---|---|---|
| | Cellulose | Wood | |
| 45 Lbs/ac (50.44 kg/ha) | 2000 Lbs/ac (2242 kg/ha) | | 60.98 Lbs/ac (68.36 kg/ha) |
| | | 2500 Lbs/ac (2803 kg/ha) | 65.34 Lbs/ac (73.25 kg/ha) |

**604S.6 Native Grass and Forb Seeding**

The seed mixture shall include both grasses and forbs. The dry and moist sites grass mix shall be seeded at rates of at least 23.5 and 17.0 lb/ac (26.32 and 19.04 kg/ha), respectively and the dry and wet site forb mix shall be seeded at a rate of at least 11.5 and 9.0 lb/ac (12.88 and 10.08 kg/ha), for total application rates of 35.00 lb/ac (39.20 and 29.12 kg/ha) [dry site] and 26 lb/ac (29.12 kg/ha) [wet site]. Minimum diversity for dry sites (Table 4) is eight species of grasses and 10 species of forbs. Minimum diversity for wet sites (Table 5) is six species of grasses and seven species of forbs. The species indicated with an asterisk shall be included in all proposed mixes. Application rates may be modified, but no species shall constitute more than 20% of a seed mix. Any species proposed for installation and not included in Tables 4 or 5 shall by City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative, and shall be native to Central Texas as referenced by the LBJ Wildflower Center plant database (www.wildflower.org) or USDA plant database.

Table 4: Native Grasses and Forbs: Dry Sites

| Type | Common Name | Botanical Name | Exposure | Recommended Application Rates | |
|---|---|---|---|---|---|
| | | | | lbs/ac | kg/ha |
| Grass Seed Mix | Sideoats grama* | Bouteloua curtipendula | Full-part sun | 7.0 | 7.8 |
| | Green sprangletop* | Leptochloa dubia | Full sun | 6.0 | 6.7 |
| | Buffalograss | Buchloe dactyloides | Full sun | 24.0 | 27.0 |
| | Blue Grama Grass | Bouteloua gracilis | Full-part sun | 10.0 | 11.2 |
| | Canada Wild Rye | Elymus canadensis | Full-part sun | 10.0 | 11.2 |
| | Purple Three-Awn | Aristida purpurea | Full sun | 4.0 | 4.5 |
| | Cane Bluestem | Bothriochloa barbinodis | Full sun | 3.0 | 3.3 |
| | Galleta | Pleuraphis jamesii | Full sun | 10.0 | 11.2 |
| | Black Grama* | Bouteloua eripoda | Full sun | 10.0 | 11.2 |
| | Sand Dropseed* | Sporobolus cryptandrus | Full sun | 1.0 | 1.1 |
| | Alkali Sacaton | Sporobolus airoides | Full sun | 0.5 | 1.7 |
| | Curly Mesquite | Hilaria belangeri | Full sun | 2.0 | 2.2 |
| | Sand Lovegrass | Eragrostis trichodes | Full sun | 2.0 | 2.2 |
| | Black-Eyed Susan | Rudbeckia hirta | Full-part sun | 2.0 | 2.2 |

| | | | | | |
|---|---|---|---|---|---|
| | Illinois Bundleflower* | Desmanthus illinoens (legume) | Full-part sun shade | 15.0 | 16.8 |
| | Scarlet Sage | Salvia coccinea | Full-part sun shade | 8.0 | 9.0 |
| | Pink Evening Primrose | Oenethera speciosa | Full-part sun shade | 1.0 | 1.1 |
| | Drummond Phlox | Phlox drummondii | Full-part sun | 8.0 | 9.0 |
| | Plains Coreopsis | Coreopsis tinctoria | Full-part sun | 2.0 | 2.2 |
| | Greenthread | Thelesperma filifoliu | Full sun | 6.0 | 6.7 |
| | Purple Prairie Clover* | Dalea purpurea | Full sun | 4.0 | 4.5 |
| | Cutleaf Daisy | Engelmannia pinnatifida | Full-part sun | 18.0 | 20.1 |
| Forb Seed Mix | Partridge Pea* | Chamaecrista fasciculate | Full-part sun | 20.0 | 22.4 |
| | Indian Blanket | Gaillardia pulchella | Full-part sun | 10.0 | 11.2 |
| | Bluebonnet* | Lupinus texensis (legume) | Full sun | 20.0 | 22.4 |
| | Mexican Hat | Ratibida columnaris | Full-part sun | 2.0 | 2.2 |
| | Maximilian Sunflower | Helianthus maximilia | Full-part sun | 5.0 | 5.6 |
| | Prairie Coneflower | Ratibidia columnifer | Full-part sun | 2.0 | 2.2 |
| | Clasping Coneflower | Dracopis amplexicau | Full-part sun | 3.0 | 3.4 |
| | Purple Coneflower | Echinacea purpurea | Full-part sun shade | 10.0 | 11.2 |
| | Lemon Mint | Monarda citriodora | Full-part sun | 3.0 | 3.4 |
| | Huisache Daisy | Amblyolepis setigera | Full-part sun | 8.0 | 9.0 |
| | Texas Yellow Star | Lindheimera texana | Full-part sun | 12.0 | 13.5 |
| | Lanceleaf Coreopsis | Coreopsis lanceolata | Full-part sun shade | 10.0 | 11.2 |
| | Bush Sunflower | Simsia calva | Full-part sun | 3.0 | 3.4 |
| | Winecup | Callirhoe involucrata | Full-part sun shade | 5.0 | 5.6 |
| | Antelope horns | Asclepias asperula | Full sun | 0.1 | 0.04 |
| | Green milkweed | Asclepias viridis | Full sun | 0.1 | 0.04 |
| TOTAL<br>Total seed mix application rate is 35.0 lb/ac (23.5 lb/ac grasses and 11.5 lb/ac forbs), to be composed of at least 8 species from the grass list and 10 species from the forb list to include the required species. | | | | | |

*Required species that must be included in the mix

Table 5: Native Grasses and Forbs: Wet Sites

| Type | Common Name | Botanical Name | Exposure | Recommended Application Rates | |
|---|---|---|---|---|---|
| | | | | lbs/ac | kg/ha |
| Grass Seed Mix | White Tridens | Tridens albescens | Full-part sun | 0.5 | 0.56 |
| | Plains Bristlegrass | Setaria leucopila | Full-part sun | 6.0 | 6.7 |
| | Switchgrass | Panicum virgatum | Full-part sun | 4.0 | 4.5 |
| | Inland Sea Oats | Chasmanthium latifoliu | Shade | 12.0 | 13.5 |
| | Canada Wild Rye | Elymus canadensis | Full sun - shade | 10.0 | 11.2 |
| | Big Bluestem | Andropogon gerardii | Full sun | 4.0 | 4.5 |
| | Bushy Bluestem | Andropogon glomeratus | Full sun | 3.0 | 3.4 |
| | Green Sprangletop* | Leptochloa dubia | Full sun | 2.0 | 2.2 |
| | Eastern Gamagrass | Tripsacum dactyloides | Full sun - shade | 3.0 | 3.4 |
| Forb Seed Mix | American Basketflower | Centaurea americana | Full sun | 10.0 | 11.2 |
| | Common milkweed | Asclepias syriaca | Full sun | 0.1 | 0.04 |
| | Butterfly weed | Asclepias tuberosa | Full sun | 0.1 | 0.04 |
| | Blue Mistflower | Conoclinium coelestinum | Full-part sun | 0.5 | 0.6 |
| | Clasping Coneflower | Dracopsis amplexicaulis | Full-part sun | 3.0 | 3.4 |
| | Maximilian Sunflower | Helianthus maximliani | Full-part sun | 4.0 | 4.5 |
| | Prairie Blazing Star | Liatris pycnostachya | Full sun | 2.0 | 2.2 |
| | Pink Evening Primrose | Oenothera speciosa | Full sun-dappled shade | 1.0 | 1.1 |
| | Mexican Hat | Ratibida columnifera | Full-part sun | 2.0 | 2.2 |
| | Black-eyed Susan | Rudbeckia hirta | Full sun-dappled shade | 2.0 | 2.2 |
| | Illinois Bundleflower | Desmanthus illinoensis | Full sun-dappled shade | 15.0 | 16.8 |
| | Obedient Plant | Physostegia virginiana | Full sun-dappled shade | 4.0 | 4.5 |
| | Partridge Pea* | Camaecrista fasciculate | Full-part sun | 20.0 | 22.4 |

| Type | Common Name | Botanical Name | Exposure | Recommended Application Rates | |
|---|---|---|---|---|---|
| | | | | lbs/ac | kg/ha |
| | Purple Prairie Clover | Dalea purpurea var purpurea | Full sun | 4.0 | 4.5 |
| | Pitcher Sage | Salvia azurea | Full-part sun | 3.0 | 3.4 |
| | Showy Tick Trefoil | Desmodium canadense | Full sun | 0.5 | 0.6 |
| | Winecup* | Callirhoe involucrata | Full-part sun | 5.0 | 5.6 |
| TOTAL<br>Total seed mix application rate is 26.0 lb/ac (17.0 lb/ac grasses and 9.0 lb/ac forbs), to be composed of at least 8 species from the grass list and 10 species from the forb list to include the required species. | | | | | |

Table 6: Cool Season Cover Crop

| Common Name | Botanical Name | Exposure | Application rates | |
|---|---|---|---|---|
| | | | lbs/ac | kg/ha |
| Western Wheatgrass | *Pascopyrum smithii* | Full-pt sun; dappled shade | 5.6 | 6.28 |
| Oats | *Avena sativa* | Full sun | 4.0 | 4.48 |
| Cereal Rye Grain | *Secale cereale* | Full sun | 34.0 | 38.11 |

One cover crop species of the listed species is required to be planted between September 15 to March 1. Contractor must ensure that any seed application requiring a cool season cover crop does not utilize annual ryegrass (*Lolium multiflorum*) or perennial ryegrass (*Lolium perenne*). Only cereal rye grain (*Secale cereale*), oats (*Avena sativa*) and western wheatgrass (*Pascopyrum smithii*) are approved as cool season cover crop.

Species substitution as necessary due to availability shall be approved by the Landscape Architect, Engineer or designated representative. Watering and fertilizer application shall follow procedures outlined above or as otherwise specified on the Drawings.

Seed shall be applied by broadcast, hydromulch, blown compost, or drill method and shall be distributed evenly over the topsoil areas. Mulching shall immediately follow seed application for broadcast and hydromulch applications.

Seed Rate Calculations

The amount of seed needed to be planted on a project shall be calculated before installation to ensure adequate seed is placed, and provided as a submittal. Table 7 is an example worksheet, followed by an example calculation. Information for calculation can be obtained from seed tags or the supplier.

Table 7. Seed Calculation Worksheet

| Plant Group | Desired Seeding Rate (1bs/ac) | PLS (pure live seed) | Bulk Rate (lbs/ac) | Seeding Area (ac) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | | | | | |
| Forbs | | | | | |
| TOTAL | | | | | |

FORMULAE:

PLS (pure live seed) = (Purity x Germination) x 100. Can also use average PLS from seed tags.

Bulk Rate (lbs/AC) =Desired Seed Rate (lbs/AC)/PLS

Amt. of Seed to be Installed (lbs) = Bulk Rate (lbs/AC) x Seeding Area (AC)

Example:

| Plant Group | Desired Seeding Rate (lbs/ac) | PLS (pure live seed) | Bulk Rate (lbs/ac) | Seeding Area (ac) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | 131.00 | 0.81 | 161.73 | 1.50* | 242.60 |
| Forbs | 65.34 | 0.87 | 75.10 | 1.50* | 112.70 |
| TOTAL | 196.34 | 0.84 (ave.) | 236.83 | 1.50 | 355.30 |

**604S.7 Mulch**

Mulches may be used to help prevent soil erosion until final stabilization is achieved. Mulch shall be used to cover broadcasted seeds, especially in sunny, open areas, to protect them from drying out during germination.

A. Straw Mulch.

Straw mulch shall be spread uniformly over the area indicated or as designated by the Engineer or designated representative at the rate of 2 to 2 1/2 tons of straw per acre (4.5 to 5.6 megagrams of straw per hectare). The actual rate of application will be designated by the Landscape Architect, Engineer or designated representative. Straw may be hand or machine placed and adequately secured.

B. Hydromulch

Refer to ECM Section 1.4.7 for hydromulching applications.

C. Shredded Brush Mulch.

Small brush or tree limbs, which have been shredded, may be used for mulching Native for mulching Native Grass seeding.

**604S.8 Management Practices**

Management Practices include (1) weed management (pesticide application or mechanical removal) to so than 90 percent of the revegetation area is free of weeds listed in Table 3, and (2) reseeding areas of poor germination to achieve coverage and height per 604S.9, with no bare areas greater than 10 s.f..

Ninety (90) percent of a permanent revegetation area must be free of weeds listed in Table 3. Weeds shall be controlled in the most efficient manner possible. Management of weed species should begin early in the project, before seeding for permanent control, and extend into plant establishment, especially for perennial weeds. Manual removal or application of an appropriate herbicide may be required after the initial seeding if emergence of an annual weed species threatens establishment of sufficient preferred plant cover. Disturbance due to weed management after the initial seeding may necessitate re-seeding of the area to establish sufficient preferred plant coverage. Care should be taken to temporarily stabilize areas where physical removal of weeds has been performed to prevent erosion and sediment runoff.

The entire root system of perennial weeds shall be removed to prevent re-sprouting. Weeds may be controlled with an approved contact, systemic herbicide, provided the product is used with appropriate care and is applied in accordance with label instructions and the following guidelines:

1. Herbicide shall not be applied when the wind is greater than 8 mph (12.9 kph),
2. Herbicide shall not be applied when rainfall is expected within 24 hours,
3. Herbicide shall not contact surface water, i.e. creeks, rivers, and lakes,
4. Herbicide shall not contact desirable vegetation (a wicking method shall be used, if necessary, to accurately contact target weed only during application).

The Landscape Architect, Engineer or designated representative shall be consulted to determine appropriate weed control management when weeds are located in an environmentally sensitive location (e.g. near water or adjacent to a critical environmental feature).

At locations that fail to show an acceptable stand of planting for any reason during the initial seeding, repair and/or reseed locations as determined by the Landscape Architect, Engineer or designated representative. A successful stand of grasses and forbs for erosion control should exhibit the following:

- Seedlings with vigorous green foliage;
- Green leaves remaining throughout the summer, at least at the plant bases;
- Uniform density, with grasses and/or forbs well intermixed;
- Minimum of 95% cover; and
- No exposed soil greater than 10 s.f. in aerial extent.

The Contractor shall meet the requirements of the initial seeding, including seeding method, seed mix, and application rates, unless otherwise agreed to in writing by the Owner. Corrected deficiencies will be re-inspected and approved by the Owner, and final acceptance will be granted upon satisfactory completion.

**604S.9 Measurement**

Work and acceptable material for "Seeding for Erosion Control" will be measured by the square yard (meter: 1 meter equals 1.196 square yards) or by the acre (hectare: 1 hectare equals 2.471 acres), complete in place, so that all areas of the site that rely on vegetation for stability must be uniformly vegetated with a minimum of 95 percent total coverage for the non-native or native mixes, and 95 percent coverage for the native mix. Bare areas shall not exceed 16 square feet (1.5 square meters), and the average height of vegetation shall stand at a minimum of 1 1/2 inch (40 millimeters). Ninety (90) percent of the revegetated area, whether native or non-native re-vegetation, must be free of weeds listed in Table 3. Bare areas greater than 10 s.f. shall be re-prepared and reseeded as required to develop an acceptable stand of plant material.

**604S.10 Payment**

The work performed and materials furnished and measured will be paid for at the unit bid price for "Seeding for Erosion Control" of the method specified on the Drawings and type of mulch. The unit bid price shall include full compensation for furnishing all materials, including all topsoil, water, seed, tackifier, fertilizer or mulch and for performing all operations necessary to complete the work.

All fertilizer will be measured and paid for conforming to Item No. 606S, "Fertilizer".

Payment will be made under one of the following:

| | | |
|---|---|---|
| Pay Item No. 604S-A: | Non-Native Seeding for Erosion Control Method, Hydraulic Planting | Per Square Yard |
| Pay Item No. 604S-B: | Non-Native Seeding for Erosion Control, Broadcast Seeding | Per Square Yard |
| Pay Item No. 604S-C: | Non-Native Seeding for Erosion Control Method, Hydraulic Planting | Per Acre |
| Pay Item No. 604S-D: | Native Seeding for Erosion Control Method, Hydraulic Planting | Per Square Yard |
| Pay Item No. 604S-E: | Native Seeding for Erosion Control, Broadcast Seeding, | Per Square Yard |
| Pay Item No. 604S-F: | Native Seeding for Erosion Control Method, Hydraulic Planting | Per Acre |
| Pay Item No. 604S-G: | Mulch, | Per Square Yard |
| Pay Item No. 604S-H: | Mulch, | Per Acre |
| Pay Item No. 604S-I: | Topsoil and Seedbed Preparation, | Per Square Yard |
| Pay Item No. 604S-J: | Topsoil and Seedbed Preparation, | Per Acre |
| Pay Item No. 604S-K: | Watering, | Per 1000 gal (Kgal) |
| Pay Item No. 604S-L: | Management Practices, | Per Square Yard |
| Pay Item No. 604S-M: | Management Practices, | Per Acre |

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item 604S "Seeding for Erosion Control" |

City of Austin Technical Specifications

| Designation | Description |
|---|---|
| Item No. 130S | Borrow |
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 606S | Fertilizer |

City of Austin Land Development Code

| Designation | Description |
|---|---|
| Section 6-4 | Water Conservation |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item 604S "Seeding for Erosion Control" |

City of Austin Technical Specifications

| Designation | Description |
|---|---|
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 602S | Sodding for Erosion Control |
| Item No. 605S | Soil Retention Blanket |
| Item No. 607S | Slope Stabilization |
| Item No. 608S | Planting |

City of Austin Standards (Details)

| Designation | Description |
|---|---|
| 627S-1 | Grass Lined Swale |
| 633S-1 | Landgrading |

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

| Designation | Description |
|---|---|
| Item No. 160 | Topsoil |
| Item No. 162 | Sodding for Erosion Control |
| Item No. 164 | Seeding for Erosion Control |
| Item No. 166 | Fertilizer |
| Item No. 168 | Vegetative Watering |
| Item No. 169 | Soil Retention Blanket |
| Item No. 180 | Wildflower Seeding |
| Item No. 192 | Landscape Planting |

**Item No. 605S**
**Soil Retention Blanket**

## 605S.1 Description

This item shall govern the provision and placement of wood, straw or coconut fiber mat, synthetic mat, paper mat, jute mesh or other material as a soil retention blanket for erosion control on slopes or ditches or short-term or long-term protection of seeded or sodded areas indicated on the Drawings or as specified 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 with SI units shown within parentheses.

## 605S.2 Submittals

The submittal requirements for this specification item shall include the soil retention blanket material type and sample, evidence that the material is listed on TxDoT/TTI Approved Products List, one (1) full set of Manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.

## 605S.3 Materials

A. Soil Retention Blankets

All soil retention blankets must be listed on TxDoT Approved Products List or approved by the Engineer or designated representative.

The soil retention blanket shall be one (1) of the following classes and types as shown on the Drawings:

1. Class 1. "Slope Protection"
   - (a) Type A. Slopes 1:3 or flatter - Clay soils
   - (b) Type B. Slopes 1:3 or flatter - Sandy soils
   - (c) Type C Slopes steeper than 1:3 - Clay soils
   - (d) Type D Slopes steeper than 1:3 - Sandy soils
2. Class 2. "Flexible Channel Liner"
   - (a) Type E Short-term duration (Up to 2 years)
     Shear Stress ($t_d$) < 1 pound per square foot [psf] (48 Pa)
   - (b) Type F Short-term duration (Up to 2 years)
     Shear Stress ($t_d$) 1 to 2 psf (48 to 96 Pa)
   - (c) Type G Long-term duration (Longer than 2 years)
     Shear Stress ($t_d$) >2 to <5 psf (>96 to <239 Pa)
   - (d) Type H Long-term duration (Longer than 2 years)
     Shear Stress ($t_d$) ≥ 5 psf (≥ 239 Pa)

B. Fasteners

The fasteners shall conform to the recommendations of the manufacturer for the selected soil retention blanket.

## 605S.4 Construction Methods

A. General

The soil retention blanket shall conform to the class and type shown on the Drawings. The Contractor has the option of selecting an approved soil retention blanket conforming to the class and type shown on the Drawings which is included on the Approved Products List published by TxDoT/TTI Hydraulics and Erosion Control Laboratory.

B. Site Preparation:

Prior to placement of the soil retention blanket, the seedbed area to be covered shall be relatively free of all clods and rocks over 1 1/2 inches (37.5 mm) in maximum dimension and all sticks or other foreign matter that will prevent close contact of the preparation mat with the soil surface. The area shall be smooth and free of ruts and other depressions. If the prepared seedbed becomes crusted or eroded as a result of rain or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's own expense. After the area has been properly prepared, the blanket shall be laid out flat, even and smooth, without stretching or crimping the material.

C. Installation

The Soil Retention Blanket, whether installed as slope protection or as flexible channel liner in accordance with the TxDoT/TTI Approved Products List, shall be placed within 24 hours after seeding (Standard Specification Item No. 604S), sodding (Standard Specification Item No. 602S) or native grassland seeding and planting (Standard Specification Item No. 609S) erosion control operations have been completed, or as approved by the Engineer or designated representative. The soil retention blanket shall be installed and anchored in accordance with the Manufacturer's recommendations. The Contractor shall contact the Engineer or designated representative three (3) days prior to the installation of the soil retention blanket to allow for inspection of the installation by City of Austin personnel.

## 605S.5 Measurement

This work and acceptable material for "Soil Retention Blanket" will be measured by the square yard (square meter: 1 square meter is equal to 1.196 square yards) of surface area covered, complete in place.

## 605S.6 Payment

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit bid price for "Soil Retention Blanket" of the class shown on the Drawings or approved by the Engineer or designated representative. The unit price shall include full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work. Anchors, checks, terminal and wire staples will not be paid for directly, but will be included in the unit price bid for this specification item.

Payment will be made under the following:

**Pay Item No. 605S-A:** Soil Retention Blanket Class__; Type __- Per Square Yard.

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification 605S, "Soil Retention Blanket" |

City of Austin Standard Specification Items

| Designation | Description |
|---|---|
| Item No. 602S | Sodding for Erosion Control |
| Item No. 604S | Seeding for Erosion Control |
| Item No. 609S | Native Grassland Seeding and Planting for Erosion Control |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|

City of Austin Standard Specification Items

| Designation | Description |
|---|---|
| Item No. 101S | Preparing Right of Way |
| Item No. 102S | Clearing and Grubbing |
| Item No. 111S | Excavation |
| Item No. 120S | Channel Excavation |
| Item No. 132S | Embankment |
| Item No. 606S | Fertilizer |
| Item No. 608S | Planting |
| Item No. 610S | Preservation of Trees and Other Vegetation |

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. 162 | Sodding for Erosion Control |
| Item No. 164 | Seeding for Erosion Control |
| Item No. 166 | Fertilizer |
| Item No. 168 | Vegetative Watering |
| Item No. 169 | Soil Retention Blanket |
| Item No. 204 | Sprinkling |

**Item No. 609S**
**Native Grassland Seeding and Planting for Erosion Control**

## 609S.1 Description

This item shall govern the preparation of a seeding and planting area to the lines and grades indicated on the Drawings. This may include seedbed preparation, sowing of seeds, planting of rooted plants, watering, hydromulch, compost and other management practices, as indicated in 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 with SI units shown within parentheses.

## 609S.2 Submittals

The submittal requirements for this specification item shall include:

A. For seed, provide Identification of the species, source, mixture and pure live seed (PLS) of the seed as listed on each seed bag to be used. Copies of the analysis tags and certification tags from all seed bags shall be submitted.

B. Type of mulch or compost.

C. Watering frequency and amount as shown on an irrigation watering schedule.

D. Type of management practices (e.g., hand weeding, pesticide application, etc.) proposed, with a proposed schedule for observation and treatment.

E. For hydromulch applications, the proposed application rate of seed, type of mulch and tacking agent, and other relevant information. An example of the required documentation is in Table 1.

F. Type of hydraulic seeding equipment and nozzles proposed for use.

G. If pesticide use is proposed, an IPM plan for pest control including pesticide label, proposed application rate and timing, and MSDS sheets.

H. One gallon sample of proposed mulch or compost.

I. The following submittal items are required before Substantial Completion.

   A. For hydromulch applications, submit the complete hydromulch application log, including date, time and quantity of product units placed in the slurry tank. An example of an application log is in Table 2.

   B. Pesticide and fertilizer application tracking log. As of January 1, 2012, documentation of all outdoor pesticide and fertilized use on city-owned properties is required to demonstrate compliance with the EPA/TCEQ mandated Municipal Stormwater Permit, the TPDES General Pesticide Permit, City Code, and the IPM program.

Table 1: Example of proposed hydromulch application rates

| | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|
| Hydro Mix | Sheet No. | SEC | Acres | Seed (Bags/ac | Tackifier (Buckets/ac) | Mulch (Bales/ac) | Fertilizer (Bags/ac) | Addl. Amendment (Bags/ac) |
| 1 | L2 | A | 1.0 | 1 | 100 | 1000 | 50 | 5 |
| 2 | L3 | A | 0.5 | 2 | 200 | 1500 | 50 | 5 |
| 3 | L5 | B | 3.0 | 3 | 300 | 3000 | 50 | 5 |

Table 2: Example of hydromulch application log

| | | | | | | Hydro Slurry Unit (per acre rates) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Date | Start time | Finish time | ac/ Tank | Water (gal) | Seed Mix | Seed (Bags /ac) | Tackifier (Buckets /ac) | Mulch (Bales /ac) | Fertilizer (Bags /ac) | Addl. Amendment (Bags/ac) |
| 4/13 | 10:30 | 11:15 | 1.0 | 3300 | A | 1 | 100 | 1000 | 50 | 5 |
| 4/17 | 2:00 | 2:30 | 0.5 | 3300 | A | 2 | 200 | 1500 | 50 | 5 |
| 5/20 | 8:30 | 10:00 | 1.2 | 3300 | B | 3 | 300 | 3000 | 50 | 5 |

**609S.3. Materials**

A. Seed
All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing PLS, name and type of seed, and all other required elements of the Analysis and Certification Tags. The seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within 12 months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers, unless a specific mix is proposed for use. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Landscape Architect, Engineer or designated representative.

The amount of seed planted per square yard (.84 square meters) or acre (hectare) shall be of the type specified in section 609S.5.

B. Water. Water shall be clean and free of industrial wastes and other substances harmful to the growth of plant materials in the area irrigated.

C. Topsoil. Topsoil shall conform to Standard Specification Item No. 601S.3(A)

D. Pesticide. A least toxic, integrated pest management (IPM) approach shall be used to control weeds. A written request for approval of weed control product(s) and/or materials shall be submitted to the City of Austin Watershed Protection

Department (ERM), IPM program coordinator for approval. Additional information can be found at http:/www.austintexas.gov/ipm.

E. Fertilizer. If fertilizer use is deemed necessary, the fertilizer shall conform to Standard Specification Item No. 606S, "Fertilizer." The type and rate of fertilizer should be based on chemical tests of recent (no older than 6 months before application) representative site soil samples. Fertilizer should be applied only when plants can take them up for growth, during:

1) seed germination and plant establishment and
2) after plant establishment.

Fertilizer shall not be applied within 48 hours of a potential rain event.

F. Tackifier. The tacking agent shall be a biodegradable material approved by the Landscape Architect, Engineer, or designated representative.

G. Mulch. Mulch may be used to help prevent soil erosion until preferred plant establishment, whether the mulch be hydraulically applied or shredded vegetative matter. Hydromulching for temporary and permanent vegetation stabilization shall conform to Environmental Criteria Section 1.4.7.

H. Hydroseeding Equipment. Hydroseeding equipment shall be clean and free of all previous seeds, fertilizer, mulch, or any hydroseeding products used on prior jobs.

I. Rooted Plants. Where proposed, rooted plants shall conform to the requirements of Standard Specification 608S, Planting.

## 609S.4 Construction Methods

A. General.

The Contractor shall limit preparation to areas that will be seeded/planted immediately. All weedy species (Table 3) shall be controlled by application of a herbicide and/or by physical removal (by the roots) prior to, during the planting operation, and through establishment. The specified weedy species shall be maintained at ten (10) percent or less of total cover after seeding. Additionally, the Landscape Architect, Engineer, or qualified landscape professional may require removal of any plant species that appears to be out-competing seeded or planted species during construction or the establishment period.

Seeds and fruits of non-native woody invasive species should be separated from the rest of the removed plants before mulching or hauling off the material. It must be bagged and disposed of in a landfill to prevent unintentional reintroduction to the site or elsewhere.

Table 3: Weed List

| Weed Type | Botanical Name | Common Name |
|---|---|---|
| Summer Annual Herb | Ambrosia spp. | Ragweed |
| Perennial Grass | Bothriochloa ischaemum | K.R. Bluestem |
| Annual Grass | Cenchrus spp. | Sandbur |
| Herb | Cnidoscolus texanus | Bull Nettle |
| Perennial Grass | Sorghum halapense | Johnson Grass |
| Perennial Grass | Arundo donax | Giant Cane |
| Perennial Grass | Phllostachys aurea | Golden Bamboo |
| Vine | Toxicodendron radicans | Poison Ivy |
| Herb | Urtica spp. | Stinging Nettle |
| Winter Annual Herb | Rapistrum rugosum | Bastard Cabbage |
| Winter Annual Grass | Bromus arvensis | Japanese Brome |
| Winter Annual Grass | Lolium multiflorum | Annual Ryegrass |
| Tree | Triadica sebifera | Chinese Tallow |
| Tree | Ligustrum sp. | Privet |
| Tree | Melia azedarach | Chinaberry |
| Tree | Lonicera japonica | Japanese Honeysuckle |
| Shrub | Nandina domestica | Heavenly Bamboo |
| Shrub | Photinia sp. | Photinia |

B. Seed Bed Preparation.

After the designated seeding/planting areas have been rough graded, a suitable planting area shall be prepared. In areas where cut or fill is required, a minimum of 6 inches (150 mm) of topsoil (see Section 609S.3.C) shall be placed or use approved existing soil (that is not infested with invasive or noxious plant rootstock [e.g., *Arundo donax rhizomes*]) stockpiled over the entire planting area.

The topsoil or growing medium must be prepared so that compaction is appropriate for plant growth, and to achieve acceptable bulk density or hydrologic function. Ripper and subsoilers may be used to loosen compacted soil and roughen the surface. Disks, plows and excavator attachments are good for compaction reduction, roughening, and for incorporating amendments. If tracked machinery is used in seedbed preparation, cleat marks should run with the contour to prevent rills.

In areas with no soil disturbance, the weeds shall be eliminated and a minimum of 6 inches (150 mm) of topsoil, if none currently exists, shall be placed. The seedbed shall be prepared with limited irregularities, lumps or soil clods and the surface shall be raked or rolled to facilitate seed to soil contact.

Water shall be gently applied as required to prepare the seedbed before the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements hereinafter described.

C. Watering

All watering shall comply with City Code Chapter 6-4 (Water Conservation). Water the seeded/planted areas immediately after installation to achieve germination and a healthy stand of native plants that can ultimately survive without supplemental water.

Apply the water uniformly to the planted areas without causing displacement or erosion of the materials or soil.

Watering applications shall insure that the plantbed is maintained in a moist condition favorable for the growth of plant materials. Watering shall continue until minimum coverage is achieved and accepted by the Landscape Architect, Engineer or designated representative.

Watering may be postponed immediately after a half inch (12.5 mm) or greater rainfall on the site but shall be resumed before the soil dries out.

D. Cool Season Cover Crop.

From September 15 to March 1, non-native and native seeding shall include a cool season cover crop at the rate specified in Tables 4, 5, or 6. Cool season cover crops are not permanent erosion control. If installed separately from the proposed seed mix, the cool season cover crops shall be mowed to a height of less than one (1) inch after March 1, and the area shall be re-seeded at the specified seeding rate for native warm-season species (March 1 to September 15).

**609S.5 Native Grassland Seeding and Planting**

Seeding and planting shall be performed in accordance with the requirements described below. The optimum depth for seeding shall be 1/4 inch (6 millimeters). Seed shall be applied by a method that achieves consistent distribution across a site and proper seed to soil contact (i.e. hand broadcasting, hydromulch, or drill method).

Rooted plants should be strategically and thoughtfully placed on a site. They need not be installed at a consistent, regular pattern across the plantable area(s) of a site but can be clustered or placed irregularly. The goal is to place the rooted plants where they will have the greatest or best effect or impact, and where there is sufficient space (e.g., root space, space off of utilities) and proper conditions (e.g., soil depth, moisture, light) for their long-term success. Installation of rooted plants shall comply with Standard Specification 608S, but rooted plants must not be spaced closer than three-feet (3') on center. Mulching around seed and rooted plants is not required, but it is a good technique for protecting plants

during germination and establishment. Figure 609S.5-1 is an example of rooted plant layout on a hypothetical site.

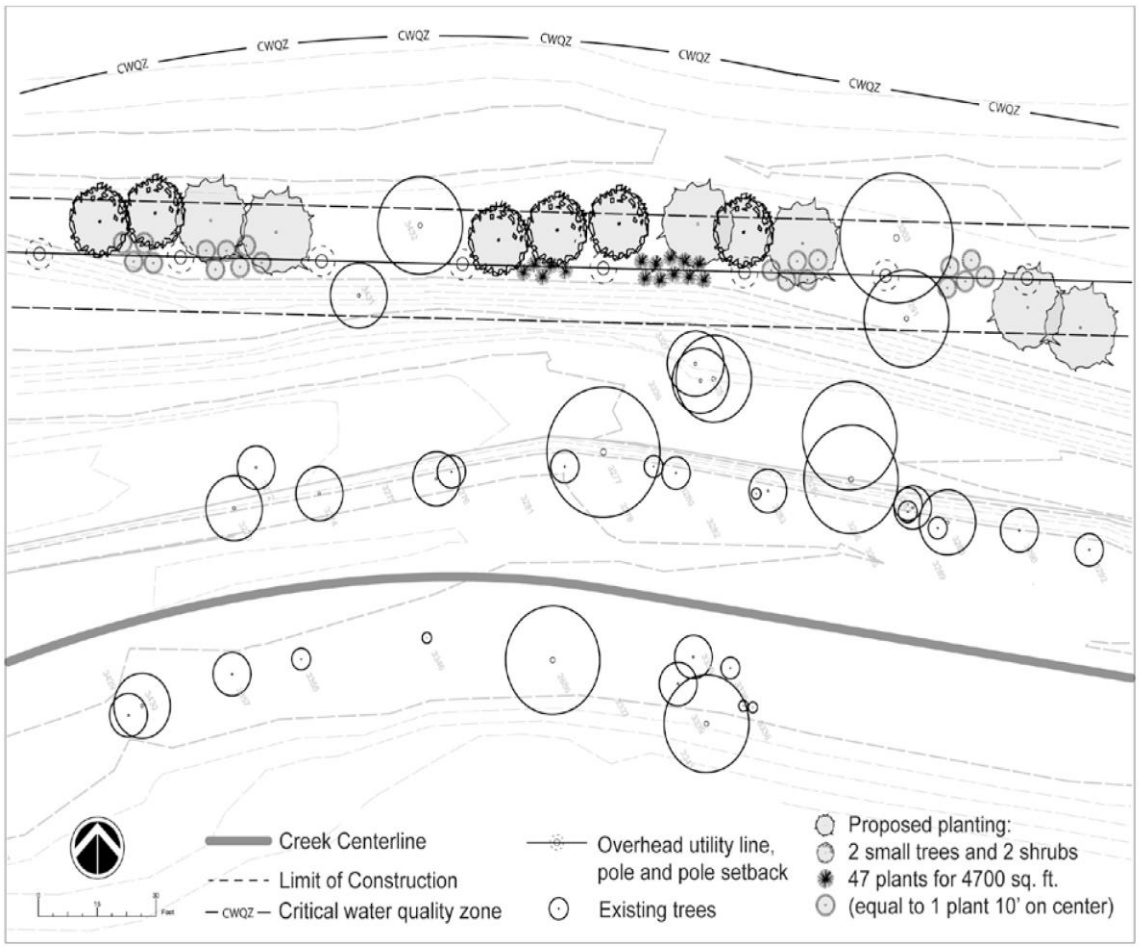


Figure 609S.5-1: Example of Rooted Plant Layout and Calculation

Rooted Plants such as trees, ornamentals, and shrubs are prohibited from being installed within fifteen (15) feet of any Austin Water Utility (AWU) infrastructure and/or within any easement dedicated for AWU infrastructure. Rooted plants such as grasses, succulents and/or ground cover are permitted within fifteen (15) of any AWU infrastructure and/or within any easement dedicated for AWU infrastructure.

Species substitution, when necessary due to availability, shall be approved by City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. Only native or adapted species suitable for the designated environmental conditions shall be allowed as substitutes. Shorter growing natives such as Buffalograss should be sodded around manholes or other structures requiring higher visibility for access.

If the plant materials are being installed during the cool season (September 15 to March 1), a cool season cover crop species (as listed below) shall be included in the seed mix or installed separately.

The seed and rooted plant mixtures shall be applied in accordance with appropriate growing environments (Upland Full Sun-Table 4, Upland Shade-Dappled-Table 5 and Facultative Moderate to High Moisture-Table 6). Grasses shall constitute 67 percent of the seed mix, with forbs comprising 33 percent. No species shall constitute more than 20% of a seed mix.

Table 4. Upland Species, Full Sun Areas

| Type | Common Name | Botanical Name | Recommended Application rate lbs/ac (kg/ha) | Rooted Plants Species, Diversity, Quantity & Size |
|---|---|---|---|---|
| Grass Seed Mix** | Buffalograss | Buchloe dactyloides | 24.0 (27.0) | A minimum of two (2) native species of small or large trees, and two (2) native species of shrubs with Very Low or Low (VL or L) water needs and Sun or Sun/Part Shade light needs as listed in the current Grow Green Native and Adapted Landscape Plants guidance document***. Plants must be a minimum size of 1-gallon (see Table 8, equivalency chart) and minimum of 1 plant per 100 square feet. |
| | Blue Grama | Bouteloua gracilis | 10.0 (11.2) | |
| | Green Sprangletop | Leptochloa dubia | 2.0 (2.2) | |
| | Sand Dropseed | Sporobolus cryptandrus | 1.0 (1.1) | |
| | Galleta | Pleuraphis jamesii | 10.0 (11.2) | |
| | Canada Wild Rye | Elymus canadensis | 10.0 (11.2) | |
| | Purple Threeawn | Aristida purpurea | 4.0 (4.5) | |
| | Sideoats Grama | Bouteloua curtipendula | 7.0 (7.8) | |
| Forb Seed Mix** | Bluebonnet | Lupinus texensis | 20.0 (22.4) | |
| | Purple Prairie Clover | Dalea purpurea | 4.0 (4.5) | |
| | Plains Coreopsis | Coreopsis tinctoria | 2.0 (2.2) | |
| | Partridge Pea | Chamaecrista fasciculata | 20.0 (22.4) | |
| | Greenthread | Thelesperma filifolium | 6.0 (6.7) | |
| | Indian Blanket | Gaillardia pulchella | 10.0 (11.2) | |
| | Lemon Mint | Monarda citriodora | 3.0 (3.4) | |

| | | | | |
|---|---|---|---|---|
| | Mexican Hat | Ratibida columnaris | 2.0 (2.2) | |
| | Pink Evening Primrose | Oenethera speciosa | 1.0 (1.1) | |
| | Sunflower (Common) | Helianthus annuus | 5.0 (5.6) | |
| | Milkweed (Antelope Horn or Green milkweed) | Asclepias asperula or Asclepias viridis | 0.1 (0.04) | |
| Total<br>Total recommended seed mix application rate is 35 lbs/ac (23.5 lbs/ac grass, 11.5 lbs/ac forbs). | | | | |
| Cool Season Cover Grasses | Cereal rye grain* | Secale cereale | 34.0 (38.1) | Add at least one of the cool season grasses to the warm-season mix between September 15 and March 1. |
| | Oats* | Avena sativa | 4.0 (4.5) | |
| | Western Wheatgrass* | Pascopyrum smithii | 5.6 (6.3) | |

* Plant only between. September 15 to March 1. Non-persistent winter cover crop for erosion control. Only one cool season species is required per installation.

** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by an authorized City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. The total pounds/acre (lbs/ac) of the proposed seed mix can be calculated based on the desired percentage of each seed in a mix.

*** www.austintexas.gov/department/grow-green/plant-guide

Table 5. Upland Species, Shade-Dappled Light Areas

| Type | Common Name | Botanical Name | Recommended Application rate lbs/ac (kg/ha) | Rooted Plants Species, Diversity, Quantity & Size |
|---|---|---|---|---|
| Grass Seed Mix*** | Inland Seaoats** | Chasmanthium latifolium | 12.0 (13.5) | A minimum of two (2) native species of small or large trees, and two (2) native species of shrubs with very low (VL), low (L), or low- medium (L-M) water |
| | Canada Wildrye | Elymus canadensis | 10.0 (11.2) | |
| | Sideoats Grama | Bouteloua curtipendula | 7.0 (7.8) | |

| | | | | |
|---|---|---|---|---|
| Forb Seed Mix*** | Purple Coneflower | Echinacea purpurea | 10.0 (11.2) | needs and Sun /Part Shade light needs as listed in the current Grow Green Native and Adapted Landscape Plants guidance document****. Plants must be a minimum size of 1-gallon (see Table 8, equivalency chart) and minimum of 1 plant per 100 square feet. |
| | Lanceleaf Coreopsis | Coreopsis lanceolata | 10.0 (11.2) | |
| | Scarlet Sage | Salvia coccinea | 8.0 (9.0) | |
| | Drummond Phlox | Phlox drummondii | 8.0 (9.0) | |
| | Black-Eyed Susan | Rudbeckia hirta | 2.0 (2.2) | |
| | Cutleaf Daisy | Engelmannia pinnatifida | 18.0 (20.2) | |
| | Tall Aster | Aster praealtus | 1.0 (1.1) | |
| | Illinois bundleflower | Desmanthus illinoensis | 15.0 (16.8) | |
| | Standing cypress | Ipomopsis rubra | 6.0 (6.7) | |
| | Winecup | Callirhoe involucrata | 5 (5.6) | |
| | Milkweed (Butterfly Weed or Showy Milkweed) | Asclepias tuberosa or Asclepias speciosa | 0.1 (0.04) | |
| Total<br>Total recommended seed mix application rate is 35 lbs/ac (23.5 lbs/ac grass, 11.5 lbs/ac forbs). | | | | |
| Cool Season Cover Grasses | Cereal rye grain*** | Secale cereale | 34.0 (38.1) | Add at least one of the cool season grasses to the warm-season mix between September 15 and March 1. |
| | Oats*** | Avena sativa | 4.0 (4.5) | |
| | Western Wheatgrass*** | Pascopyrum smithii | 5.6 (6.3) | |

** If unavailable replace with Prairie Wild Rye.

*** Plant only between September 15 to March 1. Non-persistent winter cover crop for erosion control. Only one cool-season species is required per installation.

**** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by an authorized City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. The total pounds/acre (lbs/ac) of the proposed seed mix shall be calculated based on the desired percentage of each seed in a mix.

**** www.austintexas.gov/department/grow-green/plant-guide

Table 6. Facultative Species, Moderate - High Moisture Areas

| Type | Common Name | Botanical Name | Recommended Application rate lbs/ac (kg/ha) | Rooted Plants Species, Diversity, Quantity & Size |
|---|---|---|---|---|
| Grass Seed Mix** | Big Bluestem | Andropogon gerardii | 8.0 (9.0) | A minimum of two (2) native species of small or large trees, and two (2) native species of shrubs with low (L), low-medium (L-M), or medium (M) water needs and Sun/Part Shade or Shade light needs as listed in the current Grow Green Native and Adapted Landscape Plants guidance document***. Plants must be a minimum size of 1-gallon (see Table 8, equivalency chart) and minimum of 1 plant per 100 square feet. |
| | Big Muhuly (Lindhiemers) | Muhlenbergia lindheimeri | 6.0 (6.7) | |
| | Bushy Bluestem | Andropogon glomeratus | 6.0 (6.7) | |
| | Eastern Gamagrass | Tripsacum dactyloides | 12.0 (13.5) | |
| | Indiangrass | Sorghastrum nutans | 6.0 (6.7) | |
| | Inland Seaoats | Chasmanthium latifolium | 12.0 (13.5) | |
| | Canada Wildrye | Elymus canadensis | 10.0 (11.2) | |
| | Sand Lovegrass | Eragrostis trichodes | 2.0 (2.2) | |
| | Switchgrass | Panicum virgatum | 4.0 (4.5) | |
| Forb Seed Mix** | Black-Eyed Susan | Rudbeckia hirta | 2.0 (2.2) | |
| | Illinois Bundleflower | Desmanthus illinoensis | 15.0 (16.8) | |
| | Purple Prairie Clover | Dalea purpurea | 4.0 (4.5) | |
| | Clasping Coneflower | Dracopis amplexicaulis | 3.0 (3.4) | |
| | Plains Coreopsis | Coreopsis tinctoira | 2.0 (2.2) | |
| | Goldenrod | Solidago altissima | 1.0 (1.1) | |
| | Lazy Daisy | Aphanostephus sp. | 1.0 (1.1) | |
| | Lemon Mint | Monarda citriodora | 3.0 (3.4) | |
| | Sunflower (Common) | Helianthus annuus | 5.0 (5.6) | |
| | Sunflower (Maximilian) | Helianthus maximiliana | 4.0 (4.5) | |

| | | | | |
|---|---|---|---|---|
| | Milkweed (common or Butterfly Milkweed) | Asclepias syriaca or Asclepia tuberosa | 0.1 (0.04) | |
| Total<br>Total recommended seed mix application rate is 26.0 lbs/ac (17.0 lbs/ac grass, 9.0 lbs/ac forbs). | | | | |
| Cool Season Cover Grasses | Cereal rye grain* | Secale cereale | 34.0 (38.1) | Add at least one of the cool season grasses to the warm-season mix between September 15 and March 1. |
| | Oats* | Avena sativa | 4.0 (4.5) | |
| | Western Wheatgrass* | Pascopyrum smithii | 5.6 (6.3) | |

* Plant only between September 15 to March 1. Non-persistent winter cover crop for erosion control.

** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by an authorized City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. The total pounds/acre (lbs/ac) of the proposed seed mix can be calculated based on the desired percentage of each seed in a mix.

*** www.austintexas.gov/department/grow-green/plant-guide

Table 7. Rooted Plant Size Equivalents

| Potential Substitute | | Equivalent To | |
|---|---|---|---|
| Quantity | Plant Size | Quantity | Plant Size |
| 1 | 5-gallon | 4 | One-gallon |
| 1 | Two- or Three-gallon | 2 | One-gallon |
| 4 | 4" pots or quarts | 1 | One-gallon |
| 8 | Plugs, live roots, saplings | 1 | One-gallon |

Table 8. Seed Rate Calculation

Multiple species native seed mixes require careful calculations to ensure proper planting rates. The example below is for illustrative purposes only.

| Species | Seeding Rate (lbs/ac) | Desired proportion of a species in the total mix (%) | Total quantity of seed in mix (lbs/ac) |
|---|---|---|---|
| Grass 1 | 7 | .20 | 1.40 |
| Grass 2 | 2 | .20 | 0.40 |

| Species | Seeding Rate (lbs/ac) | Desired proportion of a species in the total mix (%) | Total quantity of seed in mix (lbs/ac) |
|---|---|---|---|
| Grass 3 | 24 | .20 | 4.80 |
| Forb 1 | 10 | .20 | 2.00 |
| Forb 2 | 8 | .20 | 1.60 |
| TOTALS | - - | 1.0 (100%) | 10.2 |

Table 9. Seed Calculation Worksheet

The amount of seed needed to be planted on a project shall be calculated before installation to ensure adequate seed is placed, and provided as a submittal. Table 9 is an example worksheet, followed by an example calculation. Information for calculation can be obtained from seed tags or the supplier.

| Plant Group | Desired Seeding Rate (lbs/ac) | PLS (pure live seed) | Bulk Rate (lbs/ac) | Seeding Area (ac) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | | | | | |
| Forbs | | | | | |
| TOTAL | | | | | |

FORMULAS:

PLS (pure live seed) = (Purity × Germination) × 100. Can also use average PLS from seed tags.

Bulk Rate (lbs/ac) =Desired Seed Rate (lbs/ac)/PLS

Amt. of Seed to be Installed (lbs) = Bulk Rate (lbs/ac) × Seeding Area (ac)

Example:

| Plant Group | Desired Seeding Rate (lbs/ac) | PLS [pure live seed] (% decimal) | Bulk Rate (lbs/ac) | Seeding Area (ac) | Amt. of Seed to be Installed (lbs) |
|---|---|---|---|---|---|
| Grasses | 131.00 | 0.81 | 161.73 | 1.50* | 242.60 |
| Forbs | 65.34 | 0.87 | 75.10 | 1.50* | 112.70 |
| TOTAL | 196.34 | 0.84 (ave.) | 236.83 | 1.50 | 355.30 |

*Applied over the same 1.5 ac area.

**609S.6 Management Practices**

Management Practices include (1) weed management (pesticide application or mechanical removal) to so than 90 percent of the revegetation area is free of weeds listed in Table 3, (2) reseeding areas of poor germination to achieve coverage and height per 609S.8, with no bare areas greater than 10 s.f., and (3) replacement and replanting of rooted plants per 608S.5(O) [Plant Material Removal and Replacement] and 608S.7 (Acceptability of Plants).

Weeds, as defined in the Weed List (Table 3), shall be controlled in the most efficient manner possible. The timing of weed control may occur prior to soil disturbance, just before the installation of seed, and/or during the period of plant establishment. Weed control shall be introduced at one or all of these times, so that the greatest control is achieved. The preferred method of control is to remove weeds, either by physical or mechanical means, when the site is conducive (e.g. when the ground is moist) to this approach.

The entire root system of perennial weeds shall be removed to prevent re-sprouting. Table 9 provides management practices for woody invasive vegetation. Weeds may be controlled with an approved contact, systemic herbicide, provided the product is used with appropriate care and is applied in accordance with label instructions and the following guidelines:

1. Herbicide shall not be applied when the wind is greater than 8 mph (12.9 kph),
2. Herbicide shall not be applied when rainfall is expected within 24 hours,
3. Herbicide shall not contact surface water, i.e. creeks, rivers, and lakes,
4. Herbicide shall not contact desirable vegetation (a wicking method shall be used, if necessary, to accurately contact target weed only during application).

Table 10. Management Practices for Woody Invasive Vegetation

| Before Seeding | |
|---|---|
| Stems ≤1 inch | Pull with weed wrench |
| Stems >1 inch | Cut at base and spray stump with appropriate herbicide within five minutes. Bag and dispose of seeds and fruit in landfill. |
| After Seeding | |
| Seedlings | Hand pull |
| Sprouts | Foliar application of appropriate herbicide |

The Landscape Architect, Engineer or designated representative shall be consulted to determine appropriate weed control management when weeds are located in an environmentally sensitive location (e.g. near water or adjacent to a critical environmental feature).

**609S.7 - Reseeding/Replanting**

At locations that fail to show an acceptable stand of planting for any reason during the initial seeding, repair and/or reseed, replant locations as determined by the Landscape Architect, Engineer or designated representative. A successful stand of grasses and forbs should exhibit the following:

- Seedlings with vigorous green foliage;
- Green leaves remaining throughout the summer, at least at the plant bases;
- Uniform density, with grasses and/or forbs well intermixed;
- Minimum of 95% cover; and
- No patches of exposed soil greater than 10 s.f. in aerial extent.

The Owner or designated representative will inspect the seeding/planting during April of the calendar year following the year of initial seeding/planting and determine the necessity and extent of over seeding reseeding, or replanting required. Contractor shall ideally complete any required reseeding/replanting before May 15 of that year. This date may be extended if, in the opinion of the Owner and qualified landscape professional, the weather conditions before May 15 are not suitable for reseeding work. If the timing is bad, an annual cover crop can be over-seeded in a deficient area to temporarily provide coverage until a suitable time for seeding or planting perennial seed or rooted plants. If vegetation fails to grow and thrive, the soil must be tested to determine whether nutrient imbalances are responsible and, if so, an appropriate course of nutrient remediation (e.g., fertilizers, composts, topsoils, or other organic amendments) as recommended by a landscape professional must be implemented by the Contractor.

The Contractor shall meet the requirements for initial seeding and planting, including seeding method, seed mix, application rates, and slope texturing as applicable, unless otherwise agreed to in writing by the Owner and/or City staff. Corrected deficiencies will be re-inspected and approved by the Owner and designated representative, and final acceptance will be granted only upon satisfactory completion.

**609S.8 Measurement**

Work and acceptable material for Native Seed and Planting for Restoration will be measured by the square yard (square meter: 1 square meter equals 1.196 square yards) or by the acre (hectare: 1 hectare equals 2.471 acres), complete in place, so that all areas of a site that rely on vegetation for stability must be uniformly vegetated with a minimum of 95 percent total coverage with no bare areas exceeding 10 square feet (1.5 square meters) and a 1½ inch tall (40 millimeters) successful stand of plant materials. Ninety (90) percent of the overall planted area must be free of weeds listed in Table 3. Bare areas shall be re-prepared and reseeded as required by the Landscape Architect, Engineer or designated representative to develop an acceptable stand of vegetation.

**609S.9 Payment**

The work performed and materials furnished and measured will be paid for at the unit bid price for Native Grasslands and Planting For Restoration of the method specified on the Drawings.

The unit bid price shall include full compensation for furnishing all materials, including all topsoil, water, seed, or fertilizer or mulch and for performing all operations necessary to complete the work.

Payment will be made under one or more of the following pay items:

| | | |
|---|---|---|
| **Pay Item No. 609S-A**: | Topsoil and Seedbed Preparation | Per Square Yard. |
| **Pay Item No. 609S-B:** | Topsoil and Seedbed Preparation | Per Acre. |
| **Pay Item No. 609S-C:** | Native Seeding | Per Square Yard. |
| **Pay Item No. 609S-D:** | Native Seeding | Per Acre. |
| **Pay Item No. 609S-E:** | Rooted Plants | Per each. |
| **Pay Item No. 609S-F:** | Watering | Per 1,000 Gallons (Kgal). |
| **Pay Item No. 609S-G:** | Management Practices | Per Square Yard. |
| **Pay Item No. 609S-H:** | Management Practices | Per Acre. |

**End**

| ***SPECIFIC* CROSS REFERENCE MATERIALS** |
|---|
| Specification Item 609S "Native Grassland Seeding and Planting for Erosion Control" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 130S | Borrow |
| Item No. 601S | Salvaging and Placing Topsoil |
| Item No. 606S | Fertilizer |

City of Austin Land Development Code

| Designation | Description |
|---|---|
| Section 6-4 | Water Conversation |

| ***RELATED* CROSS REFERENCE MATERIALS** |
|---|
| Specification Item 609S “Native Grassland Seeding and Planting for Erosion Control” |

| Designation | Description |
|---|---|
| Item No. 602S | Sodding for Erosion Control |
| Item No. 604S | Seeding (Non-Native) for Erosion Control |
| Item No. 605S | Soil Retention Blanket |
| Item No. 607S | Slope Stabilization |
| Item No. 608S | Planting |

City of Austin Standards (Details)

| Standard No. | Description |
|---|---|
| 627S-1 | Grass Lined Swale |
| 62S7-2 | Grass Lined Swale W/ Stone Center |
| 633S-1 | Landgrading |

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

| Designation | Description |
|---|---|
| Item No. 160 | Furnishing and Placing Topsoil |
| Item No. 162 | Sodding for Erosion Control |
| Item No. 164 | Seeding for Erosion Control |
| Item No. 166 | Fertilizer |

| | |
|---|---|
| Item No. 168 | Vegetative Watering |
| Item No. 169 | Soil Retention Blanket |
| Item No. 180 | Wildflower Seeding |
| Item No. 192 | Roadside Planting and Establishment |

**Item No. 610S**
**Preservation of Trees and Other Vegetation**

## 610S.1 - Description and Definitions

This item shall govern the proper care, protection and treatment of trees and other vegetation in the vicinity of the permitted development activity (as defined in Land Development Code 25-1-21(27)). All work shall be performed in accordance with the City approved drawings and specifications (e.g. Standard Series 600) or as approved by the City Arborist (as defined below). Tree pruning and/or treatments shall be performed under the direct supervision of a qualified arborist (as defined below) or as allowed by the City Arborist.

Definitions

City Arborist - City official designated by the Director of the Planning and Development Review Department (Land Development Code 25-8-603) or as designated by the City Arborist.

Oak wilt - a tree disease caused by a fungus "Ceratocystis fagacearum" that infects the vascular system of Oak "genus Quercus" trees and prevents water transport through the trunk and canopy of the tree. This usually fatal tree disease can be spread by certain insects that come into contact with tree wounds or by interconnected tree roots. February through June is a high risk period due to the stage of the fungus and insect activity. See section 610S.4(H) for additional requirements for preventing Oak wilt infection.

Qualified Arborist - an individual engaged in the profession of arboriculture or closely related field who, through experience, education, and related training, possesses the competence to provide for, or supervise, the management of trees and other woody plants (as defined in the most current version of ANSI A300 (Part 1)-2001, section 4.1).

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.

## 610S.2 - Submittals

The following is a list of the minimum submittal requirements for this specification item shall include:

A. Identification of the location, type of protective fencing (i.e. A, B or C), materials of construction and installation details;

B. Qualified Arborist credentials (i.e. proof of certification from the International Society of Arboriculture, licenses, resume and/or references);

C. Type, location and construction details for proposed tree wells;

D. Location, type, materials of construction and installation details for permeable paving;

E. Proposed nutrient mix specifications and when required by the City Arborist, soil

and/or foliar analysis for fertilizer applications.

**610S.3 - Materials**

A. Protective Fencing and Signage

Protective fencing is designated as the materials used to protect the root zones of trees as illustrated in City of Austin Standard Detail 610S-1. Three basic types of protective fencing materials are allowed by the City of Austin. Type A and Type B are typical applications and shall be installed where damage potential to a tree root system is high, while Type C shall be installed where damage potential is minimal. The specific type of protective fencing for the work shall be as indicated on the drawings. Type C fence materials shall be subject to approval by the City Arborist. Type C fencing shall be replaced by Type A or Type B fencing as directed by the City Arborist if it fails to perform the necessary function.

1. Type A Chain Link fence (Typical Application-high potential damage)

   Type A protective fencing shall be installed in accordance with City of Austin Standard Details 610S-2 and 610S-4 and shall consist of a minimum five-foot (1.5 meters) high chain link fencing with tubular steel support poles or "T" posts.

2. Type B Wood Fence (Typical Application-high potential damage)

   Type B protective fencing shall be installed in accordance with City of Austin Standard Details 610S-3 and 610S-5 and shall consist of any vertical planking attached to 2x4-inch (50 x 100 mm) horizontal stringers which are supported by 2x4-inch (50 x 100 mm) intermediate vertical supports and a 4x4-inch (100 x 100 mm) at every fourth vertical support .

3. Type C Other Materials (Limited Application-minimal potential damage)

   The following materials may be permitted as alternates for limited or temporary applications (3 days or less) where tree damage potential is minimal (as determined by the City Arborist):

   (a) High visibility plastic construction fencing.

   The fabric shall be 4 feet (1.2 meters) in width and made of high density polyethylene resin, extruded and stretched to provide a highly visible international orange, non-fading fence. The fabric shall remain flexible from -60°F to 200°F (-16°C to 93°C) and shall be inert to most chemicals and acid. The fabric pattern may vary from diamond to circular with a minimum unit weight of 0.4 lbs./Ft. (0.6 kilograms per meter).

   The fabric shall have a 4 foot (1.2 meters) width minimum tensile yield strength (Horizontal) of 2000 psi [13.9 megaPascals], ultimate tensile strength of 2680 psi [18.5 megaPascals] (Horizontal) and a maximum opening no greater than 2 inches (50 mm).

   (b) Other approved equivalent restraining material.

   The fencing materials, identified in (a) and (b) above, shall be supported bysteel pipe, tee posts, U posts or 2″ × 4″ (50 mm x 100 mm) timber

posts that are a minimum of 5½ feet (1.68 meters) in height and spaced no more than 8 feet (2.44 meters) on centers. The fabric shall be secured to post by bands or wire ties.

4. Signage

A laminated sign, no smaller than 8.5 X 11 inches, shall be posted on each tree protective device, and at least every 100 linear feet on protective fencing, identifying the following information: Tree & Root Protection Zone, Per City of Austin code (Chapter 25-8, Subchapter B, Article 1) this protective device is to remain in place for the entirety of the development project and illegal removal is subject to fines and work suspensions. Additional information can be obtained at the City Arborist (512-974-1876) web site (http://www.ci.austin.tx.us/trees). Zona de Protección del Árbol y las Raíces: el dispositivo protector debe quedarse en el lugar para la totalidad del proyecto de la construcción. Para información adicional, contacta la Arborista Municipal (512) 974-1876 o http://www.ci.austin.tx.us/trees/trees_spanish.htm.

B. Trunk Protection (Limited Application)

When indicated on the drawings or directed by the City Arborist tree trunk protection shall be provided in accordance with City of Austin Standard Details 610S-4 and 610S-5. Tree trunk protection shall consist of any 2 x 4-inch (50 x 100 mm) or 2 x 6-inch (50 x 150 mm) planking or plastic strapping and shall be attached in a manner that does not damage the tree.

C. Tree Dressing

Wound treatments should not be used to cover wounds or pruning cuts, except when recommended for disease (see section 610S.4 (H)), insect, mistletoe, or sprout control (from ANSI A300 (Part 1)-2001, section 5.4.1).

D. Tree Wells for Raised Grades

When existing grades are raised by more than 4 inches (10.16 cm), the tree root system shall be protected by the installation of tree wells in accordance with City of Austin Standard Detail 610S-6. Native stone or non-toxic timber shall be used for the separator wall of the well and PVC conforming to ASTM D-2729, SDR-35 shall be used for the aeration systems in fill areas.

E. Permeable Paving (Environmental Criteria Manual Section 3.5.A.1)

Permeable segmented pavers in conjunction with PVC pipe aeration system or concrete on gravel base with cored holes shall be used to protect existing tree root zones when indicated on the drawings or directed by the City Arborist.

F. Fertilizer

Humate/nutrient solutions with mycorrhizae components or soil injection at recommended rates are to be used when appropriate. Construction which will be completed in less than 90 days may use materials at half the recommended rates. Alternative organic fertilizer materials are acceptable when approved by the City Arborist.

**610S.4 - Construction Methods**

A. Protective Fencing

All trees and shrubs in the proximity of the construction site shall be carefully checked for damage prior to initiation of the permitted development activity.

All individual or groups of trees, shrubs, and natural areas shown to be protected on the drawings or identified to be protected by the City Arborist, shall be protected during construction with temporary fencing as indicated on the drawings or as directed by the City Arborist.

Protective fences (section 610S.4.A) shall be installed prior to the start of any site preparation work (clearing, grubbing, or grading), and shall be maintained in functioning condition throughout all phases of the construction project.

Protective fence locations in close proximity to intersecting streets or drives shall adhere to the sight distance (Section 1.3.1.C.6) and desirable sight triangle (Figure 1-6 criteria found in the City of Austin Transportation Criteria Manual).

1. Protective fences shall be constructed at the locations (typically the outer limits of the critical root zone) and with materials indicated on the drawings to prevent the following (Environment Criteria Manual, Appendix P-2, Note 6):

   (a) Soil compaction in the root zone area resulting from vehicular traffic or storage of equipment or materials.

   (b) Critical root zone disturbances due to grade changes [greater than 4″ (10.16 cm) cut or fill] or trenching not reviewed and authorized by the City Arborist.

   (c) Damage to exposed roots, trunks or limbs by mechanical equipment.

   (d) Other activities detrimental to trees such as chemical storage, concrete truck cleaning, and fires.

2. Exceptions to the installation of protective fences at the tree drip lines may be permitted in the following cases:

   (a) Where there is to be an approved grade change, impermeable paving surface, tree well, or other such site development, the fence shall be erected no more than 2 feet (0.6 meters) beyond the area of disturbance unless approved by the City Arborist;

   (b) When permeable paving is to be installed within a tree's critical root zone, the fence shall be erected at the outer limits of the permeable paving area (prior to any site grading so that this enclosed area is graded separately to minimize root damage);

   (c) When trees are located close to a proposed building or other construction activity (Environment Criteria Manual, Appendix P-2, Note 6.c), the fence shall be erected up to 10 feet (3 meters) to allow work space between the fence and the structure. Apply organic mulch to a depth of 8 inches [30.48 cm] in the unprotected root zone area;

(d) When there are street-side pedestrian walkways, fences shall be constructed in a manner that does not obstruct safe passage;

(e) When there are severe space constraints due to tract size or other special requirements, the Contractor shall contact the City Arborist to discuss alternatives.

When any of the exceptions listed above will result in a fence being located closer than five (5) feet (1.5 meters) to a tree trunk, the Contractor shall also protect the trunk with strapped-on planking to a height of 8 feet [2.4 meters] (or to the limits of lower branching) in addition to the fencing requirement (City of Austin Standard Details 610S-4 and 610S-5).

B. Pruning and Repair of Damage

Tree pruning, to provide clearance for the work and/or to remove hazards, shall be performed under the direct supervision of a qualified arborist and shall follow standards identified in ANSI A300 (Part 1), "Pruning". A minimum clearance height of eight (8) feet (2.4 meters) above the street level must be provided and maintained for all existing trees if adjacent to a sidewalk. However, if the limbs of trees overhang the curb line or edge of travel lane of any street, a minimum clearance height of fourteen (14) feet (4.2 meters) is required (Transportation Criteria manual section 6.2.3,A, 4, "Clearance Height"). Pruning shall provide the minimum clearance needed to perform the work or remove a hazard unless otherwise directed by the City Arborist to comply with transportation criteria or to mitigate for damage.

If tree damage compromises a tree's structural integrity then the area shall be adequately secured until a qualified arborist makes an assessment of the tree and corrective actions are completed with approval from the City Arborist. Damage to oak trees shall be treated immediately, with consideration for site safety, to reduce the risk of Oak Wilt infection (See 610S.4.H, "Oak Wilt Prevention"). Tree root wounds shall be treated to remove loose, damaged tissue from in and around the wound or if necessary the root shall be cut cleanly and covered with topsoil, or other material approved by the City Arborist, to prevent drying of root tissue and to create a favorable environment for root sprouting. Trunk wounds shall also be treated to remove loose, damaged tissue around the wound. Tree canopy repairs shall be performed in accordance with the most current version of ANSI A300 (Part 1), "Pruning", to prevent further damage to the tree and to promote recovery of the tree to sound condition. The ANSI standard describes proper pruning methods for limb removal and for making finish pruning cuts.

Trees damaged or removed without prior approval or where minimum design criteria is exceeded due to failure to maintain approved tree protection shall be mitigated (Environmental Criteria Manual section 3.5.4, "Mitigation Measures") in accordance with Land Development Code Chapter 25-8, Subchapter B, Article 1.

All trees damaged during construction shall receive an application of fertilizer within the drip line conforming to Standard Specification Item No. 606S, "Fertilizer" at the rate of 4 pounds per caliper inch (.07 kilograms per caliper mm).

C. Cutting and Filling Around Trees

When the depth of an excavation or embankment exceeds 4 inches (10.16 cm)

within the critical root zone of any tree with a trunk diameter greater than 8 inches (200 mm), the City Arborist may require a tree well to be constructed per the City of Austin approved specifications and details (Section 610S.3.D and City of Austin Standard Detail 610S-6).

D. Paving Around Trees

Where new paving within the ½ critical root zone of any tree greater than a 8 inches (10.16 cm) diameter is approved, a permeable pavement and aeration system may be required by the City Arborist per the City of Austin Standard Detail (Section 610S.3.E, Environmental Criteria Manual Section 3.5.3.A.1 and Figure 3-8) must be installed as indicated on the Drawings, except for street construction.

E. Tree Removal

Tree removal shall comply with Land Development Code Chapter 25-8, Subchapter B, Article 1. An approved permit, or an approved site plan is required for removal of trees 8″ and larger (see Environmental Criteria manual section 3.3.2.A.2 and figure 3-1 for measurement standards) with additional requirements for City Parkland properties and for Hill Country Roadway Corridor sites. Trees 19 inches in diameter and greater are defined as protected trees and require specific review from the City Arborist to approve a permit or site plan for removal. In addition heritage trees require a more extensive evaluation by the City Arborist and may require rulings from boards and commissions.

All trees to be removed shall be performed in a manner that does not damage the canopies, trunks or root systems of remaining trees and that protects all existing facilities, improvements and vegetation. Removal of oak trees shall follow the Oak Wilt Prevention procedures per the City of Austin Standards (Section 610S.4,(H)). All tree material shall be removed from the site unless authorized by the City Arborist or if it will be used as wood chips or mulch.

When a tree or shrub is scheduled for removal, it shall be cut to a maximum depth of 12 inches (30.5 cm) below the surrounding grade (the tree(s) should be removed at grade, and with hand saws, in situations where other tree root systems are present which are to be preserved). When applicable, after tree removal, soil shall be placed in the hole to a depth matching the existing grade.

All damage resulting from tree removal or pruning shall be repaired at the Contractor's own expense and shall follow guidelines in this specification.

F. Final Cleanup

All temporary tree and shrub preservation and protection measures shall be removed when the construction has been completed and any mulch applications shall be removed or reduced to no more than 3 inches (7.62 cm) depth.

G. Root Zone Aeration and Fertilization

As a component of an effective remedial tree care program per Environmental Criteria Manual section 3.5.4, preserved trees within the limits of construction may require soil aeration and supplemental nutrients. Soil and/or foliar analysis should be used to determine the need for supplemental nutrients. The City Arborist may require these analyses as part of a comprehensive tree care plan. Soil pH shall be

considered when determining the fertilization composition as soil pH influences the tree's ability to uptake nutrients from the soil. If analyses indicate the need for supplemental nutrients, then humate/nutrient solutions with mycorrhizae components are highly recommended. In addition, soil analysis may be needed to determine if organic material or beneficial microorganisms are needed to improve soil health. Materials and methods are to be approved by the City Arborist (512-974-1876) prior to application. The owner or general contractor shall select a fertilization contractor and ensure coordination with the City Arborist.

Pre-construction treatment should be applied in the appropriate season; ideally the season preceding the proposed construction. Minimally, areas to be treated include the entire critical root zone of trees as depicted on the City approved plans. Treatment should include, but not limited to, fertilization, soil treatment, mulching, and proper pruning.

Post-construction treatment should occur during final revegetation or as determined by a qualified arborist after construction. Construction activities often result in a reduction in soil macro and micro pores and an increase in soil bulk density. To ameliorate the degraded soil conditions, aeration via water and/or air injected into the soil is needed or by other methods as approved by the City Arborist. The proposed nutrient mix specifications and soil and/or foliar analysis results need to be provided to and approved by the City Arborist prior to application (Fax # 512-974-3010). Construction which will be completed in less than 90 days may use materials at ½ recommended rates. Alternative organic fertilizer materials are acceptable when approved by the City Arborist. Within 7 days after fertilization is performed, the contractor shall provide documentation of the work performed to the City Arborist, Planning and Development Review Department. P.O. Box 1088, Austin, TX 78767. This note should be referenced as item #1 in the Sequence of Construction.

H. Oak Wilt Prevention Policy

1. Purpose and Scope

The purpose of this Oak Wilt Prevention Policy is to identify measures that city staff and city-hired contractors and their sub-contractors, who perform the services of removing or trimming trees, will take to prevent the spread of oak wilt.

2. Definitions

Oak Wilt Disease: A tree disease caused by the fungus, Ceratocystis fagacearum. The fungus infects the vascular system of a tree. The vascular system contains vessels which transport moisture throughout the tree. The vessels of an infected tree effectively become blocked by the infection of the fungus, and cannot transport adequate moisture to sustain a healthy or living tree. In most cases, the end result is tree mortality.

3. Prevention Policy

(a) Prior to beginning field work, all city staff associated with projects involving potential contact with oak trees shall be made aware of the city's official Oak Wilt Policy by receiving and reading a written copy of this policy. Staff receiving a written copy of the policy shall include, but not limited to, project managers, equipment operators responsible for

removing or trimming trees, or operators using heavy equipment which could cause wounding of susceptible oaks in the use of the equipment. In addition, individual city departments will provide a written copy of the Oak Wilt Policy to contractors participating in city projects in areas where oak trees are present before initiating field work.

(b) When possible, city staff and contractors should avoid trimming, pruning, or wounding Live Oaks and Red Oaks (Spanish, Shumard, Texas Red, and Blackjack oaks) from February through June.

(c) At all times and irrespective of limb size, all cuts and wounds to oak trees shall be dressed immediately using a non-phytotoxic tree wound dressing. Stump cuts and damaged roots (both above and below ground) shall also be dressed.

(d) Disinfection of pruning tools, saws, and related equipment is mandatory during the trimming or pruning of oak trees. Disinfection of tree removal and trimming equipment shall occur before work begins in a project area, between work in individual oak trees, and again prior to leaving a project area. Acceptable disinfectants include either aerosol disinfectant or a 10 percent bleach-water solution.

*NOTE: Although this policy would require the disinfection of pruning equipment before and between oak trees as a precaution, research does not substantiate disinfection as a means of preventing the transmission of the oak wilt disease.

4. Disposal Policy

(a) Chipping or shredding the wood from infected trees to use as mulch is an acceptable means of recycling the wood. Chipping or shredding allows the wood to dry out quickly, thereby killing the fungus.

(b) Burning diseased wood is an acceptable means of disposal. Burning diseased logs will kill the fungus, and the fungus will not spread with the smoke.

(c) Logs from diseased Red Oaks, that are not chipped, shredded, or burned shall be disposed of at a landfill.

(d) Firewood from diseased Red Oak trees shall not be stored near healthy trees where fungal spores or insects that carry the spores have the potential to spread the fungus to healthy trees. It is recommended to store oak firewood under a sheet of clear plastic, tightly sealing the edges of plastic with soil or bricks. Doing so will prevent any spore carrying beetles from escaping and will solarize and heat the stored firewood to speed the drying process. It is also recommended to use clear plastic, as black plastic will reveal any escape holes to the beetles.

(e) In situations where diseased Red Oak trees are identified and are not accessible for chipping, shredding, or removal, the trunk of the diseased tree should be girdled, and the stem treated with an appropriate herbicide to deaden the tree and hasten the desiccation and drying of the wood below the minimum moisture content that could support the development of fungal spores.

**610S.5 - Measurement**

Tree and shrub pruning, fencing, drains, fertilization, etc. will not be measured for payment unless included as a contract pay item. Tree wells for tree protection will be measured by the units, complete in place, conforming to the Drawings and City of Austin Standard Detail 610S-6, "Tree Protection, Tree Wells".

Removal of existing trees will be measured per each tree.

**610S.6 - Payment**

The work and materials prescribed herein with the exception of the Protective Fencing and Tree Well (Tree Protection) will not be paid for directly but shall be included in the unit price bid for the item of construction in which this activity is used, unless a payment item is included as a contract pay item.

Payment will be made under:

| | | |
|---|---|---|
| **Pay Item 610S-A:** | Protective Fencing Type A Chain Link fence (Typical Application-high damage potential) | Per Lineal Foot |
| **Pay Item 610S-B:** | Protective Fencing Type B Wood Fence (Typical Application-high damage potential) | Per Lineal Foot |
| **Pay Item 610S-C:** | Protective Fencing Type C Other Materials (Limited Application-minimal damage potential) | Per Lineal Foot |
| **Pay Item 610S-D:** | Tree Well (Tree Protection) | Per Each |
| **Pay Item 610S-E:** | Tree Trunk Protection (Wood Planking) | Per Each |
| **Pay Item 610S-R:** | Removal of Existing Trees | Per Each |

Source: Rule No. R161-18.24 , 12-7-2018.

**End**

SPECIFIC CROSS REFERENCE MATERIALS

Specification Item 610S, "Preservation of Trees and Other Vegetation"

**City of Austin Standard Specification Items**

| Designation | Description |
|---|---|
| **Item No. 606S** | Fertilizer |

**City of Austin Standard Details**

| Designation | Description |
|---|---|
| **Item No. 610S-1** | Tree Protection Fence Locations |
| **Item No. 610S-2** | Tree Protection Fence, Type A, Chainlink |
| **Item No. 610S-3** | Tree Protection Fence, Type B, Wood |
| **Item No. 610S-4** | Tree Protection Fence, Modified Type A, Chainlink |
| **Item No. 610S-5** | Tree Protection Fence, Modified Type B, Wood |
| **Item No. 610S-6** | Tree Protection, Tree Wells |

**City of Austin Transportation Criteria Manual**

| Designation | Description |
|---|---|
| **Section 1.3.1.C.6** | Sight Distance |
| **Section 6.2.3.A.4** | Clearance Height |
| **Figure 1-6** | Desirable Sight Triangle |

**City of Austin Environmental Criteria Manual**

| Designation | Description |
|---|---|
| **Appendix P-2, Note 6** | Exceptions to Installing Fences |
| **Appendix P-2, Note 6c** | Trees close to proposed buildings----- |
| **Appendix P-6** | Remedial Tree Care Notes |
| **Section 3.3.2.A.2** | Diameter of trees------ |
| **Section 3.5.0** | Design Criteria |
| **Section 3.5.3.A.1** | Permeable Paving |
| **Figure 3-8** | Example of Minimum Design Criteria Applied to Permeable Parking |

**City of Austin Land Development Code**

| **Designation** | Description |
|---|---|
| **Section 25-8-603** | Tree Protection Administration |
| **Section 25-8-623** | Inspection by City Arborist |

**ASTM, American Society for Testing and Materials**

| **Designation** | Description |
|---|---|
| **D-2729** | Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings |

***RELATED CROSS REFERENCE MATERIALS***

**Specification 610S, "Preservation of Trees and Other Vegetation"**

**City of Austin Standard Specification Items**

| **Designation** | Description |
|---|---|
| **Item No. 101S** | Preparing Right of Way |
| **Item No. 102S** | Clearing and Grubbing |
| **Item No. 111S** | Excavation |
| **Item No. 120S** | Channel Excavation |
| **Item No. 132S** | Embankment |
| **Item No. 608S** | Planting |

**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. 166** | Fertilizer |
| **Item No. 168** | Vegetative Watering |

**Item No. 628S**
**Sediment Containment Dikes**

## 628S.1 Description

This item shall govern the provision and placement of temporary filtration dikes along or across such areas as indicated on the Drawings. This method shall be used during construction only and its purpose shall be to temporarily control erosion by intercepting and retaining sediment.

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.

## 628S.2 Submittals

The submittal requirements for this specification item shall include:

A. Locations and Types of containment dikes (Hay Bales or Triangular Sediment Filter Dike).

B. Seeding

1. Identification of the type, source, mixture, pure live seed (PLS) and rate of application of the seeding.

2. Type of mulch.

3. Type of tacking agent.

4. Type and rate of application of fertilizer.

## 628S.3 Materials

A. Hay Bales

"Hay Bales" shall be free of Johnson Grass or other nocuous weeds. The bales shall consist of either hay or straw in good condition and be securely tied with wire. Stakes for anchoring bales shall be #4 (10M) reinforcing bars, 1/2 inch (12.5 mm) steel pickets, or 2 x 2 inch (50 x 50 mm) wooden stakes. Hay bales shall be limited to drainage areas less than 2,500 square feet (0.02 hectares).

B. Filter Dike

"Filter Dike" shall be prefabricated from 6x6-D2.9xD2.9 (150x150-MW19xMW19) WWF and 4.5 oz. (127 grams) non-woven polyester filter fabric securely fastened to WWF with galvanized shoat rings or j-clips. A 12-inch (300-mm) skirt shall be a continuous extension of the filter fabric on the upstream face.

The filter fabric shall extend beyond the dike joints to provide a 3-inch (75-mm) overlap. Ends of dike not lapped with filter fabric shall be plugged with filter fabric.

**628S.4 Construction Methods**

The Contractor may select the material for the dikes, unless otherwise indicated, conforming to the details on the Drawings and Standard Detail Numbers 628S and 628S-1.

Bales shall be placed with ends tightly abutting the adjacent bales. Each bale shall be embedded in the soil a minimum of 4 inches (100 mm) and a maximum of 6 inches (150 mm). Bales shall be securely anchored in place by a minimum of 2 stakes per bale. The first stake in each bale shall be angled toward the previously placed bale to force the bales together. Stakes shall be embedded in the soil a minimum of 1 1/2 feet (0.45 meters). Bales that are not able to be imbedded and are place on impervious cover should be placed level with the concrete and have all bales butted end to end with no voids or gaps between them. Bales shall be bound by either wire or nylon string. Bales shall be replaced every 2 months or more often during wet periods.

For filter dikes, the filters shall be placed with ends tightly abutting the adjacent filter. Each filter and skirt shall be securely anchored in place using 6 inch (150 mm) staples at a maximum spacing of 12 inches (300 mm) on center. Anchoring on impervious areas shall be accomplished with gravel bags placed at 18 inches (450 mm) on center or with a nominal 1 inch by 4 inch (25 mm by 100 mm) board nailed at 18 inches (450 mm) on center.

Silt accumulation behind hay bales and triangular sediment filter dikes shall be removed at a maximum depth of 6 inches (150 mm) or when, in the opinion of the Engineer or designated representative, the structure ceases to function as intended.

All dikes shall be inspected by the Contractor at least monthly and after each rainfall. Dikes shall be repaired or replaced when necessary or as directed by the Engineer or designated representative.

After completion of construction or when directed by the Engineer or designated representative the dike shall be removed and the site re-graded to the final grades. Any depression shall be filled and any accumulations of silt shall be spread or removed to a permitted disposal area. After removal of the dike the area shall be graded and seeded conforming to Item No. 604S, "Seeding for Erosion Control".

**628S.5 Measurement**

The work performed and the materials furnished as prescribed by this item will be measured by the lineal foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) of "Sediment Containment Dikes", complete in place.

**628S.6 Payment**

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Sediment Containment Dikes" indicated on the Drawings. The Unit bid price shall include full compensation for: (a) furnishing, hauling and placing all materials including all labor, tools, equipment and incidentals needed to complete the work, (b) the repair and/or replacement of materials, (c) the removal and disposal of all silt and debris and (d) the removal of all dikes, silt and debris after completion of construction or when directed by the Engineer or designated representative.

When indicated on the Drawings, payment for sediment containment will be made under:

| | | |
|---|---|---|
| **Pay Item No. 628S-A:** | Sediment Containment Dikes with hay bales | Per Lineal Foot. |
| **Pay Item No. 628S-B:** | Sediment Containment Dikes with filter fabric | Per Lineal Foot. |

**End**

| SPECIFIC CROSS REFERENCE MATERIALS |
|---|
| Specification 628S, “Sediment Containment Dike" |

City of Austin Standard Details

| Designation | Description |
|---|---|
| Number 628S | Triangular Sediment Filter Dike |
| Number 628S-1 | Hay Bale Dike |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 604S | Seeding for Erosion Control |

City of Austin Standard Contract

| Section | Description |
|---|---|
| 00300U | Bid Form (Unit Prices) |

| RELATED CROSS REFERENCE MATERIALS |
|---|
| Specification 628S, “Sediment Containment Dike" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 101S | Preparing Right of Way |
| Item No. 102S | Clearing and Grubbing |
| Item No. 111S | Excavation |
| Item No. 120S | Channel Excavation |
| Item No. 401S | Structural Excavation and Backfill |
| Item No. 406S | Reinforcing Steel |
| Item No. 602S | Sodding for Erosion Control |
| Item No. 605S | Soil Retention Blanket |
| Item No. 606S | Fertilizer |
| Item No. 608S | Planting |
| Item No. 610S | Preservation of Trees and Other Vegetation |
| Item No. 620S | Filter Fabric |

| RELATED CROSS REFERENCE MATERIALS (Continued) |
|---|
| Specification 628S, “Sediment Containment Dike" |

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. 166 | Fertilizer |
| Item No. 168 | Vegetative Watering |
| Item No. 169 | Soil Retention Blanket |
| Item No. 204 | Sprinkling |

**ITEM NO. 639S**
**ROCK BERM**

## 639S.1 Description

This item shall govern the construction of a temporary berm of open graded rock that is installed at the toe of a slope on the perimeter of a developing area. Rock berms are appropriate for use as flow diverters, energy dissipators, grade control, and level spreaders to release the water in sheet flow (Environmental Criteria Manual Section 1.4.5.E). This item shall also govern the removal of the "Rock Berm" and re-vegetation of the area.

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.

## 639S.2 Submittals

The submittal requirements for this specification item shall include:

A. Function (flow diversion, grade control, energy dissipator, level spreader, or other) and dimensions of the rock berm

B. Source, type and gradation of rock

C. Re-vegetation program, including:

1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
2. Type of mulch.
3. Type of tacking agent.
4. Type and rate of application of fertilizer.

## 639S.3 Design Criteria

A detailed design is not required for the installation of a rock berm; however, the following criteria shall be observed:

| | |
|---|---|
| Drainage area | less than 5 acres (2 hectares). |
| Height | 18 inches (450 mm) minimum height, measured vertically from the top of the existing ground at the upslope toe to the top of the berm. |
| Top width | 2 feet (0.6 meter) minimum. |
| Side slopes | 2:1 or flatter. |
| Grade | Berms will be built along a contour as near possible to a 0 percent grade. |

**639S.4 Materials**

Surplus rock excavated from utility trenches or from other excavations may be used in construction of these berms. In general, the rocks shall be sound with a minimum of 3 inches (75 mm) in smallest dimension and shall weigh between 10 and 30 pounds (4.5 to 13.6 kilograms) each. Seeding for re-vegetation shall conform to Item No. 604S, "Seeding for Erosion Control".

Use only open-graded rock of the size indicated on Standard Detail No. 639S-1, with most of the fines removed.

**639S.5 Construction Methods**

All trees, brush, stumps and objectionable material shall be removed and disposed in a manner that will not interfere with the construction of the berm.

A trench shall be excavated to a minimum depth of 4 inches (100 mm) below existing grade for placement of the rock as indicated on Standard Detail No. 639S-1 and the Drawings. The rocks shall be placed in interlocking layers with close joints starting at the base. Open joints shall be filled with rock-spalled materials as required to stabilize the berm.

The area upstream from the rock berm shall be maintained in a condition, which will allow sediment to be removed following the runoff from a rainfall event. After each rainfall event with an accumulation of 1 inch (25 mm) or more, an inspection of the rock berm will be made by the Contractor and the stone shall be replaced, when the structure ceases to function as intended because of sediment accumulation among the rocks, washout, construction traffic damage, etc.

If the sediment reaches a depth equal to 1/3 the height of the berm or 6 inches (150 mm), whichever is less, the Contractor will remove the accumulated sediment and dispose of it at an approved disposal site in a manner that will not contribute to additional sedimentation. The berm will be reshaped as needed during construction.

When the site is completely stabilized, the berm will be removed and disposed of in a manner approved by the Engineer or designated representative.

The area will be re-vegetated as required by Item No. 604S, "Seeding for Erosion Control".

**639S.6 Measurement**

Acceptable work performed and prescribed in this item will be measured by the linear foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) along the centerline of top of berm.

**639S.7 Payment**

The work performed and material furnished and measured as provided under "Measurement" to construct this item will be paid for at the unit bid price per linear foot of rock berm barrier as indicated on the Drawings. The Unit Bid Price shall include full compensation for:

(a) furnishing, hauling and placing all materials including all labor, tools, equipment and incidentals needed to complete the work,
(b) maintaining the berm,
(c) removing sediment accumulations,
(d) rock replacement,
(e) removing and disposing of all materials when the berm is no longer required and
(f) re-vegetating the site upon removal of the berm.

Payment will be made under:

| | | |
|---|---|---|
| **Pay Item No. 639S:** | Rock Berm | Per Lineal Foot. |

**End**

| ***SPECIFIC* CROSS REFERENCE MATERIALS** |
|---|
| Specification 639S, “Rock Berm" |

City of Austin Environmental Criteria Manual

| Designation | Description |
|---|---|
| Section 1.4.2.E | Rock Berm |

City of Austin Standard Details

| Designation | Description |
|---|---|
| Number 639S-1 | Rock Berm |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 604S | Seeding for Erosion Control |

| ***RELATED* CROSS REFERENCE MATERIALS** |
|---|
| Specification 639S, “Rock Berm" |

City of Austin Environmental Criteria Manual

| Designation | Description |
|---|---|
| Table 1-1.3 | Recommended Design Values For Functional Controls |
| Table 1-2 | Maximum Water Depth At The Barrier |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 101S | Preparing Right of Way |
| Item No. 102S | Clearing and Grubbing |
| Item No. 111S | Excavation |
| Item No. 120S | Channel Excavation |
| Item No. 401S | Structural Excavation and Backfill |
| Item No. 602S | Sodding for Erosion Control |
| Item No. 605S | Soil Retention Blanket |
| Item No. 606S | Fertilizer |

| | |
|---|---|
| Item No. 608S | Planting |
| Item No. 610S | Preservation of Trees and Other Vegetation |
| Item No. 620S | Filter Fabric |

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. 166 | Fertilizer |
| Item No. 168 | Vegetative Watering |
| Item No. 169 | Soil Retention Blanket |
| Item No. 204 | Sprinkling |

**Item No. 641S**
**Stabilized Construction Entrance**

## 641S.1 Description

This item governs the construction of a stabilized pad of crushed stone located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk or parking area. The removal of the stabilized pad of crushed stone shall also be included in the item. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking or deposition of sediment onto public right of way (Environmental Criteria Manual Section 1.4.2.N.4).

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.

## 641S.2 Submittals

The submittal requirements for this specification item shall include:

A. Source, type and gradation of rock

B. Drainage technique (i.e. drainage swale or entrance grading) proposed to prevent runoff from exiting the construction site.

## 641S.3 Materials

Aggregate for construction shall conform to the following gradation:

| Table 1: Aggregate Gradation Chart (TEX 401-A, % Retained per sieve) | |
|---|---|
| US 5 inch (SI 125 mm) | US 3 inch (SI 75 mm) |
| 0 | 100 |

## 641S.4 Construction Methods

All trees, brush, stumps, obstructions and other objectionable material shall be removed and disposed of in a manner that will not interfere with the excavation and construction of the entrance as indicated on the Drawings or as presented in Standard Details No. 641S-1. The entrance shall not drain onto the public right of way or shall not allow surface water runoff to exit the construction site.

When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right of way. When vehicle washing is required, it shall be done on an area stabilized with crushed stone, which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence (Standard Specification Item No 642S) or other methods approved by the Engineer or designated representative.

The entrance shall be maintained in a condition that will prevent tracking or disposition of sediment onto public right of way. This restriction may require periodic top dressing with additional stone as conditions demand, as well as the repair and/or cleanout of any measures used to trap sediment. All sediment that is spilled, dropped, washed or tracked onto public right of way must be removed immediately.

**641S.5 Measurement**

Acceptable work performed as prescribed in this item will be measured by unit of each stabilized construction entrance installed.

**641S.6 Payment**

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Stabilized Construction Entrance". The price shall include full compensation for furnishing, hauling and placing all materials, labor, tools, equipment and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating existing fencing, removal of silt and removal and disposal of all materials at the completion of construction.

Payment, when included as a contract pay item, will be made under:

**Pay Item No. 641S:** Stabilized Construction Entrance Per Each.

**End**

***SPECIFIC*** CROSS REFERENCE MATERIALS

Specification 641S, "Stabilized Construction Entrance (SCE)"

City of Austin Environmental Criteria Manual

| Designation | Description |
|---|---|
| Section 1.4.2.N.4 | Stabilized Construction Entrance "Design Criteria" |

City of Austin Standard Details

| Designation | Description |
|---|---|
| Number 641S-1 | Stabilized Construction Entrance |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 642S | Silt Fence (SF) |

***RELATED*** CROSS REFERENCE MATERIALS

City of Austin Environmental Criteria Manual

| Designation | Description |
|---|---|
| Section 1.4.2.J | Sandbag Berm |
| Figure 1-11 | Sand Bag Berm |
| Section 1.4.2.G | Silt Fence |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 101S | Preparing Right of Way |
| Item No. 102S | Clearing and Grubbing |
| Item No. 111S | Excavation |
| Item No. 120S | Channel Excavation |
| Item No. 401S | Structural Excavation and Backfill |
| Item No. 610S | Preservation of Trees and Other Vegetation |

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. 168 | Vegetative Watering |

**ITEM NO. 642S**
**SILT FENCE**

## 642S.1 Description

This item shall govern the provision and placement of a silt fence fabric fence (Environmental Criteria Manual Section 1.4.5.G) including maintenance of the fence, removal of accumulated silt, removal of the silt fence and re-vegetation of disturbed areas upon completion of the project.

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.

## 642S.2 Submittals

The submittal requirements for this specification item shall include:

A. Source, manufacturer, characteristics and test data for the silt fence fabric,

B. Manufacturer, characteristics and test data for the posts and wire fence.

C. Re-vegetation program, including:

1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
2. Type of mulch.
3. Type of tacking agent.
4. Type and rate of application of fertilizer.

## 642S.3 Materials

A. Fabric

1. General:

   The silt fence fabric shall be of nonwoven polypropylene, polyethylene or polyamide thermoplastic fibers with non-raveling edges. The silt fence fabric shall be non-biodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The silt fence fabric shall be supplied in rolls a minimum of 36 inches (0.9 meter) wide.

2. Physical Requirements:

   The fabric shall meet the requirements presented in Table 1, when sampled and tested in accordance with the methods indicated herein, on Standard Detail No. 642S-1 and/or on the Drawings.

B. Posts:

Posts shall be steel Tee or Y-posts, not less than 4 feet (1.22 meters) in length with a minimum weight of 1.25 pounds per foot (1.86 kilograms per meter) with a minimum Brinell Hardness of 143. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A-702. Caps are required (*not specifying discretionary criteria).

C. Wire Fence:

Wire fence shall be welded wire fabric 2 in. x 4 in. 12.5 SWG, wire diameter 0.099 in (±0.005 in.), and shall conform to Standard Specification Item No. 406, "Reinforcing Steel".

TABLE 1. Silt Fence Fabric Requirements

| Physical Properties | Method | Requirements |
|---|---|---|
| Fabric Weight in ounces per square yard (grams/square meter) | TEX-616-J[1] | 5.0 minimum (150 minimum) |
| Equivalent Sieve Opening Size: US Standard (SI Standard sieve size) | CW-02215[2] | 40 to 100 (425 to 150 □m) |
| Mullen Burst Strength: lbs. per sq. inch (psi) megaPascal (mPa) | ASTM D-3786[3] | 280 minimum (1.9 minimum) |
| Ultraviolet Resistance; % Strength Retention | ASTM D-1682[4] | 70 minimum |

[1] TxDoT Test Method Tex-616-J, "Testing of Construction Fabrics".
[2] US Army Corps of Engineers Civil Works Construction Guide Specification CW-02215, "Plastic Filter Fabric".
[3] ASTM D-3786, " Test Method for Hydraulic Bursting Strength of Knitting Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method".
[4] ASTM D-1682, " Test Methods for Breaking Load and Elongation of Textile Fabrics ".

**642S.4 Construction Methods**

The silt fence fabric shall be securely attached to the posts and the wire support fence with the bottom 12 inches (300 mm) of the material buried in a trench a minimum of 6 inches (150 mm) deep and 6 inches (150 mm) wide to prevent sediment from passing under the fence. When the silt fence is constructed on impervious material, a 12-inch (300-mm) flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss. No horizontal joints will be allowed in the silt fence fabric. Vertical joints shall be overlapped a minimum of 12 inches (300 mm) with the ends sewn or otherwise securely tied.

The silt fence shall be a minimum of 24 inches (0.6 meter) high. Posts shall be embedded a minimum of 12 inches (300 mm) in the ground, placed a maximum of 8 feet (2.4 meters) apart and set on a slight angle toward the anticipated runoff source. When

directed by the Engineer or designated representative, posts shall be set at specified intervals to support concentrated loads.

* Per OSHA §1926.701, 'all protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement'. Caps must be large enough to dissipate the forces of impact to prevent impalement from a reasonably foreseeable fall distance. It should be noted that the use of impalement protection caps is but one method of protection; covers or wooden troughs can be another means of meeting the guarding requirement. For City of Austin purposes, this also applies to t-posts and wooden stakes.

The silt fence shall be repaired, replaced, and/or relocated when necessary or as directed by the Engineer or designated representative. Accumulated silt shall be removed when it reaches a depth of 6 inches (150 mm).

**642S. 5 Measurement**

The work performed and the materials furnished under this item will be measured by the lineal foot of "Silt Fence", complete in place.

**642S.6 Payment**

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Silt Fence". The price shall include full compensation for furnishing, hauling and placing all materials, labor, tools, equipment and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating the fence, removal of silt and removal and disposal of all materials at the completion of construction in and re-vegetation of disturbed areas.

Payment will be made under:

| | | |
|---|---|---|
| **Pay Item No. 642S:** | Silt Fence for Erosion Control | Per Lineal Foot. |

**END**

| **SPECIFIC** CROSS REFERENCE MATERIALS |
|---|
| Specification 642S, "Silt Fence" |

City of Austin Environmental Criteria Manual

| Designation | Description |
|---|---|
| Section 1.4.5.G | Silt Fence |

City of Austin Standard Details

| Designation | Description |
|---|---|
| Number 642S-1 | Silt Fence |

City of Austin Technical Specifications

| Designation | Description |
|---|---|
| Item No. 406 | Reinforcing Steel |

American Society For Testing and Materials (ASTM)

| Designation | Description |
|---|---|
| A-702 | Specification for Steel Fence Posts and Assemblies, Hot Wrought |
| D-1682 | Test Methods for Breaking Load and Elongation of Textile Fabrics |
| D-3786 | Test Method for Hydraulic Bursting Strength of Knitting Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method |

Texas Department of Transportation Manual of Testing Procedures

| Designation | Description |
|---|---|
| Tex-616-J | Testing of Construction Fabrics |

U.S. Army Corps of Engineers

| Designation | Description |
|---|---|
| CW-02215 | Civil Works Construction Guide Specification "Plastic Filter Fabric" |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification 642S, "Silt Fence" |

City of Austin Environmental Criteria Manual

| Designation | Description |
|---|---|
| Table 1-1.3 | Recommended Design Values For Functional Controls |
| Table 1-2 | Maximum Water Depth At The Barrier |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 101S | Preparing Right of Way |
| Item No. 102S | Clearing and Grubbing |
| Item No. 111S | Excavation |
| Item No. 120S | Channel Excavation |
| Item No. 401S | Structural Excavation and Backfill |
| Item No. 610S | Preservation of Trees and Other Vegetation |

**ITEM NO. 648S**
**MULCH SOCK**

## 648S.1 Description

A Mulch sock consists of material encased in a tube of mesh. It is used to intercept, settle, and filter sheet flow and pond runoff. Mulch socks provide an environmentally sensitive and cost-effective alternative to sediment fences.

## 648S.2 Submittals

The submittal requirements for this specification item shall include the following:

A. Mulch Material

1. A small sample of mulch material proposed to be used on the site will be provided to the engineer.
2. Provide a designated project stockpile of mulch for sampling and testing at the producer's site.
3. A copy of the lab analysis, performed by an STA-certified lab, verifying that the mulch material meets the requirements of Table 1.

Table 1

| Item | Requirement | Reference Specification |
|---|---|---|
| Particle Size | 3" minus screening process | Equivalent to TXDOT item 161, Compost, Section 1.6.2.B, Wood Chip requirements |
| pH | 5.5 – 8.5 | TMECC 04. 11-A, "1.5 Slurry pH" |
| Organic Matter Content | 25%, dry weight basis | TMECC 05.07-A, "Loss-On-Ignition Organic Matter Method" |

B. Tube Material

The CONTRACTOR shall submit a sample of the material that the CONTRACTOR proposes to use on the project. A sample of the material should be accompanied by material data sheet identifying composition, ability of the material to biodegrade, and size of openings in tube at a minimum.

### 648S.3 Materials

A. Mulching material can be manufactured on or off the project site and may consist of:

1. Shredded bark
2. Stump grindings
3. Composted bark

B. The mulch shall have the following composition:

1. Wood chips shall be produced from a 3-inch minus screening process (equivalent to TxDOT item 161, Compost, Section 1.6.2.B Wood Chip Requirements).
2. Large portions of silts, clays, or fine sands are not acceptable.
3. The pH of the mulch shall be between 5.5 and 8.5.
4. The organic matter content shall be greater than or equal to 25% on a dry weight basis.

C. Mulch material must be free of refuse, physical contaminants, and material toxic to plant growth. It is not acceptable for the mulch material to contain ground construction debris, biosolids, manure, or recyclable material.

D. Prior to placement, a representative sample of the mulching material must be tested and certified by the project engineer or his/her designee and accepted by the city inspector.

E. “Sock” material will be 100% biodegradable, photodegradable, or recyclable such as burlap, twine, UV photodegradable plastic, polyester, or any other acceptable material. The material mesh opening should be equal to or less than 3/8 inch (10 mm) and the material tensile strength should be equal to or greater than 44 psi (3.09 kg/cm2).

### 648S.4 Installation

A. Use 12 or 18 inch diameter mulch socks for all sediment control applications. This diameter of mulch sock material has proven to be the most consistent for all sediment control applications (TxDOT, April 2006).

B. Install mulch socks per Figure 1.4.5.F in the City of Austin Environmental Criteria Manual.

C. Mulch socks should be used at the base of slopes no steeper than 2:1 and should not exceed the maximum spacing criteria provided in the following table.

| Slope | Max. Slope Length Between *18 in. Dia. Sock* (ft) | Max. Drainage Area (sf) per 100ft of Sock |
|---|---|---|
| 100:1 - 50:1 | 100 | 10,000 |
| 50:1 - 30:1 | 75 | 7,500 |
| 30:1 - 25:1 | 65 | 6,500 |
| 25:1 - 20:1 | 50 | 4,800 |
| 20:1 - 10:1 | 25 | 2,600 |
| 10:1 - 5:1 | 15 | 1,300 |
| 5:1 - 2:1 | 10 | 1,000 |

| Slope | Max. Slope Length Between *12 in. Dia. Sock* (ft) | Max. Drainage Area (sf) per 100ft of Sock |
|---|---|---|
| 100:1 - 50:1 | 100 | 6,000 |
| 50:1 - 30:1 | 40 | 4,000 |
| 30:1 - 25:1 | 30 | 3,000 |
| 25:1 - 20:1 | 25 | 2,600 |
| 20:1 - 10:1 | 15 | 1,300 |
| 10:1 - 5:1 | 10 | 1,000 |
| 5:1 - 2:1 | 5 | 500 |

D. Place mulch socks at a 5 ft or greater distance away from the toe of the slopes to maximize space available for sediment deposition.

E. When placed on level contours, sheet flow of water should be perpendicular to the mulch sock at impact and unconcentrated.

F. Install mulch socks using rebar (#5 minimum with safety caps) a minimum of 48 inches in length placed on 2-ft centers. In order to prevent the movement or floating of the mulch sock during rain events or construction operations, install steel posts on alternating sides of the sock. Drive the posts into the ground to a minimum depth of 24 inches, leaving less than 12 inches of post above the exposed mulch sock.

G. In order to prevent water flowing around the ends of the mulch socks, point the ends of the socks up slope.

H. In order to prevent water from flowing between the gaps at adjacent ends of mulch socks, overlap the ends of adjacent mulch socks a minimum of 12 inches. Never stack mulch socks on top of one another.

I. Mulch Socks should be placed using ‘smiles’ and ‘j-hooks’. See ECM Section 1.4.5 G (Silt Fence)

J. For steeper slopes, an additional mulch sock can be constructed on the top of the slope and within the slope area as determined by specific field conditions. Multiple mulch socks are recommended on steeper slopes.

K. Do not use mulch socks in areas of concentrated flow as they are intended to control sheet flow only.

### 648S.5 Inspection and Maintenance

A. Inspect mulch socks after installation for gaps under the mulch socks and for gaps between the joints of adjacent ends of mulch socks. Contractor shall repair gaps such that no water flows under or around sock.

B. Inspect every seven days and within 24 hours of a rainfall event of 0.5 inches or greater. Replace and repair mulch socks as necessary.

C. Sediment retained by the mulch socks shall be removed when it has reached one third of the exposed height of the mulch socks.

D. Mulch socks can be vegetated or un-vegetated. Vegetated mulch socks can be left in place. The vegetation will grow in the slope, further anchoring the sock.

### 648S.6 Payment

The work performed and the materials furnished as prescribed by this item shall be paid for by the linear foot of mulch sock installed.

Payment will be made under:

| | | |
|---|---|---|
| **Pay Item No. 648S:** | Mulch Sock | Per Lineal Foot. |

**END**

| ***SPECIFIC* CROSS REFERENCE MATERIALS** |
| --- |
| Specification Item No. 648S, “Mulch Sock” |

City of Austin Environmental Criteria Manual

| Designation | Description |
| --- | --- |
| 1.4.5.F | Mulch Sock |
| 1.4.5.G | Silt Fence |

City of Austin Standard Details

| Designation | Description |
| --- | --- |
| 648S-1 | Mulch Sock |

**Item No. 700S**
**Mobilization**

## 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.

## 700S.3 Payment.

The adjusted contract amount as used below is defined as the original contract amount less the lump sum bid for Mobilization and any payments for materials or equipment not yet incorporated in the Work. The Contractor shall submit a lump sum amount for Payment Item No. 700S-TM, "Total Mobilization Payment".

"Initial Mobilization Payout" as used below is defined as:

1. 8% of the original contract amount for projects with an original contract amount of $ 0.5 million or less; or
2. 4% of the original contract amount for projects with an original contract amount greater than $ 0.5 million.

In those instances where the "Initial Mobilization Payout", as defined above, exceeds the "Total Mobilization Payment" lump sum bid item (i.e. Payment Item No. 700S-TM), the "Total Mobilization Payment" shall be used as the "Initial Mobilization Payout". In no instance shall the "Initial Mobilization Payout" exceed the "Total Mobilization Payment" bid item.

Partial payments of the "Initial Mobilization Payout" shall be as follows:

A. Upon presentation of a paid invoice for the Payment Bond, Performance Bond and/or required insurance, the Contractor will be paid that cost from the amount bid for "Total Mobilization Payment".

B. The Mobilization of tunnel boring machines, batch plants or other similar facilities, along with supporting materials and equipment, to the work site or to the vicinity of the Work site will be considered as partial Mobilization under this contract. The Contractor shall provide a certified statement of the Contractor's

expenditure for the Mobilization and setup of the facility and supporting equipment. Upon approval by the Engineer or designated representative, the certified expenditure will be paid from the amount bid for the Specification Item, “Total Mobilization Payment”. In no case shall the combined amount for all of these facilities be more than 10 percent of the Mobilization “Total Mobilization Payment" lump sum bid or one (1) percent of the total contract amount, whichever is less.

C. When one (1) percent of the adjusted contract amount is earned, 50 percent of the "Initial Mobilization Payout” will be paid. Previous payments under this item will be deducted from this amount.

D. When five (5) percent of the adjusted contract amount is earned, seventy-five (75) of the "Initial Mobilization Payout” will be paid. Previous payments under this item will be deducted from this amount.

E. When ten (10) percent of the adjusted contract amount is earned, one hundred (100) percent of the "Initial Mobilization Payout” will be paid. Previous payments under this item will be deducted from this amount.

F. Payment for the remainder of Pay Item No. 700S-TM, “Total Mobilization Payment” will be made upon receipt of the final pay estimate.

Payment will be made under:

**Pay Item No. 700S-TM**: **"**Total Mobilization Payment" Lump Sum

**END**

| **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 |

# Fencing

## 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 12-1/2 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 $45^{o}$ 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 3/4 inch (19 mm). Hand mixing of concrete will be permitted on batches under 1/2 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) 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 bid price 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. 701*S* -AS:** Chain Link Fence, - Per Lineal Foot
**Pay Item No. 701*S* –B:** Chain Link Pedestrian Single Swing Gate, ___Foot. x __Foot. Per Each
**Pay Item No. 701S -BD:** Chain Link Pedestrian Double Swing Gate, __Foot. x __Foot. Per Each
**Pay Item No. 701S -CS:** Chain Link Vehicular Single Swing Gate, ____Foot. x ___Foot. Per Each
**Pay Item No. 701S -CD:** Chain Link Vehicular Double Swing Gate, __Foot. x ___Foot. Per Each
**Pay Item No. 701*S* -D:** Wire Fence Per Lineal Foot
**Pay Item No. 701*S* -E:** Wood Fence Per Lineal Foot
**Pay Item No. 701*S* -F:** Wood Fence Pedestrian Gate, ___Foot. x __Foot. Per Each
**Pay Item No. 701*S* -G:** Wood Fence Vehicular Gate, ___Foot. x ___Foot. Per Each
**Pay Item No. 701*S* -H:** Security Fence, ___Foot, High Type ___ Per Lineal Foot
**Pay Item No. 701*S* -T:** Temporary Fence, ___Foot High, ____Type Per Lineal Foot
**Pay Items No. 701S-MS**: Mowing Strip Per Lineal Foot

**End**

***SPECIFIC*** CROSS REFERENCE MATERIALS

*City of Austin Standard Specifications*

| *Designation* | *Description* |
|---|---|
| Item No. 403S | 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

*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 |

**Item No. 702S**
**Removal and Relocation of Existing Fences**

## 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.

### 702.S 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<br>Existing _Ft. Chain Link Fence | Per Lineal Foot. |
| **Pay Item No. 702S -B:** | Removing and Relocating<br>Existing _Ft. x _Ft. Chain Link Pedestrian Gate | Per Each. |
| **Pay Item No. 702S-C:** | Removing and Relocating<br>Existing _Ft. x _Ft. Chain Link Vehicular Gate | Per Each. |
| **Pay Item No. 702S-D:** | Removing and Relocating<br>Existing _Ft. Wooden Fence | Per Lineal Foot. |

**Pay Item No. 702S-E:** Removing and Relocating
Existing _Ft. x _Ft. Wooden Pedestrian Gate Per Each.
**Pay Item No. 702S-F:** Removing and Relocating
Existing _Ft. x _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. x _Ft. Metal Gate Per Each.

**End**

| ***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 |
|---|

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 |

**Item 703**
**Fencing for Excavations**

## 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, 5-1/2 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 |

**END**

**Item No. 802S**
**Project Signs**

## 802S.1 Description

This item shall govern furnishing, fabricating, erecting, maintaining and removing Project Signs on Capital Improvement Projects (C.I.P.), Bond Program Projects and for project identification at other construction sites, when required on the Drawings. The C.I.P. signs shall be constructed in accordance with Standards 802S-1, 802S-1A, 802S-2, 802S-2A, 802S-2B and 804S-5 or 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.

## 802S.2 Materials

A. Sign Face

Sign face shall be manufactured on standard exterior waterproof plywood sheets or other suitable material approved by the Engineer or designated representative. Unless indicated otherwise on the Standard Details or Drawings, the thickness of the plywood sheet shall be a minimum of ¾ inches (19 mm).

B. Posts

Lumber posts, of the size indicated on the Standard Details or on the Drawings, shall be pressure treated with pentachlorophenol.

C. Paint

Exterior oil base paint, colors as indicated on the Standard Details or on the Drawings.

D. Decals for Capital Improvement Projects and Bond Program Projects

City seal shall be in color using the 4 color process. Electronic images, in EPS format, are available from the Public Works Website (http://www.ci.austin.tx.us/publicworks/techspecs.htm) for downloading.

## 802S.3 Installation

The signs shall be erected at each major entrance to the project for maximum public identification and exposure. At locations where construction is confined to a specific area, the installed sign size shall be 4 x 8 foot (1.2 x 2.4 meter). At locations where C.I.P. roadway construction is in progress, such as a street paving or construction of a sidewalk, the sign shall be 2 x 3 foot (0.2 x 0.8 meter). Signs for Bond Program Projects shall be 3 x 4 foot (0.9 x 1.2 meters).

The signs shall be posted on portable wood frames or stanchions and will be located in the proximity of the work area as construction progresses. All lumber shall be painted with 2 coats of paint as indicated herein, on the Standard Details or in the Drawings.

In special cases the size of the sign may be changed to meet special requirements, but general proportions shall be maintained.

It shall be the responsibility of the Contractor to maintain and relocate signs, if necessary during the progression of the project. Care shall be exercised to assure that placement of the signs does not interfere with or cause sight obstruction to vehicular and pedestrian traffic.

For projects located on a street with curb and gutter, signs shall be installed no closer than 2 feet (0.6 meter) from the face of curb on the street.

For projects located on a street without curb and gutter, signs shall be installed no closer than 6 feet (1.8 meters) from the edge of street pavement.

The Contractor may install, at the Contractor's own expense, company signs to identify the Contractor, architectural firm, etc. Signs are to be securely attached to the posts at locations indicated on the Drawings and shall not be larger than 18 x 36 inches (0.45 x 0.90 meter).

### 802S.4 Measurement

The CIP contract and/or Bond Program, signs shall be measured by either lump sum or per each.

### 802S.5 Payment

The work performed and the materials furnished as prescribed by this item shall be paid for by lump sum or per each price bid only. The 'lump sum' bid or 'per each' price bid shall include full compensation for all work performed and all materials furnished in constructing, transporting, maintaining and removing the signs as specified on the Drawings and as directed by the Engineer or designated representative.

Payment will be made under one of the following:

| | |
|---|---|
| **Pay Item No. 802S-A C.I.P.:** C.I.P. Project Signs | Lump Sum. |
| **Pay Item No. 802S-B C.I.P.:** C.I.P. Project Sign | Per Each. |
| **Pay Item No. 802S-A BOND:** Bond Project Signs | Lump Sum. |
| **Pay Item No. 802S-B BOND:** Bond Project Sign | Per Each. |

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 802S, "Project Signs" |

City of Austin Standard Details

| Designation | Description |
|---|---|
| Item No. 802S-1 | 2.4 m x 1.2 m (8'x4') C. I. P. Building Project Sign |
| Item No. 802S-1A | 2.4 m x 1.2 m (8'x4')Bond Program Building Project Sign |
| Item No. 802S-2 | 600 mm x 900 mm (24" x 36")C. I. P. Movable Sign Type II |
| Item No. 802S-2A | 600 mm x 900 mm (24" x 36")Joint C. I. P. Movable Sign Type II |
| Item No. 802S-2B | 900 mm x1.2 m (36" x 48") Bond Program Project Movable Sign Type II |
| Item No. 804S-5 | Typical CMTA / C.I.P. Sign Locations |

## 803S.1 Description

This item shall govern for providing, installing, moving, replacing, maintaining, cleaning and removing upon completion of the work, all temporary or permanent street closure barricades, signs, cones, lights or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform Traffic Control Devices for Street and Highways and as indicated on the Drawings or directed by the Engineer or designated representative.

Constructing A Detour, if required, shall conform to Standard Specification Item No. 801S, " Constructing A Detour". Capital Improvement Project Signs shall conform to Standard Specification Item No. 802S, " Project Signs".

This item shall also include the installation of all required safety fencing as described in the latest adopted version of Standard Detail 804S-4.

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.

## 803S.2 Submittals

The submittal requirements of this specification item include:

A. Type of Barricade and proposed materials and Construction of the barricade,

B. Test results for Retro-Reflective sheeting.

## 803S.3 Materials

All barricades, signs, cones, lights and other types of devices to handle traffic, as indicated on the Drawings or directed by the Engineer or designated representative, shall conform to details shown on the Drawings or those indicated in the Texas Manual on Uniform Traffic Control Devices (TMUTCD).

## 803S.4 Construction Methods

Prior to commencement of construction, suitable "Barricades, Signs and Traffic Handling" devices shall be installed to protect the workers and the public.

The Contractor shall be responsible for the installation of all markers, signs and barricades in accordance with the Drawings and in conformance with the Texas Manual on Uniform Traffic Control Devices (TMUTCD) and/or as indicated on the Drawings or directed by the Engineer or designated representative. If, in the opinion of the Engineer or designated representative, additional markers, signs or barricades are needed in the interest of safety, the Contractor will install such as are required or as directed by the Engineer or designated representative. All changes and/or revisions to the detour/traffic control plan shall be approved by the Engineer or designated representative.

Lumber shall be painted with 2 coats of paint as indicated on the Drawings.

**803S.5 Maintenance**

It shall be the Contractor's responsibility to maintain, clean, move and replace if necessary, barricades, signs and traffic handling devices during the time required for construction of the project. Permanent barricades shall be constructed as required after the completion of the street by drilling holes to place the posts and concrete foundations. Foundation concrete shall be cured before the rails are attached. When no longer needed, all temporary Barricades, Signs and Traffic Handling Devices shall be removed and the area restored to its original condition or as directed by the Engineer or designated representative.

**803S.6 Measurement**

The work performed and material furnished as prescribed by this item, City of Austin Standard Details, details included on the Drawings or indicated in the TMUTCD shall be measured as follows:

A. Pavement Markings.

   All pavement marking required for proper installation of the designated Traffic Control Plans and Details, as well as required removal of existing pavement marking, shall be measured and paid for under Standard Specification Item No. 870S, “Work Zone Pavement Markings” and Standard Specification Item No. 874S, “Eliminating Existing Pavement Markings”.

B. Barricades, Signs and Traffic Handling.

   All work performed and material furnished as prescribed by this item, City of Austin Standard Details, details shown on the Drawings or indicated in the TMUTCD, that are not included in the above paragraph, shall be measured by the number of calendar days, working days or months of actual service.

   Traffic control for the project will be measured and paid for once per contract defined time period, i.e. either per Calendar Day, Working day or Month at the contract rate, regardless of the number of set-ups, locations or streets under construction.

C. Safety Fencing

   Safety fencing will be measured by the lineal foot.

**803S.7 Payment**

The work performed and materials furnished as prescribed by this item, measured as provided under section “803S.6 Measurement” shall be paid for at the contract unit price for barricades, signs and traffic handling. This unit price shall include full compensation for furnishing, placement and removal of all materials and for all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

| | | |
|---|---|---|
| **Pay Item No. 803S -CD:** | Barricades, Signs, and Traffic Handling | Per Calendar Day. |
| **Pay Item No. 803S-WD:** | Barricades, Signs, and Traffic Handling | Per Working Day. |
| **Pay Item No. 803S-MO:** | Barricades, Signs, and Traffic Handling | Per Month. |
| **Pay Item No. 803S-SF:** | Safety Fence | Per Lineal Foot. |

**End**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 803S, "Barricades, Signs and Traffic Handling" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 801S | Constructing A Detour |
| Item No. 802S | Project Signs |
| Item No. 870S | Work Zone Pavement Markings |
| Item No. 874S | Eliminating Existing Pavement Markings and Markers |

Texas Technical Documents:

| Designation | Description |
|---|---|
| (TMUTCD) | Texas Manual on Uniform Traffic Control Devices |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 803S, "Barricades, Signs and Traffic Handling" |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 403S | Concrete for Structures |
| Item No. 860S | Pavement Marking Paint (Reflectorized) |
| Item No. 863S | Reflectorized Pavement Markers |
| Item No. 864S | Abbreviated Pavement Markings |
| Item No. 867S | Epoxy Adhesive |
| Item No. 871S | Reflectorized Pavement Markings |
| Item No. 875S | Pavement Surface Preparation For Markings |

City of Austin Standard Details

| Designation | Description |
|---|---|
| 803S-1 | Street-End Barricades |

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

| Designation | Description |
|---|---|
| Item No. 502 | Barricades, Signs and Traffic Handling |
| Item No. 508 | Constructing Detours |
| Item No. 510 | One-Way Traffic Control |
| Item No. 512 | Portable Concrete Traffic Barrier |
| Item No. 514 | Permanent Concrete Traffic Barrier |
| 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 |

**Item No. 870S**
**Work Zone Pavement Markings**

## 870S.1 Description

This item shall govern the placement and maintenance of work zone pavement markings of the colors, types and sizes 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, inch-pound units are given preference followed by SI units shown within parentheses.

## 870S.2 General

Work zone pavement markings shall consist of guide marks, short-term markings and/or standard pavement markings. Existing markings are considered to be any standard pavement markings in place at the time of commencement of the Work. All streets, which are to be opened to traffic, shall be marked with short-term markings or standard markings, as shown on the Drawings, at the end of each day of operation.

When inclement weather prohibits the application of short-term markings or standard markings indicated on the Drawings, guide marks may be considered as temporary short-term markings for asphaltic surfaces, upon approval by the Engineer. The placement of pavement markings as shown on the Drawings may be delayed until the time that weather conditions allow the application of pavement markings.

## 870S.3 Materials

All non-removable markings shall be thermoplastic, unless otherwise indicated on the Drawings. Thermoplastic markings shall have a thickness of 90 mils (2.3 millimeters) unless indicated otherwise on the Drawings. All non-removable work zone markings shall conform to the requirements of Specification Item 871S, “Reflectorized Pavement Markings”, except for Section 871C.5, ‘Performance Period for Type I Markings’, Section 871C.6, ‘Measurement’ and Section 871C.7, ‘Payment’.

Thermoplastic or paint and beads applications shall not be used for removable markings.

Unless otherwise shown on the Drawings or indicated in the Contract Documents:

> The Contractor shall have the option to use raised pavement markers to simulate standard markers in accordance with the Drawings. Longitudinal lines wider than four (4) inches {100 millimeters} may be simulated by the side-by-side placement of markers to increase the apparent line width in multiples of four (4) inches {100 millimeters}.

Removable work zone pavement markings on final pavement surfaces shall be removable tape conforming to TxDOT Departmental Materials Specification DMS-8241.

When raised reflective pavement markers are required on the Drawings to supplement the removable pavement markings, a marker shall be applied to the top of the tape at the approximate mid-length of tape used for broken lines and at approximate 20 foot (6 meter) spacing for solid lines.

Raised pavement markers will not be allowed for words, symbols, shapes and diagonal or transverse lines.

The paint shall be water-based and shall conform to Standard Specification Item 860S, “Pavement Marking Paint”.

The beads shall conform to Standard Specification Item 860S, “Pavement Marking Paint”.

The thermoplastic type materials shall conform to TxDOT Departmental Materials Specification Item DMS-8220, “Thermoplastic Pavement Markings”.

### 870S.4 Performance Requirements

The markings in construction areas shall remain in proper alignment and shall be distinctly visible when dry from a minimum distance of 300 feet (90 meters) in daylight hours and distinctly visible from a minimum distance of 120 feet (36 meters) at night, when illuminated by automobile low-beam headlights. The visibility distances will be determined when viewed from an automobile traveling on the street.

The daytime color and the nighttime reflected color of the markings shall be distinctly white or yellow as shown on the Drawings. The markings shall exhibit uniform retroflective characteristics.

### 870S.5 Construction Methods

A. Placement and Maintenance.

The Contractor shall exercise due diligence in the selection of materials and placement of work zone pavement markings. The Contractor at its own expense shall maintain work zone pavement markings to the satisfaction of the Engineer or designated representative in accordance with this Specification Item.

Unless approved otherwise in writing by the Engineer or designated representative, all Portland cement concrete surfaces shall have standard markings in place prior to opening to traffic.

All asphaltic surfaces, which are scheduled for opening to traffic, shall be marked with guide marks immediately following placement and final rolling of any course. Guide marks shall consist of a single temporary flexible-reflective street marker tab or a single temporary construction raised reflective pavement marker at 40-foot (12-meter) spacing.

Guide marks shall be placed in proper alignment with the final location of future standard markings. Any guide marks, which are not in alignment with standard markings, shall be removed by the Contractor at its own expense.

The standard pavement markings shall be installed in accordance with the Texas Manual on Uniform Traffic Control Devices for Streets and Highways (TMUTCD) and as shown on the Drawings.

Surfaces to receive surface treatments (Standard Specification Item 320S) shall be marked in accordance with the Drawings. Unless otherwise shown on the Drawings, the standard pavement markings shall be placed in accordance with TMUTCD, no sooner

than three (3) days nor later than two (2) weeks after the placement of the surface treatment.

Short- term markings required by the Drawings shall conform to the TMUTCD and details shown on the Drawings. Unless otherwise shown on the Drawings, short-term markings shall be removed immediately prior to placement of the final pavement markings.

B. Marking Removal.

Any work zone pavement markings placed by the Contractor that conflict with any succeeding work zone markings shall be removed by the Contractor at its own expense in accordance with Specification Item 874S, “Eliminating Existing Pavement Markings and Markers”, except for measurement and payment.

Removable marking materials shall leave minimal evidence of the existence of the marking upon removal.

C. Maintenance of Markings

The Contractor shall be responsible for maintaining all work zone pavement markings in accordance with this specification item, at its own expense, to the satisfaction of the Engineer or designated representative.

**870S.6 Measurement**

This Standard Specification Item will be measured by the lineal foot (lineal meter: 1 lineal meter is equal to 3.281 lineal feet) of standard marking or short-term marking, by each guide mark, by each word, shape or symbol, by each temporary flexible-reflective street marker tab on surface treatments or by any other unit as shown on the Drawings. Raised pavement markers used to simulate a stripe will be measured by the lineal foot (lineal meter) of simulated stripe or each raised pavement marker as shown on the Drawings. Where double stripes are placed, each stripe will be measured separately.

Payment for revised quantities will be paid for at the unit price bid for that bid item.

**870S.7 Payment**

The work performed and materials furnished in accordance with this Standard Specification Item and measured as provided under “Measurement” will be paid for at the Unit bid price for “Work Zone Pavement Markings (Removable)”, “Work Zone Pavement Markings (Non-removable)”, “Work Zone Pavement Markings (Short-Term)” and “Work Zone Pavement Markings (Guide mark)” of the width, color and type shown on the Drawings. This price shall include full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to place, maintain and remove, when required, the markings, except as described below.

Removal of existing markings will be paid for under Specification Item 874S, “Eliminating Existing Pavement Markings and Markers”.

Final work zone pavement markings (paint and beads) which will be used within 30 calendar days after application as a sealer for Type I pavement markings will not be paid for under this Specification Item, but will be paid for under Specification Item 871S, “Reflectorized Pavement Markings”.

Payment will be made under one or more of the following:

| | | |
|---|---|---|
| **Pay Item 870S-A:** | Work Zone Pavement Markings (Removable), ___inches in width, _____ in color | per lineal foot. |
| **Pay Item 870S-B:** | Work Zone Pavement Markings (Non-removable), ___inches in width, _____ in color | per lineal foot. |
| **Pay Item 870S-C:** | Work Zone Pavement Markings (Short Term), ___inches in width, _____ in color | per lineal foot. |
| **Pay Item 870S-D:** | Work Zone Pavement Markings (Guide mark), ___inches in width, _____ in color | per lineal foot. |
| **Pay Item 870S-E:** | Work Zone Pavement Marking (Removable), Words | per each. |
| **Pay Item 870S-F:** | Work Zone Pavement Marking (Removable), Symbols | per each. |
| **Pay Item 870S-G:** | Work Zone Pavement Marking (Non-removable), Words | per each. |
| **Pay Item 870S-H:** | Work Zone Pavement Marking (Non-removable), Symbols | per each. |

**END**

***SPECIFIC*** CROSS REFERENCE MATERIALS

City of Austin Contract Documents

| Designation | Description |
|---|---|
| Section 00300U | Bid Form (Unit Price) |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 320S | Two Course Surface Treatment |
| Item No. 860S | Pavement Marking Paint (Reflectorized) |
| Item No. 871S | Reflectorized Pavement Markings |
| Item No. 874S | Eliminating Existing Pavement Markings and Markers |

***RELATED*** CROSS REFERENCE MATERIALS

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| 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 | Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete) |
| Item No. 315S | Milling Asphaltic Concrete Paving |
| 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 |
| 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. 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. 872S | Prefabricated Pavement Markings |
| Item No. 873S | Raised Pavement Markers |
| Item No. 875S | Pavement Surface Preparation For 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 |

***RELATED*** CROSS REFERENCE MATERIALS - Continued

Texas Department of Transportation:
Manual of Testing Procedures

| Designation | Description |
|---|---|
| Tex-729-I | Sampling of Traffic Markers |
| Tex-732-I | Sampling of Prefabricated Pavement Marking Materials |
| 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 Specifications

| 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-10 | Pavement Paint |

**Item No. 871S**
**Reflectorized Pavement Markings**

## 871S.1 Description

This item shall govern furnishing and placement of reflectorized pavement markings of the colors, types, shapes, sizes, widths and thickness 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.

## 871S.2 Materials

A. Type I Marking Material.

Type I markings are thermoplastic type materials that require heating to elevated temperatures for application. Type I marking materials shall conform to TxDOT Departmental Materials Specification Item DMS-8220, "Thermoplastic Pavement Markings". Each container of Type I Marking Material shall be clearly marked to indicate the color, weight (mass), type of material, manufacturer's name and lot/batch number.

B. Type II Marking Material.

Type II markings are paint- type materials that are applied at ambient temperature or slightly elevated temperatures. Type II marking materials shall conform to Specification Item No. 860S, "Pavement Marking Paint".

C. Source of Supply.

All Type I marking materials shall be purchased on the open market. All glass traffic beads shall be purchased on the open market.

## 871S.3 Equipment Requirements

The equipment used to place pavement markings shall:

(1) be maintained in satisfactory operating condition;

(2) be considered in satisfactory operating condition if it has an average placement rate of 5,000 lineal feet (1 525 lineal meters) per hour of acceptable four (4) inch {100 millimeters} solid or broken lines over any five (5) consecutive working days;

(3) meet or exceed the material handling at elevated temperature requirements of the National Fire Underwriters and the Texas Railroad Commission;

(4) be capable of placing a minimum of 40,000 lineal feet (12 190 lineal meters) of 4 inch {100 millimeters} solid or broken markings per day;

(5) have production capabilities similar to four-inch (100 mm) marking equipment and shall be capable of placing linear markings up to 8 inches {200 millimeters} in width in a single pass when used for placing markings in widths other than 4 inches {100 millimeters};

(6) have production capabilities considered satisfactory by the Engineer or designated representative, when used to place markings other than solid or broken lines;

(7) be capable of placing a centerline and no-passing barrier-line configuration consisting of one broken line with two solid lines at the same time to the alignment and spacing shown on the Drawings;

(8) be capable of placing broken and/or continuous white line from both sides;

(9) be capable of placing lines with clean edges and of uniform cross-section. All lines shall have a tolerance of plus or minus 1/8 inch per 4-inch width {3 mm per 100-mm width};

(10) have an automatic cut-off device with manual operating capabilities to provide clean, reasonably square marking ends to the satisfaction of the Engineer, and to provide a method of applying broken line in an approximate stripe-to-gap ratio of 10 to 30. The length of the stripe shall not be less than 10 feet (3.05 meters) or more than 10.5 feet (3.2 meters). The total length of any stripe-gap cycle shall not be less than 39.5 feet (12 meters) or more than 40.5 feet (12.3 meters);

(11) provide continuous mixing and agitation of the pavement marking material. The use of pans, aprons or similar appliances, which the die overruns, will not be permitted for longitudinal striping applications;

(12) apply beads by an automatic bead dispenser attached to the pavement marking equipment in such a manner that the beads re-dispensed uniformly and almost instantly upon the marking as the marking is being applied to the road surface. The bead dispenser shall have an automatic cut-off control, synchronized with the cut-off of the pavement marking equipment.

## 871S.4 Construction Methods

A. General.

When required by the Engineer, the Contractor and the Engineer shall review the sequence of Work to be followed and the estimated progress schedule.

Markings may be placed on streets either free of traffic or open to traffic. On streets already open to traffic, the markings shall be placed under traffic conditions that exist with a minimum of interference to the operation of the facility. Traffic control shall be as shown on the Drawings or as approved in writing by the Engineer or designated representative. All markings placed under open-traffic conditions shall be protected from traffic damage and disfigurement. On streets open to traffic with 3 lanes of travel in one direction, all markings shall be placed from the outside lanes only, unless otherwise approved in writing by the Engineer or designated representative.

Guides to mark the lateral location of pavement markings shall be established as shown on the Drawings or as directed by the Engineer or designated representative. The Contractor shall establish the pavement marking guide and the Engineer or designated representative will verify the location of the guides.

Markings shall be placed in proper alignment with the guides. The deviation rate in alignment shall not exceed 1 inch per 200 feet {25 mm per 60 meters} of street. The maximum deviation shall not exceed 2 inches {50 millimeters} nor shall any deviation be abrupt.

Markings shall essentially have a uniform cross-section. The density and quality of markings shall be uniform throughout their thickness. The applied markings shall have no more than five (5) percent, by area, of holes or voids and shall be free of blisters.

Markings, in place on the street, shall be reflectorized both internally and externally. Glass beads shall be applied to the materials at a uniform rate sufficient to achieve uniform and distinctive retroflective characteristics when observed in accordance with TxDOT Test Method Tex-828-B.

Contractor personnel shall be sufficiently skilled in the Work of installing pavement markings.

Markings placed that are not in alignment or sequence, as shown on the drawings or as stated in the Standard Specification Item, shall be removed by the Contractor at its own expense. Removal shall be in accordance with Specification Item 874S, "Eliminating Existing Pavement Markings and Markers", except for measurement and payment. Guides placed on the street for alignment purposes shall not establish a permanent marking on the street.

Unless indicated otherwise on the Drawings, pavement markings shall not be placed sooner than 3 calendar days after the placement of a new hot mix asphaltic concrete surface course or surface treatment.

Unless otherwise shown on the Drawings, pavement markings may be applied by any method that will yield markings meeting the requirements of the Specification Item.

B. Surface Preparation

New Portland cement concrete surfaces shall be cleaned in accordance with Specification Item 875S, "Pavement Surface Preparation for Markings" to remove curing membrane, dirt, grease, loose and/or flaking existing construction markings and other forms of contamination.

Older Portland cement concrete surfaces and asphaltic surfaces that exhibit loose and/or flaking existing markings shall be cleaned in accordance with Specification Item 875S, "Pavement Surface Preparation for Markings" to remove all loose and flaking markings.

Pavement to which material is to be applied shall be completely dry. Pavements shall be considered dry if, on a sunny day after observation for 15 minutes, no condensation occurs in the underside of a 1 foot {300 mm} square piece of clear plastic that has been placed on the pavement and weighted on the edges.

C. Application of Type I Markings.

New Portland cement concrete surfaces shall be further prepared for Type I markings, after cleaning, by placing a Type II marking as a sealer in accordance with the Specification Item. When placing Type I markings in new locations on asphaltic surfaces 3 years old or older or any Portland cement concrete surfaces, a Type II marking shall be used as a sealer. Unless otherwise shown on the Drawings, existing Portland cement concrete and asphaltic surfaces to be restriped will not require Type II markings as a sealer; existing markings may be used as a sealer in lieu of Type II markings. Type II markings shall be placed a minimum of 2 and a maximum of 30 calendar days in advance of placing Type I markings. Type II markings which become dirty due to inclement weather or street conditions shall be cleaned by washing, brushing, compressed air or other means approved by the Engineer, prior to application of Type I markings. If washing is used, the surface of Type II markings shall become thoroughly dry before placing Type I

markings. Color, location and configuration of Type II markings shall be the same as that of Type I markings.

Type I pavement marking material shall be applied within temperature limits recommended by the material manufacturer. Application of Type I pavement markings shall be done only on clean, dry pavement having a surface temperature above $50^0$F ($10^0$C). Pavement temperature shall be measured in accordance with TxDOT Test Method Tex-829-B.

When Type I pavement marking application is by spray, and operations cease for 5 minutes or more, the spray head shall be flushed by spraying pavement marking material into a pan or similar container until the pavement marking material being sprayed is at the proper temperature for application.

Unless otherwise directed by the Engineer in writing, Type I pavement-marking materials shall not be placed on streets between September 30 and March 1, subject to temperature and moisture limitations specified herein.

Unless otherwise shown on the Drawings, the minimum thickness of Type I marking shall be 0.060 inches (60 mil) {1.5 millimeters} for edgeline markings and 0.090 inches (90 mil) {2.3 millimeters} for stop-bars, legends, symbols, gore and center-line/no-passing barrier-line markings, when measured in accordance with TxDOT Test Method Tex-854-B. The maximum thickness of all Type I markings shall be 0.180 inches (180 mil) {4.6 millimeters}.

The thickness of Type I markings at the time of placement will be measured above the plane formed by the pavement surface. The Contractor will supply an approved device to measure the thickness of the applied markings. The markings shall be of uniform thickness throughout their lengths and widths.

D. Application of Type II Markings

The application of Type II marking materials shall be done only on surfaces with a minimum surface temperature of $50^0$F ($10^0$C).

The application rate for Type II marking material shall be between 15 and 20 gallons per mile (35 to 47 liters per kilometer) of solid 4 inch {100 millimeter} line and between 30 and 40 gallons per mile (70 to 95 liters per kilometer) of solid 8 inch {200 millimeter} line. For new surface treatment projects the application rate shall be between 25 and 30 gallons per mile (60 to 70 liters per kilometer) of solid four (4) inch line {one hundred (100) millimeters} and between 40 and 50 gallons per mile (95 to 120 liters per kilometer) of solid 8 inch {200 millimeters} line.

Pavement markings for new surface treatment projects shall be applied in two applications, each approximately one-half the application rate. The first application shall not contain glass beads. The interval between the first and second application shall be a minimum of 1 hour.

When there is impending inclement weather and the Contractor chooses to apply water-based traffic paint and the markings, that are subsequently damaged by rain, sleet, hail, etc., the Contractor is responsible for all costs associated with the replacement markings. The Contractor will be paid, when the work is acceptable.

**871S.5 Performance Period for Type I Markings.**

Type I pavement markings shall meet all the requirements of this technical specification for a minimum of 15 calendar days after installation. Pavement markings that fail to meet all requirements of this specification shall be removed and replaced by the Contractor at its own expense. The Contractor shall replace all pavement markings failing the requirements of this technical specification within 30 calendar days following notification by the Engineer or designated representative of such failing. All replacement markings shall also meet all requirements of this technical specification for a minimum of 15 calendar days after installation.

**871S.6 Measurement**

This Specification Item will be measured by the lineal foot (lineal meter), by each of the various words, shapes or symbols, or by any other unit as shown on the Drawings.

Where double stripes are placed, each stripe will be measured separately.

Type II pavement markings requiring 2 applications on new surface treatments (Specification Item No. 320S) will be measured as 1 marking.

Type II pavement marking materials, when used as a sealer for Type I markings will be measured as Type II markings.

Final work zone pavement markings (paint and beads), which will be used as a sealer for Type I pavement markings, will not be measured for payment.

**871S.7 Payment**

The work performed and materials furnished in accordance with this Standard Specification Item and measured as provided under "Measurement" will be paid for at the Unit bid price for "Reflectorized Pavement Markings" of the various types, colors, shapes, sizes, widths and thickness (Type I markings only) specified. This price shall include full compensation for furnishing all materials; for application of pavement markings; and for all other labor, tools, equipment and incidentals necessary to complete the Work, except as described below.

Surface Preparation, when indicated on the Drawings, will be paid for under Specification Item 875S, "Pavement Surface Preparation for Markings."

Final work zone pavement markings (paint and beads), which will be used as a sealer for Type I pavement markings, shall be included in the unit price bid for the item of construction for which final work zone pavement markings are used.

When replacement Type II markings are required due to damage to the original markings from rain, sleet, hail, etc., and the original markings were placed at the Direction of the Engineer, the Contractor will be paid for the actual quantity of original and replacement markings at the unit bid price for the bid item.

Payment will be made under one or more of the following:

<u>Original placement of Reflectorized Pavement Markings</u>:

**Pay Item 871S-A:** Reflectorized Type I Thermoplastic Pavement Markings ___inches in width, ___mils in thickness_____ in color per lineal foot.

**Pay Item 871S-B:** Reflectorized Type I Thermoplastic Pavement Markings ___inches in width, ___ mils in thickness_____ in color **<u>Words</u>** per each.

**Pay Item 871S-C:** Reflectorized Type I Thermoplastic Pavement Markings **Shapes**
___inches in width, ___ mils in thickness_____ in color per each.

**Pay Item 871S-D:** Reflectorized Type I Thermoplastic Pavement Markings **Symbols**
___inches in width, ___ mils in thickness_____ in color per each.

**Pay Item 871S-E:** Reflectorized Type II Paint Pavement Markings
___inches in width, _____ in color per lineal foot.

**Pay Item 871S-F:** Reflectorized Type II Paint Pavement Markings **Words**
___inches in width, _____ in color per each.

**Pay Item 871S-G:** Reflectorized Type II Paint Pavement Markings **Shapes**
____inches in width, _____ in color per each.

**Pay Item 871S-H:** Reflectorized II Paint Pavement Markings **Symbols**
___inches in width, _____ in color per each.

Replacement of Reflectorized Pavement Markings:

**Pay Item 871S-AR:** Replace Reflectorized Type I Thermoplastic Pavement Markings
___inches in width, ___mils in thickness_____ in color per lineal foot.

**Pay Item 871S-BR:** Replace Reflectorized Type I Thermoplastic Pavement Markings **Words**
___inches in width, ___ mils in thickness_____ in color per each.

**Pay Item 871S-CR:** Replace Reflectorized Type I Thermoplastic Pavement Markings **Shapes**
___inches in width, ___ mils in thickness_____ in color per each.

**Pay Item 871S-DR:** Replace Reflectorized Type I Thermoplastic Pavement Markings **Symbols**
___inches in width, ___ mils in thickness_____ in color per each.

**Pay Item 871S-ER:** Replace Reflectorized Type II Paint Pavement Markings
___inches in width, _____ in color per lineal foot.

**Pay Item 871S-FR:** Replace Reflectorized Type II Paint Pavement Markings **Words**
___inches in width, _____ in color per each.

**Pay Item 871S-GR:** Replace Reflectorized Type II Paint Pavement Markings **Shapes**
___inches in width, _____ in color per each.

**Pay Item 871S-HR:** Replace Reflectorized Type II Paint Pavement Markings **Symbols**
___inches in width, _____ in color per each.

**END**

| ***SPECIFIC*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 871S, "Reflectorized Pavement Markings" |

City of Austin Contract Documents

| Designation | Description |
|---|---|
| Section 00300U | Bid Form (Unit Price) |

City of Austin Standard Specifications

| Designation | Description |
|---|---|
| Item No. 320S | Two Course Surface Treatment |
| Item No. 860S | Pavement Marking Paint (Reflectorized) |
| Item No. 874S | Eliminating Existing Pavement Markings and Markers |
| Item No. 875S | Pavement Surface Preparation For Markings |

Texas Department of Transportation: Manual of Testing Procedures

| Designation | Description |
|---|---|
| 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 |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 871S, "Reflectorized Pavement Markings" |

City of Austin Standard 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. 340S | Hot Mix Asphaltic Concrete Pavement |
| Item No. 341S | Paving Fabric |
| Item No. 350S | Heating, Scarifying and Repaving |
| Item No. 360 | Concrete Pavement |
| Item No. 801S | Construction Detours |
| Item No. 803S | Barricades, Signs and Traffic Handling |
| Item No. 863S | Reflectorized Pavement Markers |
| Item No. 864S | Abbreviated Pavement Markings |
| Item No. 865S | Nonreflectorized Traffic Buttons |
| Item No. 866S | Jiggle Bar Tile |
| Item No. 867S | Epoxy Adhesive |
| Item No. 870S | Work Zone Pavement Markings |
| Item No. 872S | Prefabricated Pavement Markings |
| Item No. 873S | Raised Pavement Markers |
| Item No. 863S-1 | Pavement Buttons (Reflectorized-Type I & Type II) |
| Item No. 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 |

| ***RELATED*** CROSS REFERENCE MATERIALS |
|---|
| Specification Item No. 871S, "Reflectorized Pavement Markings" |

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

| Designation | Description |
|---|---|
| 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 |

Texas Department of Transportation: Departmental Materials Specifications

| Designation | Description |
|---|---|
| DM S-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-10 | Pavement Paint |

**Item No. 874S**
**Eliminating Existing Pavement Markings and Markers**

## 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 301S, “Asphalts, Oils and Emulsions”, and Specification Item 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 two (2) feet {600 mm} wide to cover the existing marking.
2. Placement of a surface treatment, thin overlay or microsurfacing a minimum of one (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 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 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 two (2) foot (600 mm) wide surface treatment for longitudinal markers with no directional change or a minimum of one (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: **Words** ___inches in width per each

**Pay Item 874S- D:** Eliminating Existing Reflectorized Thermoplastic Pavement Markings: **Shapes** ___inches in width per each

**Pay Item 874S- E:** Eliminating Existing Reflectorized Thermoplastic Pavement Markings: **Symbols** ___inches in width per each

**Pay Item 874S- F:** Eliminating Existing Raised Pavement Markings,
____ Type' . per each

**END**

| ***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. 340S | 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 |

| **RELATED** CROSS REFERENCE MATERIALS - Continued |
|---|
| Specification Item No. 874S, “Eliminating Existing Pavement Markings And Markers” |

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-10 | Pavement Paint |

# SPECIAL PROVISION
## To Standard Specification Item No. 506 (Version 03/15/2011)
## Manholes

For this project, Item No. 506, Manholes, of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this section of the City of Austin Standard Technical Specification are waived or changed.

### 1. 506.5 Construction

**Delete** the following Section 506.5(L) Abandonment of Existing Manholes

**Add** the following sections after Section 506.5.K Structural Linings of Existing Wastewater Manholes

L. Abandonment, Removal and Disposal of Existing Manholes for New Manholes Construction

Manholes designated for abandonment and removal by the OWNER's Representative, shall be removed, including base, and properly disposed of.

M. Internal Drop Structure

Internal drop structure shall be constructed per special detail "SD-1 Drop Connections" and standard specification, using products manufactured by Reliner/Duran Inc., or approved equal. All hardware installed shall be stainless steel.

### 2. 506.7 Measurement

**Delete** the paragraphs 2nd and 3rd in the Section 506.7 Measurement

**Add** the following paragraphs after the first paragraph in the Section 506.7 Measurement

A "Standard Pre-cast Portland Cement Concrete Manhole with Pre-cast Base", and "Standard Pre-cast Portland Cement Concrete Manhole with Cast-in-Place (CIP) Base", will be measured by each structure of the indicated size, and the indicated depth.

An "Extra Depth Manhole" will be measured by linear vertical foot of "Standard Pre-cast Portland Cement Concrete Manhole with Pre-cast Base", and "Standard Pre-cast Portland Cement Concrete Manhole with CIP Base" of the indicated size in excess of the indicated depth.

**Add** the following paragraphs at the end of Section 506.7 Measurement

New manholes constructed to interim elevations to facilitate stage construction shall be measured as one unit regardless of the number of interim elevations constructed. All labor, materials and other expenses necessary for the stage construction shall be included in the unit price bid for the completed unit. Cost of "Abandonment, Removal and Disposal of Existing Manholes for New Manholes Construction" shall be included in the unit price bid of new manholes construction for the completed unit.

"Internal Drop Structure" will be measured per each, for all drop lengths, complete in place.

**3. 506.8 Payment**

**Delete** the paragraph 8th in the Section 506.8 Payment

**Add** the following paragraphs

Payment for "Abandonment, Removal and Disposal of Existing Manholes for New Manholes Construction" shall be included in the unit price bid of new manholes construction for the completed unit.

Payment for "Internal Drop Structure" will be paid for at the unit price bid for the indicated size, complete in place. The unit price bid shall include all labor, equipment, materials, time and incidentals necessary to complete the work.

**Add** the following pay items:

Payment will be made under:

**Wastewater:**

| **Pay Item No.** | **Item Description** | **Unit** |
|---|---|---|
| SP506S-EDMWW48 | Extra Depth of Portland Cement Concrete Manhole, 48 Inch Dia. | Per Linear Vertical Foot |
| SP506S-EDMWW72 | Extra Depth of Portland Cement Concrete Manhole, 72 Inch Dia. | Per Linear Vertical Foot |
| SP506S-IDSWW8 | Internal Drop Structure, 10 Inch Inlet and 12 Inch Outlet | Per Each |
| SP506S-MWW48 | Standard Pre-Cast Portland Cement Concrete Manhole w/CIP Base, 48 Inch Dia., including Abandonment, Removal and Disposal of Existing Manhole, Complete in Place **(0 Feet – 8 Feet Depth)** | Per Each |
| SP506S-MWW72 | Standard Pre-Cast Portland Cement Concrete Manhole w/CIP Base, 72 Inch Dia., including Abandonment, Removal and Disposal of Existing Manhole, Complete in Place **(0 Feet – 8 Feet Depth)** | Per Each |
| SP506S- 2 | Remove and Replace Cone and Lid of Existing Manhole | Per Each |

**END**

# SPECIAL PROVISION TO
# Standard Specification Item No. 510
# Pipe (Version 10/03/13)

For this project Item No. 510 Pipe of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

## 510.1 Description

**Add** the following after the last paragraph:

"This item shall also govern trench excavation within the critical root zone of trees, removing oversized rocks from the wastewater trench excavation, and disposal of excess material removed during excavation."

## 510.3(4) Trench Excavation

**Add** the following after the last paragraph:

"Excavation within the critical root zone of trees shall be performed using manual methods (i.e. hand digging) or air spade to minimize potential impacts and damage to the tree. No roots larger than 2 inches shall be cut without prior approval from the City Arborist. All roots that require cutting shall be cut flush with the side of the trench using pruning saws.

The Contractor shall have a certified arborist onsite during all excavation within the critical root zone of trees to monitor construction activities, ensure the protection and preservation of all trees that are not scheduled for removal, and guarantee compliance with the City's Environmental Criteria Manual Section 3 and all applicable City, State, and Federal standards, specifications, guidelines, and requirements. The Contractor's arborist shall be responsible for determining excavation methods, pruning or cutting needs and methods, tree or root treatments to be applied, and coordinating any necessary approvals with the City Arborist.

## 510.4 Measurement

**Add** the following after the last paragraph:

"Oversized rocks that are removed from the wastewater trench excavation shall be measured per Cubic Yard. The first 1000 cubic yards of oversized rocks removed shall be subsidiary to Item 510 "Pipe" pay items. The first 1000 cubic yards of select fill used to backfill the pipe trench shall be subsidiary to Item 510 "Pipe" pay items. For the purpose of this project, an oversized rock is defined as a rock having any dimension greater than 8 inches.

"The Flexible Base and Cold Mix furnished in accordance with Standard Detail 1100S-4 for temporary pavement repairs shall not be paid for directly but shall be subsidiary to Item 510 "Pipe" pay items. This shall include full compensation for all materials, tools, equipment, labor, incidentals, and maintenance necessary to complete this work.

Alternative excavation methods, including hand digging and air spade, will not be measured or paid for directly, but will instead be considered subsidiary to Item 510 "Pipe" pay items.

The Contractor's certified arborist will not be measured or paid for directly, but will instead be considered subsidiary to Item 510 "Pipe" pay items."

**510.5 Payment**

**Add** the following items to the end of Section (1) Pipe:

"v. potholing and surveying to verify locations, alignments and sizes of existing utility pipes and duct banks
w. removal and disposal of existing utility pipes and appurtenances
x. abandonment of existing utility pipes and appurtenances"

**Add** the following Pay Items:

| | | |
|---|---|---|
| **Pay Item No. SP510-LWW:** | Cut / Plug Existing Wastewater Line | Per Each |
| **Pay Item No. SP510-MWW:** | Removal of Excess Oversized Rocks from Wastewater Trench Excavation | Per Cubic Yard |
| **Pay Item No. SP510-RWW:** | Trench Excavation Through Rock, All Depths | Per Linear foot |

**End**

**SPECIAL PROVISIONS TO**
**Standard Specification Item No. 609S**
**Native Grassland Seeding and Planting for Erosion Control (Version 1/4/2016)**

For this project **Native Grassland Seeding and Planting for Erosion Control Item No. 609S** of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

**Article 609S.4 Construction Methods**

**Add** the following to (C) Watering

Watering shall continue for twenty-four (24) months.

**Article 609S.9 Payment**

**Add** the following Pay Item:

| | | |
|---|---|---|
| Pay Item No. **SP609S-E-5-1** | 5-Gallon Rooted Plant - Mexican Plum | Per Each |
| Pay Item No. **SP609S-E-5-2** | 5-Gallon Rooted Plant - Golden Lead Ball | Per Each |
| Pay Item No. **SP609S-E-5-3** | 5-Gallon Rooted Plant - Dessert Willow | Per Each |
| Pay Item No. **SP609S-E-5-4** | 5-Gallon Rooted Plant - Yaupon | Per Each |

**END**

# SPECIAL PROVISION TO
# Standard Specification Item No. 702S Removal and Relocation of Existing Fences
# (Version 05/20/02)

For this project Item No. 702S Removal and Relocation of Existing Fences of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

**Article 702S.2 Removal of Existing Materials**

**Add** the following sections after section E

F. Remove and relocate existing shed.

**Article 702S.5 Measurement**

**Add** the following paragraph after the first paragraph

Shed of the size and type to be relocated will be measured by each.

**Article 702S.6 Payment**

**Add** the following Pay Item

| | | |
|---|---|---|
| **Pay Item No. SP702S-I** | Removing and Relocating Existing Shed | Per Each. |

**End**

# SPECIAL PROVISION TO
# Standard Specification Item No. 803S
# Barricades, Signs and Traffic Handling (Version 06/21/07)

For this project Item No. 803S Barricades, Signs and Traffic Handling of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

## 803S.6 Measurement

**Replace** the entire Section A - Pavement Markings with the following:

"A. Pavement Markings
All pavement marking required for proper installation of the designated Traffic Control Plans and Details, as well as required removal of existing pavement marking, shall be measured as directed under Standard Specification Item No. 870S, "Work Zone Pavement Markings" and Standard Specification Item No. 874S, "Eliminating Existing Pavement Markings"."

## 803S.7 Payment

**Add** the following pay items:

| | | |
|---|---|---|
| "Pay Item No. SP803S-CD-03 | Barricades, Signs, and Traffic Handling; Location 03 | Per Calendar Day |
| Pay Item No. SP803S-CD-04 | Barricades, Signs, and Traffic Handling; Location 04 | Per Calendar Day |
| Pay Item No. SP803S-CD-11 | Barricades, Signs, and Traffic Handling; Location 11 | Per Calendar Day |
| Pay Item No. SP803S-CD-19 | Barricades, Signs, and Traffic Handling; Location 19 | Per Calendar Day |
| Pay Item No. SP803S-CD-26 | Barricades, Signs, and Traffic Handling; Location 26 | Per Calendar Day |
| Pay Item No. SP803S-CD-26A | Barricades, Signs, and Traffic Handling; Location 26A | Per Calendar Day" |

**End**

# SPECIAL PROVISION TO
# Standard Specification Item No. 870S
# Work Zone Pavement Markings (Version 11/21/05)

For this project Item No. 870S Work Zone Pavement Markings of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

## 870S.6 Measurement

**Delete** the following paragraph:

"Payment for revised quantities will be paid for at the unit price bid for that bid item."

## 870S.7 Payment

**Replace** the entire section with the following:

"The work performed and materials furnished in accordance with this Standard Specification Item and measured as provided under "Measurement" will not be paid for directly. "Work Zone Pavement Markings (Removable)", "Work Zone Pavement Markings (Non-removable)", "Work Zone Pavement Markings (Short-Term)" and "Work Zone Pavement Markings (Guide mark)" of the width, color and type shown on the Drawings shall be considered subsidiary to Standard Specification 803S "Barricades, Signs and Traffic Handling". This price shall include full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to place, maintain and remove, when required, the markings, except as described below.

Removal of existing markings will be paid for as directed under Specification Item 874S "Eliminating Existing Pavement Markings and Markers".

Final work zone pavement markings (paint and beads) which will be used within 30 calendar days after application as a sealer for Type I pavement markings will not be paid for under this Specification Item, but will be paid for as directed under Specification Item 871S "Reflectorized Pavement Markings"."

**End**

# SPECIAL PROVISION TO
# Standard Specification Item No. 874S
# Eliminating Existing Pavement Markings and Markers (Version 04/03/09)

For this project Item No. 874S Eliminating Existing Pavement Markings and Markers of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

## 874S.4 Measurement

**Delete** the following paragraph:

"Payment for revised quantities will be paid for at the unit price bid for that bid item."

## 874S.5 Payment

**Replace** the entire section with the following:

"The work performed and materials furnished in accordance with this Specification Item and measured as provided under "Measurement" will not be paid for directly. The bid price for "Eliminating Existing Pavement Markings and Markers" of the various types specified shall be considered subsidiary to Standard Specification 803S "Barricades, Signs and Traffic Handling". 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."

**End**

## SS1025.1: Definitions

This item shall govern the following:

***CONTRACTOR*** means the individual, firm, corporation, or other business entity with whom the OWNER has entered into the Contract (as defined in Section 700).

***DISTRIBUTION LINE*** means a wastewater mainline installed to transport wastewater from a wastewater main located within a public right-of-way or easement.

***IMPROVEMENTS*** means any structure on Customer's Premises to which a Private Lateral will be connected.

***OWNER*** means the 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 (as defined in Section 700).

***PREMISES*** means Customer's property on which a Private Lateral will be relocated.

***PRIVATE LATERAL*** means a wastewater line installed on private property that connects the Improvements on the Premises to the OWNER's Distribution line.

## SS1025.2: References

A. 2015 Uniform Plumbing Code
B. City of Austin Standard Detail 520-AW-01, "Water and Wastewater Service Connection" (adopted: 5/18/2016)
C. City of Austin Standard Detail 520-AW-03, "Wastewater Clean-out Frame and Lid" (adopted: 5/18/2016)
D. City of Austin Standard Specification "510 Pipe (rev. 10-3-2013)"

## SS1025.3: Description

This item shall govern the following:

A. All coordination as described in Section SS1025.4.

B. All preliminary surveying and research shall be done by the contractor prior to placing a bid, in order to ensure an accurate bid price.

C. Locating the existing Private Lateral on the premises between the improvement and the property line and obtaining all necessary elevation information from this line to develop a new wastewater Private Lateral design.

D. Designing, permitting, furnishing, installing and testing a new wastewater Private Lateral on private property with all necessary fittings between the existing improvements and the new wastewater Private Lateral at the property line of the premises. The plumber must be licensed by the State of Texas and registered with the City of Austin. All work on private property must meet the City of Austin Plumbing Code.

E. Notifying the property owner of the proposed wastewater Private Lateral design at least five (5) working days prior to submitting the design to the City of Austin for approval.

F. Obtaining approval for the new wastewater Private Lateral design from an authorized City of Austin Building/Plumbing Inspector.

G. Disconnecting all improvements from the existing Private Lateral and immediately reconnecting these improvements to the new Private Lateral and private distribution and wastewater main.

H. Proper abandonment of the existing Private Lateral after the new Private Lateral is in service. Abandonment shall be considered to be, at a minimum, flushing, cutting and plugging of the existing lateral, per City of Austin standards.

I. The contractor shall be responsible for any damages/ repairs needed for the installation of the new private lateral service.

J. All required submittals as described in Section SS1025.5. A single electronic copy of each submittal may be submitted in lieu of multiple hard copies with prior approval from the Owner's representative, Inspector, and Engineer.

## SS1025.4: Coordination

The CONTRACTOR shall be responsible for the following:

A. The preliminary surveying and researching of the existing private lateral services in order to anticipate any costs associated with the new private lateral service.

B. Coordinating all permit and inspection requirements between the plumber(s) and the City of Austin Building/Plumbing Department and Austin Water Utility.

C. Coordinating all work between the CONTRACTOR, subcontractors performing wastewater improvements for this project within City of Austin Right-of-Way or Easement Areas and the licensed plumber(s) performing wastewater Private Lateral relocation work on private property.

D. Coordinating all work between the plumber(s) and property owner(s) and providing the property owner with appropriate notice and information about the Private Lateral work. CONTRACTOR shall provide written notice to each property owner at least 30 working days prior to work affecting the Private Lateral. CONTRACTOR shall submit to the property owner a proposed design for each residence connected

under the Contract. EACH SKETCH SHALL BE SUBMITTED TO THE OWNER FIVE (5) WORKING DAYS PRIOR TO PERMITTING THE DESIGN AND BEGINNING CONSTRUCTION ON THE PREMISES.

E. Coordinating all work between the plumber(s), OWNER's Construction Inspector and OWNER's Building/Plumbing Inspector. All work performed on private property must be done in the presence of the OWNER's Construction Inspector or OWNER's Building/Plumbing Inspector.

F. Restoring the property owner's lot to the existing condition or better. Coordinate with the property owner on all rehab, restoration, revegetation and damages.

**SS1025.5: Submittals**

The CONTRACTOR shall be responsible for the following submittals in accordance with Section 1300:

A. Plumber(s) License and Registration:
- Ten (10) copies each of both the plumber's license from the State of Texas and registration with the City of Austin. The license and registration must be current, active and in good standing. This is required for each plumber.

B. Photographs and Videotape:
- Two (2) copies of all photographs and videotapes required under Section SS1025.6 will be submitted to the OWNER's REPRESENTATIVE in accordance with the submittal process.

C. Private Lateral Plumbing Design:
- Ten (10) copies of the letter notifying the property owner of the proposed Private Lateral plumbing design shall be submitted to the OWNER's REPRESENTATIVE in accordance with the submittal process prior to beginning any construction on the premises.
- Ten (10) copies of all plumbing design approved and permitted by the City of Austin shall be submitted to the OWNER's REPRESENTATIVE in accordance with the submittal process prior to beginning any construction on the premises.

D. Building/Plumbing Permit:
- Ten (10) copies of all building/plumbing permits from the City of Austin shall be submitted to the OWNER's REPRESENTATIVE in accordance with the submittal process prior to beginning any construction on the premises.

E. Property Owner Notification:
- Ten (10) copies of all notification letters sent to the property owner as required in Section SS1025.4.

F. As-built with Certification Letter:

- Ten (10) copies of all as-builts with certification letters for all approved Private Lateral plumbing work shall be submitted to the OWNER's REPRESENTATIVE in accordance with the submittal process prior to application for payment for any construction on any private premises. The certification letter must state that all work was performed by a licensed plumber, meets City of Austin Plumbing Code and was inspected and approved by a City of Austin Building/Plumbing Inspector. The Inspection Approval Letter shall be attached. The certification letter must be certified by the licensed plumber. PAYMENT FOR A COMPLETELY CONNECTED RESIDENCE SHALL NOT BE MADE UNTIL AN AS-BUILT SKETCH WITH CERTIFICATION LETTER FOR THAT RESIDENCE HAS BEEN SUBMITTED. Such sketches may be red-lines of the permitted Private Lateral Plumbing Design. The as-built sketches shall, at a minimum, identify all installed lengths of pipe, cleanout locations, points of intersections (PIs), fittings, adapters, concrete supports, distances from permanent structures such as house slabs, pools, sheds, etc. and any other information that may assist the home owner in identifying the Private Lateral location at a later date. The CONTRACTOR shall review each as-built sketch with the OWNER's Construction Inspector and OWNER's Building/Plumbing Inspector prior to submitting to the OWNER's REPRESENTATIVE. Upon acceptance, the OWNER's Construction Inspector shall provide each property owner with a copy of the as-built with certification letter.

### SS1025.6: Photographs and Videotape

A. Prior to initiating any construction at a residence, CONTRACTOR shall document pre-construction conditions of each residence by use of a digital camera. A minimum of five digital exposures of each residence shall be taken, or otherwise an adequate number, to fully document all landscaping, residential features and existing conditions along the entire connection alignment of each residence that may be affected during construction. Two (2) copies of all such documentation shall be provided in electronic format, in accordance with Section 01380 (Construction Photographs), to the OWNER's REPRESENTATIVE prior to initiating any construction at a residence.

B. A video of each property showing the proposed Private Lateral alignment shall be taken prior to beginning any construction on private property. Two (2) copies of the all such documentation shall be provided to the OWNER's REPRESENTATIVE prior to initiating any construction at a residence. An additional video shall be taken along the same route following completion of the fieldwork, but prior to final acceptance of project. Both the initial and final videos shall show details of all objects within and in close proximity of the construction work area, with particular attention to landscaping, trees, plants, shrubs, sidewalks, pavement and other surface features. Videos shall also be taken of all staging and storage areas used on the premises. Two (2) copies of the all such documentation shall be provided to the OWNER's REPRESENTATIVE prior to final acceptance of project.

## SS1025.7: CONTRACTOR Responsibilities

A. All building/plumbing permits as described in Section 00810 of the Contract Documents.

B. The CONTRACTOR shall perform all work within public right-of-ways and easement areas. The CONTRACTOR shall be responsible for the distribution lines and Private Lateral between the distribution line and the property line, including all fittings and cleanouts at the property line.

C. The CONTRACTOR shall have a licensed plumber design and perform all work on private property between the new wastewater Private Lateral at the property line and the improvements on the premises. This work shall include supplying and installing all necessary fittings, bends, adapters, cleanouts, and concrete supports. The plumber must be licensed by the State of Texas and registered with the OWNER.

D. All work on private property must meet the City of Austin Plumbing Code.

E. All work shall be inspected and approved by the OWNER's Wastewater Plumbing/Building Inspector. A new Private Lateral shall not be used until this Plumbing/Building Inspector grants approval in writing. The CONTRACTOR shall coordinate all required inspections.

F. No Private Lateral shall be relocated or connected to a new distribution line until the OWNER's Construction Inspector has approved the new distribution line for use.

G. No segment of an existing distribution line shall be abandoned until after all Private Laterals connected to this segment of the existing distribution line are relocated and connected into the new distribution line, all relocated Private laterals have been approved by the OWNER's Plumbing/Building Inspector, and all relocated Private Laterals are fully active on the new distribution line.

## SS1025.8: Private Lateral Requirements

A. All Work under this Contract must comply with the City of Austin Plumbing Code as referenced in Section SS1025.2, all applicable rules, codes and regulations of the Texas Commission on Environmental Quality (TCEQ) for wastewater service connections. Formal certification letters that line installations, Private Lateral connections and Private lateral abandonment were completed in compliance with the City of Austin Plumbing Code and all applicable rules, codes and regulations, shall be submitted for each residence so connected under the Contract as required in Section SS1025.5 (F).

B. Each new private lateral must comply with/ pass the "Quality Testing for installed Pipe," described in Specification 510.3 (Pipe), Section 26.

C. Restoration to the existing condition or better shall be an on-going process during construction operations and shall immediately follow completion of construction for each residence.

### SS1025.9: Maintaining Wastewater Service to Residences

A. CONTRACTOR shall ensure that no improvement is without wastewater service at any time except for the minimum time required to make the formal reconnection from the existing Private Lateral to the new Private lateral. During the reconnection of the existing Private Lateral to the new Private lateral, the CONTRACTOR shall specifically coordinate with the property owner and tenant(s), and OWNER's Construction Inspector to minimize any inconveniences to the resident(s) and, to the full extent possible, limit the length of time the residence is out of wastewater service to no more than two to three hours. Upon completion of the connection, the CONTRACTOR shall immediately notify the property owner and resident(s) that wastewater service has been restored.

### SS1025.10: Right Of Entry Agreement

The OWNER will be responsible for obtaining a Right Of Entry Agreement from each property owner. The Right of Entry Agreement authorizes the CONTRACTOR to relocate the Private Lateral on the premises. A copy of the Right Of Entry documents will be provided to the CONTRACTOR.

### SS1025.11: Measurement and Payment

Private Lateral Relocation, when so called for in the design or specifications, will be paid for at the unit bid price for each Private Lateral relocation; for the size, type and class specified in the 2015 Uniform Building Code, as adopted and amended by ordinance for the City of Austin, complete and in place.

The bid price shall include excavation, pavement and sidewalk removal, dewatering, pipe, fittings, encasement pipe, bedding material, traffic control, disposal of surplus material, laying of pipe, backfilling, compaction of backfill, quality testing, repairing damage to any existing structures, abandonment of existing Private Lateral, pavement and sidewalk replacement, landscape restoration, revegetation, cleanup, and one year warranty.

For private lateral relocations requiring cutting through asphalt pavement, CONTRACTOR shall make a full trench repair using COA Standard Detail 1100S-2. For Private Lateral relocations requiring cutting into concrete pavement, CONTRACTOR shall remove and replace damaged panels. For Private Lateral relocation alignments requiring cutting the length of a residential concrete driveway, CONTRACTOR shall remove and replace the entire driveway. CONTRACTOR shall utilize materials complying with the Specifications listed within the Contract Documents. All costs for cutting, removing, disposing, and replacing of pavement, including seal coat and reinforcement bars, shall be included in the bid price.

PAYMENT FOR A COMPLETELY CONNECTED RESIDENCE SHALL NOT BE MADE UNTIL AN AS-BUILT SKETCH WITH CERTIFICATION LETTER FOR THAT RESIDENCE HAS BEEN SUBMITTED AS DESCRIBED IN SECTION SS1025.5 (F).

Payment will be made under the following:

**Pay Item No. SS1025-WW**: Relocate Private Wastewater Service Line Per Each

**END**

## SS1540.1 Description

A. This special specification governs bypass pumping for the flow of wastewater around the section or sections of pipe designated for removal and replacement or in-place rehabilitation including active services.

B. The work covered by this specification consists of furnishing all labor, supervision, tools, equipment, appliances, and materials to perform all operations in connection with pumping of wastewater and wet weather flows around pipe section(s). The purpose of bypass pumping is to prevent wastewater overflows and provide reliable sewer service at all times. The Contractor shall maintain sewage flow in the construction area in order to prevent back-up and/or overflow into upstream pipe segments and laterals, adjacent ditches, storm sewers, and waterways.

C. Anticipated flow rates based on diameter of wastewater main:

| Diameter (in) | General Flow (gpm) |
|---|---|
| 6 | 400 |
| 8 | 400 |
| 12 | 1,100 |

If the pipe size at a location is not listed in the tables above, then the contractor shall coordinate with the Wastewater Collection System Engineering Division to determine the flow rate at that location.

## SS1540.2 Definitions

A. Bypass pumping is the installation and operation of plugs, hoses, piping, and pumps to maintain wastewater flow and prevent backup and overflow.

B. Bypass pumping provides continuous wastewater service to the users while maintenance or construction operations are in progress by diverting flow when necessary around the construction location and pumping it to a downstream manhole.

## SS1540.3 Contractor's Responsibility

A. It is the sole responsibility of the CONTRACTOR to locate and identify all existing sewer lines and services and to provide any and all labor, material, equipment, techniques and methods to bypass pump as necessary for his construction methods and to monitor the effectiveness of this installed system and its effect on adjacent facilities.

B. Operate, maintain and modify the system(s) as required to conform to this specification. Upon completion of the Construction, CONTRACTOR shall remove the system(s).

C. Assume sole responsibility for bypass pumping systems and for all loss or damage resulting from partial or complete failure of protective measures and any spills or resultant damage caused by his operation.

D. It is the sole responsibility of the CONTRACTOR to ensure that bypass pumping operations do not cross, close, reduce, or otherwise impact any streets classified by the Austin Transportation Department as "Critical Arterials".

## SS1540.4 Materials

A. The pump and bypass pumping lines shall be of adequate capacity and size to handle peak wet weather flows. All piping, joints, and accessories shall be designed to withstand at least twice the maximum system pressure, or a minimum of 50 psi, whichever is greater.

B. Fused high density polyethylene (HDPE) or heavy wall discharge hose shall be used. Four-inch and six-inch diameter discharge hose shall be capable of limited traffic driving over the hose for situations where the hose crosses a driveway.

C. Pumps shall be self-priming, in good working order, with a working pressure gauge on the discharge. A back-up pump of the same capacity as the primary pump shall be maintained on site at all times to be used in the event that the primary pump fails. No wastewater shall be allowed to drain or stand in earthen sump pits.

D. All pumps shall be equipped with integral sound attenuating enclosures. Sound attenuated pumps shall reduce noise generated by the equipment to a maximum of 70 dBA when measured 30 feet from the pump as 50% throttle.

E. Any wastewater back-ups and/or overflows as the result of inadequate equipment are the responsibility of the Contractor.

F. The Contractor shall be required to have all materials, equipment, and labor necessary to complete the pipe rehabilitation work on the job site prior to isolating the wastewater manhole or line segment and beginning by-pass pumping operations.

**SS1540.5 Submittals**

A. Submittals: Comply with Item 01300 “Submittals.”

B. The Contractor shall provide a written description and plan/sketch for implementation and sequencing of bypass pumping for review and approval of the Owner prior to installation of the bypass system. The plan shall include sufficient detail to show the location, number and size of pumps, the number, location, size and type of hoses and/or rigid piping, and the location of the downstream discharge. Show any special features where pipes or hoses cross roadways, such as temporary trenches, support bridges, etc. A plan for each line segment(s) around which flows are being bypassed is required. The plan shall include but not be limited to details of the following:

(a) Project information including the project name, location, and permit number (from plan cover sheet).

(b) Contact information for general contractor/submitting entity shall include the company name, contact person (24hrs/day), phone number(s), and fax number.

(c) Staging areas for pumps including a schematic showing the arrangement and layout of the pumping and bypassing facilities at various stages in the work.

(d) Sewer plugging method and types of plugs.

(e) Calculations for selection of bypass pump and pipe size(s) based on wastewater flows.

(f) Length, size, material, location and method of installation of suction piping.

(g) Length, size, material, location, method of installation and location of discharge piping and hose.

(h) Pump manufacturer model and pump curve.

(i) Calculations of static lift, friction losses, and flow velocity, (pump curves showing pump operating range shall be submitted).

(j) Downstream discharge plan.

(k) Method of protecting discharge manholes or structures from erosion, damage, and unauthorized entry.

(l) Method of noise control for each pump and expected decibel levels.

(m) Any temporary pipe supports and anchoring, if required.

**SS1540.6 Construction Methods**

A. The normal practice will be to setup by-pass pumping at the beginning of each work day and pump around to allow for the day's wastewater construction activities; however, continuous by-pass pumping for longer than one day may be necessary, depending on the Contractor's means and methods. With normal practice, the preferred suction point will be at a manhole upstream of the relay section. In some cases, the suction location may be the existing pipe in the trench. Discharge of bypass must be into a manhole (discharge into a cleanout is not acceptable). At the end of the work day, the new and existing pipe will be reconnected to allow gravity flow until the next work day. Access to driveways must be coordinated with residences / businesses and maintained during by-pass pumping.

B. The contractor's efforts shall maintain sewage flow to prevent backup of sewage in the collection system with the goal of preventing an overflow onto streets, yards and unpaved areas or into buildings, adjacent ditches, storm sewers, and waterways. Do not divert sewage outside of the sanitary sewer system. The Contractor shall take all necessary steps to prevent flooding of public or private property. Maintaining flow inside the existing pipe during rehabilitation operations is preferred.

C. Any time the bypass pump(s) are operating, an experienced operator shall be on site to monitor the operation: adjust pump speed, valves, etc.; maintain and make minor repairs to the system; and report problems.

D. Where work requires bypassing beyond working hours, the Contractor shall operate bypass pumping and provide at least 2 attendants for the system for twenty-four (24) hours per day.

E. Contractor shall ensure that no damage will be caused to private property as a result of bypass pumping operations. Access to adjacent properties shall be maintained at all times including driveways. Ramps, steel plates, or other methods shall be employed by the Contractor to facilitate traffic over surface piping and hose. High traffic commercial properties may require alternate methods to maintain access.

F. Contractor shall complete the Work as quickly as possible and satisfactorily pass all tests, inspections, and repair all deficiencies prior to discontinuing bypass pumping operations and returning flow to the sewer manhole or line segment.

G. During bypass pumping, do not allow sewage to be leaked, dumped, or spilled in or onto any area outside of the existing sanitary sewer system.

H. In the event of accidental spill or overflow, immediately stop the discharge and take action to clean up and disinfect the spill. Promptly notify the Owner so that required reporting can be made to the Texas Commission on Environmental Quality (TCEQ) by the Owner.

I. In the event of accidental spill or overflow, the Contractor is responsible for any damages that may have occurred to public or private property including cleaning, disinfection, and other corrections to the satisfaction of the E/A at no cost to the Owner.

J. Contractor shall not intentionally damage, alter, or remove portions of the existing sewer system structures for the purpose of installing a bypass pumping system without specific approval from the E/A or Inspector. If a structure is damaged, it shall be reconstructed or replaced to the satisfaction of the E/A at no additional cost to the Owner.

K. The Contractor shall be responsible for any and all damage that results directly or indirectly from the interference of storm water runoff to bypassing equipment, piping, and/or appurtenances.

L. When bypass pumping operations are complete, piping shall be drained into the sanitary sewer prior to disassembly, and all pumps and lines shall be flushed with clean water until all discharge is clear.

M. Plugging a manhole and holding wastewater in the manhole while work is performed downstream is unacceptable.

**SS1540.7 Scheduling**

A. The Contractor shall report any bypass pumping activities not included in the submitted plan to the Engineer prior to proceeding with these activities.

B. The Contractor shall cease bypass pumping operations when directed by the Engineer.

C. The Contractor shall perform leakage and pressure tests of the bypass pumping discharge piping using clean water prior to actual operation. The Engineer will be given a 24 hour notice prior to testing.

**SS1540.8 Measurement and Payment**

No separate payment will be made for installation, operation, maintenance, or removal of bypass pumping systems. Payment for furnishing all materials, tools, equipment, labor, fuel, and incidentals to perform the bypass pumping will be considered subsidiary to Standard Specification 510 “Pipe”.

**End**

## SS1900.1 Summary

This specification shall govern the removal and disposal of asbestos cement pipe.

## SS1900.2 References

See Section 01901 through 01917 for full description of work. Contractor shall comply with all requirements of Section 01901 through 01917.

## SS1900.3 Measurement

Removal and disposal of asbestos cement pipe shall be measured per linear foot.

## SS1900.4 Payment

Payment for removal and disposal of asbestos cement pipe of the size indicated on the Drawings shall be made at the appropriate unit bid price. The unit bid price shall include all labor, equipment, materials, time, and incidentals necessary to complete the work.

**Pay Item No. SS1900-__:** Removal and Disposal of __ AC Pipe Per Linear Foot

**End**

## PART 1 GENERAL

### 1.01 SCOPE

**A.** This specification covers the excavation, handling, loading, temporary storage, transportation and disposal of contaminated soils and water encountered during the installation of the planned wastewater improvements. An environmental assessment (included as an attachment to this specification) indicated that hydrocarbon odors were noticeable in some project locations, which may indicate contaminated soils and groundwater are present at depths less than the proposed depth of the wastewater line excavation. Based on this assessment, if the CONTRACTOR encounters, during excavation and/or earth moving for the work, soil or groundwater that is contaminated, discolored, has a noticeable odor or is otherwise out of the ordinary, the CONTRACTOR shall immediately notify the OWNER and follow the procedures set forth in this Section.

### 1.02 REGULATORY REQUIREMENTS

**A.** Work covered under this specification shall be performed in accordance with all applicable local, state, and federal regulations, statues, codes, rules, ordinances and policies. In the event of a conflict, the more stringent standards shall apply. Applicable regulations and laws include, but are not limited to:

- *Code of Federal Regulations, Title 29, Part 1910.120 Hazardous Waste Operations and Emergency Response* (29 CFR § 1910.120). U.S. Government Printing Office, Washington, DC.
- RG-022 – Texas Natural Resource Conservation Commission. *Classifying and Coding of Industrial and Hazardous Waste*. Austin, TX.
- SW-846 - U.S. Environmental Protection Agency. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Vol. I*. Washington, DC.
- *Texas Administrative Code, Title 30, Chapter 335* (30 TAC § 335). Office of the Secretary of State, Austin, TX.
- *Texas Administrative Code, Title 30, Chapter 350* (37 TAC § 350). Office of the Secretary of State, Austin, TX.
- *Texas Administrative Code, Title 37, Chapter 16* (37 TAC § 16). Office of the Secretary of State, Austin, TX.
- *Austin City Code, Volume 1, Title IV § 4-1-82*
- *Austin City Code, Volume 1, Title XVIII § 18-2-003*

### 1.03 HEALTH AND SAFETY

**A.** The CONTRACTOR shall be responsible for developing, implementing, and maintaining a health and safety program for their personnel including subcontractors. Prior to commencement of work, the CONTRACTOR shall submit a site-specific

Health and Safety Plan (HASP) to the OWNER for review. *The HASP shall be prepared and signed by a certified safety professional (CSP) or a certified industrial hygienist (CIH).* The resume of the CSP or CIH shall be submitted as an attachment to the HASP and shall document their qualifications and applicable experience. In addition to the health and safety requirements as described in the sewer construction specifications, the HASP shall address exposure of workers to contaminated soil and groundwater, temporary storage, transportation and disposal of contaminated materials. The HASP shall be prepared in accordance with the requirements of 29 CFR 1910.120 and shall contain, at minimum, the following sections:

- Project Description
- Site Description
- Summary of Field Activities
- Listing of Field Staff including Project Manager, On-site Manager, and Health and Safety Officer
- Emergency Contact Information
- Site Control Measures
- Identification of Environmental Hazards
- Protective Equipment
- Exposure Limits for Chemicals of Concern
- Monitoring Requirements and Action Levels
- Decontamination Procedures
- Disposal Procedures
- Employee Training Records
- *Resume of CSP or CIH*

1.04 RECORD KEEPING

**A.** When performing work within the scope of this specification, the CONTRACTOR shall be responsible for maintaining a Project record on-site that includes:

1. A copy of the CONTRACTOR's HASP;
2. A daily sign in sheet including the signatures of all personnel, regardless of affiliation, who enter the site acknowledging that they;
   i. Have read and understood the CONTRACTOR'S Site Specific HASP;
   ii. Meet the training requirements described in the CONTRACTOR HASP; and
   iii. Have been made aware of potential site hazards including environmental hazards.
3. A copy of all waste manifests or load tickets generated during the transport of contaminated soils or water in accordance with Section 3.07 of this Specification.

4. A copy of all waste manifests or scale tickets generated during the disposal of contaminated soils or water in accordance with Section 3.08 of this Specification.

## PART 2 PRODUCTS

### 2.01 PLASTIC SHEETING

**A.** The CONTRACTOR shall use plastic sheeting at least 6 mil thick for lining of all trucks, transport vehicles, soil stockpiles, and roll-off boxes.

**B.** Plastic sheeting shall be used and or applied in a manner to prevent migration of soils and contaminants from soils. Soil stockpiles must be placed on, and covered by, plastic sheeting. Under no circumstances will leakage of fluids from soil stockpiles, roll-off boxes or transport trucks be allowed.

## PART 3 EXECUTION

### 3.01 EXCAVATION

**A.** If an area of potential soil contamination is identified, then the CONTRACTOR shall place all excavated soils from that approximate area into soil stockpiles or lined roll-off containers in the designated staging area. For areas beyond the approximate area of soil contamination, the CONTRACTOR shall notify the OWNER if soil or groundwater is encountered that is contaminated, discolored, has a noticeable odor or is otherwise out of the ordinary. This notification shall be made immediately upon encountering contaminated soil and groundwater beyond the limits currently identified.

**B.** If the excavation fills with water such that the CONTRACTOR cannot perform construction activities in accordance with the construction specifications, the OWNER shall determine, if the water is potentially contaminated in accordance with Section 3.03 of this specification. The CONTRACTOR shall collect water that is found to be potentially contaminated in a clean temporary storage tank.

### 3.02 MONITORING

**A.** During excavation activities, the CONTRACTOR shall be responsible for monitoring the excavation for potentially hazardous vapor concentrations and preventing exposure of workers to contaminated media in accordance with their health and safety plan.

**B.** If contaminated soils or groundwater, (soil or groundwater that is discolored, has a noticeable odor or is otherwise out of the ordinary) are encountered, then the CONTRACTOR shall immediately notify the OWNER or OWNER'S REPRESENTATIVE, who will screen excavated soils. The CONTRACTOR shall abide by the directions of the OWNER'S REPRESENTATIVE and shall provide the OWNER'S REPRESENTATIVE the opportunity to screen soils in accordance with the following procedure:

1. The OWNER'S REPRESENTATIVE will screen excavated soil with a photoionization detector (PID). If OWNER or OWNER's REPRESENTATIVE determines that readings are above pre-determined

action levels, the CONTRACTOR shall stage soils in soil stockpiles or roll-offs separate from other fill materials.

2. If the OWNER'S REPRESENTATIVE determines that soils are contaminated by visual inspection or odor, the CONTRACTOR shall stage soils in soil stockpiles or roll-offs separate from the other fill materials.

3.03 COLLECTION OF SAMPLES

**A.** The OWNER or OWNER'S REPRESENTATIVE will collect soil samples from stockpiled soil that is suspected to be contaminated, confirmation samples from clean soil stockpiles, and samples of potentially contaminated groundwater based on the procedures defined in Section 3.02 of this specification. The OWNER shall pay for any testing undertaken for soil that is suspected of contamination due to existing conditions. The OWNER or OWNER'S REPRESENTATIVE will perform waste characterization (testing) of the soil and water, and the CONTRACTOR shall abide by the waste characterization decisions of the OWNER. Depending on the type of contamination discovered, testing duration may be up to three (3) weeks. Testing may need to be conducted on an ongoing basis as additional contaminated soil is discovered. Soils that are thought to be contaminated must remain in the staging area and protected from rainfall and contact by the CONTRACTOR until the OWNER determines how the soil is to be disposed in accordance with Section 3.07–of this Specification.

3.04 TEMPORARY STORAGE

**A.** Soils that are determined by the OWNER or OWNER'S REPRESENTATIVE to be potentially contaminated by shall be staged in soil stockpiles or roll-off containers separately from soils that are to be used as fill. Soil stockpiles shall be placed on, and covered by, plastic sheeting. Roll-off containers shall be covered to prevent accumulation of water in the container. The roll-off containers shall be located so that they do not block surface drainage pathways, or prevent access to storm sewer inlets or manholes. The CONTRACTOR must ensure that roll-off containers and soil stockpiles are completely sealed and covered. The CONTRACTOR will be responsible for replacing or repairing any roll-off box found to be leaking or in poor condition.

**B.** Water that is determined by the OWNER or OWNER'S REPRESENTATIVE to be contaminated shall be collected as required to allow work. Such water shall be collected and temporarily stored in clean, sealed tank(s) by CONTRACTOR. The CONTRACTOR shall place tank(s) such that they do not block surface drainage pathways, storm sewer inlets or manholes. The CONTRACTOR shall be responsible for repairing or replacing any tanks that are found to be leaking or in poor condition.

**C.** During storage, contaminated soil and groundwater containers shall be placed within designated or approved areas. The limits of these areas shall be indicated via barricades, flagging, and/or fencing and access to storage areas shall be restricted.

3.05 CLASSIFICATION OF SOILS AND WATER

**A.** The OWNER or OWNER's REPRESENTATIVE will determine the waste classification of soils and groundwater for the purpose of proper disposal.

**B.** Confirmation samples collected from clean soil must have Total Petroleum Hydrocarbon (TPH) concentrations, as measured by Method TX 1005, less than 60 mg/kg per Texas Risk Reduction Program Tier 1 Protective Concentration Levels. Soils with TPH concentrations greater than 60 mg/kg but less than 1500 mg/kg are classified as Class 2 industrial non-hazardous waste and must be disposed in accordance with Section 3.07 at a permitted Class 2 industrial waste landfill.

**C.** Soils with TPH concentration greater than or equal to 1500 mg/kg are classified as Class I industrial non-hazardous wastes and must be disposed at a permitted Class I landfill.

**D.** Groundwater with TPH concentrations less than 0.73 mg/L is unregulated and can be disposed of by the contractor in accordance with city stormwater disposal regulations. Groundwater with TPH concentrations greater than 0.73 mg/L but less than 1500 mg/l TPH concentration is classified as Class 2 industrial, non-hazardous waste. Groundwater with TPH concentration greater than or equal to 1500 mg/l must be classified as Class I industrial non-hazardous waste.

3.06 TRANSPORTATION

**A.** The CONTRACTOR shall perform transport operations in a manner that precludes the spread of contamination. The CONTRACTOR shall remediate waste spillage in transport in accordance with applicable requirements of 30 TAC 335.93, 330.34, and other applicable Federal, State, and local regulations at no additional cost to the OWNER.

Open waste transport vehicles shall be covered by the CONTRACTOR prior to leaving the project site. Covers shall be constructed from water-resistant material with sufficient strength to withstand wind loads during transit. Covers shall effectively prevent release of dust from the transport vehicle. Covers shall have tie-downs or other restraint mechanisms necessary to securely fasten them to the transport vehicle.

Waste transport vehicles shall not leave the project site until the OWNER or OWNER'S REPRESENTATIVE signs the waste manifest as generator of the waste. The CONTRACTOR shall not sign any waste manifest or shipping papers as generator. Payment will not be made for any waste shipment that leaves the site without signatory approval of OWNER or OWNER's REPRESENTATIVE.

The CONTRACTOR shall line all trucks transporting potentially contaminated or known contaminated soils with plastic liner as described in Section 2.01 of this specification. The liner shall be secured in such a manner as to prevent the leaking of liquid materials from the truck bed. The CONTRACTOR shall be responsible for ensuring that trucks leaving the site are NOT leaking liquid materials, and shall be

responsible for sealing or re-lining any trucks that are leaking liquids. The CONTRACTOR shall also be responsible for clean-up of any releases.

**B.** The CONTRACTOR shall retain a copy of all waste manifests and load tickets for each waste shipment prior to off-site transportation, for record purposes. The CONTRACTOR shall submit a copy of all waste manifests and load tickets to the OWNER within THREE (3) business days of transport. The CONTRACTOR shall notify the OWNER whenever a waste shipment does not arrive at the approved disposal site in a timely manner.

The CONTRACTOR will inspect vehicles before they enter or exit the Project site to verify compliance with decontamination criteria provided in Part A of this Section. The CONTRACTOR shall be responsible to remedy deficiencies identified by OWNER or OWNER REPRESENTATIVES.

**C.** All transport vehicles shall be properly licensed, labeled and placarded in a manner consistent with TCEQ and DOT regulations for material being transported.

3.07 DISPOSAL

**A.** The CONTRACTOR shall submit contact information for off-site hazardous and non-hazardous waste transfer, storage, processing, and disposal facilities prior to the commencement of work to the OWNER for approval. The OWNER or appointed representative must review and approve of all off-site disposal facilities prior to commencement of work. In the event that the CONTRACTOR does not receive approval from the OWNER or the appointed representatives for the selected off-site disposal facility prior to starting work, the CONTRACTOR will be responsible for all costs incurred in identifying an alternative off-site disposal facility and the cost of staging any contaminated material until a facility acceptable to the OWNER is identified.

**B.** The CONTRACTOR shall retain a copy of all waste manifests, certificates of disposal, and load or weight tickets from disposal facility on-site for the duration of the project and submit copies of the waste manifests, certificates of disposal, and load or weight tickets with the corresponding Application for Progress Payment.

3.08 DECONTAMINATION

**A.** The CONTRACTOR shall be responsible for preventing the spread of contaminated material beyond the excavation and temporary storage areas. To accomplish this, the CONTRACTOR shall include, as part of the health and safety plan, written procedures for decontamination of personnel and equipment, including transport vehicles, that come in contact with potentially contaminated material.

**B.** The CONTRACTOR shall establish exclusion and contamination reduction zones around the excavation when potentially contaminated soils and/or water are encountered. The exclusion zone is the zone around the excavation and the temporary storage piles and/or tanks. All personnel and equipment entering or exiting the exclusion zone must do so through the contamination reduction zone.

The contamination reduction zone includes all of the equipment and materials necessary to clean workers and equipment, and to collect all decontamination materials and water for proper disposal.

**C.** The CONTRACTOR shall be responsible for all fines, penalties, or citations resulting from non-conformance with these specifications.

## PART 4 MEASUREMENT AND PAYMENT

4.01 Work Includes

**A.** Provide all labor, equipment, and materials to excavate, handle, load, place in temporary storage, transport, and dispose of contaminated soils and groundwater in accordance with this specification.

4.02 Measurement

**A.** Soils- Measurement of soils will be based on tons of waste received and disposed at the approved off-site facility as weighed on a certified scale at the disposal facility. Submittal of certificates of disposal and weight tickets will be required for all nonhazardous solid wastes prior to the OWNER's recommendation for payment. Submittal of final waste manifests will be required for Class I industrial nonhazardous solid wastes prior to the OWNER's recommendation of payment. Soils transported and disposed of off-site shall contain no free liquids.

**B.** Water - Measurement of bulk liquid nonhazardous wastes will be based on gallons of wastewater received and disposed at the approved facility/location as measured at the disposal facility/location by a means accepted by the OWNER. Measurement of nonhazardous liquid wastes in drums, barrels or other containers will be based on the number of waste containers received and disposed at the off-site facility. Submittal of certificates of disposal and load tickets will be required for all nonhazardous liquid wastes prior to the OWNER's recommendation of payment. Submittal of final waste manifests will be required for Class I industrial nonhazardous wastes prior to the OWNER's recommendation of payment.

4.03 Payment – Payment for soil and water disposal under this section shall be all inclusive of all costs associated with disposal of this material, including but not limited to fees, temporary storage, loading and unloading storage containers, decontamination of equipment if required, and any and all other costs associated with disposal of this material.

Payment, when included as a Contract pay item, will be made under one of the following:

| | | |
|---|---|---|
| Pay Item No. SS4150-CL1-S | Removal and Disposal of Class I Contaminated Soil | Per Ton |
| Pay Item No. SS4150-CL2-S | Removal and Disposal of Class II Contaminated Soil | Per Ton |

| | | |
|---|---|---|
| Pay Item No. SS4150-CL1-L | Removal and Disposal of Class I Contaminated Liquid | Per Gallon |
| Pay Item No. SS4150-CL2-L | Removal and Disposal of Class II Contaminated Liquid | Per Gallon |

## PART 5 ENVIRONMENTAL ASSESSMENT REPORT

See attached “Final Report, Environmental Sampling Services”.

# Item 340
# Dense-Graded Hot-Mix Asphalt (Small Quantity)

## 1. DESCRIPTION

Construct a hot-mix asphalt (HMA) pavement layer composed of a compacted, dense-graded mixture of aggregate and asphalt binder mixed hot in a mixing plant. This specification is intended for small quantity (SQ) HMA projects, typically under 5,000 tons total production.

## 2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

2.1. **Aggregate**. Furnish aggregates from sources that conform to the requirements shown in Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse, intermediate, or fine aggregate. Aggregate from reclaimed asphalt pavement (RAP) is not required to meet Table 1 requirements unless otherwise shown on the plans. Supply aggregates that meet the definitions in Tex-100-E for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in Tex-200-F, Part II.

2.1.1. **Coarse Aggregate**. Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance; and
- once approved, do not add material to the stockpile unless otherwise approved.

Provide aggregate from non-listed sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources.

Provide coarse aggregate with at least the minimum SAC shown on the plans. SAC requirements only apply to aggregates used on the surface of travel lanes. SAC requirements apply to aggregates used on surfaces other than travel lanes when shown on the plans. The SAC for sources on the Department's *Aggregate Quality Monitoring Program* (AQMP) (Tex-499-A) is listed in the BRSQC.



Adopted by for Project by City of Austin, January 14, 2019

2.1.1.1. **Blending Class A and Class B Aggregates**. Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate to meet requirements for Class A materials. Ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source when blending Class A and B aggregates to meet a Class A requirement. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300. Coarse aggregate from RAP and Recycled Asphalt Shingles (RAS) will be considered as Class B aggregate for blending purposes.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 4 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 4 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

2.1.2. **Intermediate Aggregate**. Aggregates not meeting the definition of coarse or fine aggregate will be defined as intermediate aggregate. Supply intermediate aggregates, when used that are free from organic impurities.

The Engineer may test the intermediate aggregate in accordance with Tex-408-A to verify the material is free from organic impurities. Supply intermediate aggregate from coarse aggregate sources, when used that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve, and verify that it meets the requirements in Table 1 for crushed face count (Tex-460-A) and flat and elongated particles (Tex-280-F).

2.1.3. **Fine Aggregate**. Fine aggregates consist of manufactured sands, screenings, and field sands. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with Tex-408-A to verify the material is free from organic impurities. No more than 15% of the total aggregate may be field sand or other uncrushed fine aggregate. Use fine aggregate, with the exception of field sand, from coarse aggregate sources that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve, and verify that it meets the requirements in Table 1 for crushed face count (Tex-460-A) and flat and elongated particles (Tex-280-F).

**Table 1**
**Aggregate Quality Requirements**

| Property | Test Method | Requirement |
|---|---|---|
| **Coarse Aggregate** | | |
| SAC | Tex-499-A (AQMP) | As shown on the plans |
| Deleterious material, %, Max | Tex-217-F, Part I | 1.5 |
| Decantation, %, Max | Tex-217-F, Part II | 1.5 |
| Micro-Deval abrasion, % | Tex-461-A | Note 1 |
| Los Angeles abrasion, %, Max | Tex-410-A | 40 |
| Magnesium sulfate soundness, 5 cycles, %, Max | Tex-411-A | 30 |
| Crushed face count,[2] %, Min | Tex-460-A, Part I | 85 |
| Flat and elongated particles @ 5:1, %, Max | Tex-280-F | 10 |
| **Fine Aggregate** | | |
| Linear shrinkage, %, Max | Tex-107-E | 3 |
| **Combined Aggregate[3]** | | |
| Sand equivalent, %, Min | Tex-203-F | 45 |

1. Not used for acceptance purposes. Optional test used by the Engineer as an indicator of the need for further investigation.
2. Only applies to crushed gravel.
3. Aggregates, without mineral filler, RAP, RAS, or additives, combined as used in the job-mix formula (JMF).

**Table 2**
**Gradation Requirements for Fine Aggregate**

| Sieve Size | % Passing by Weight or Volume |
|---|---|
| 3/8" | 100 |
| #8 | 70–100 |
| #200 | 0–30 |

2.2. **Mineral Filler**. Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Use no more than 2% hydrated lime or fly ash unless otherwise shown on the plans. Use no more than 1% hydrated lime if a substitute binder is used unless otherwise shown on the plans or allowed. Test all mineral fillers except hydrated lime and fly ash in accordance with Tex-107-E to ensure specification compliance. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:

- is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
- does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
- meets the gradation requirements in Table 3.

**Table 3**
**Gradation Requirements for Mineral Filler**

| Sieve Size | % Passing by Weight or Volume |
|---|---|
| #8 | 100 |
| #200 | 55–100 |

2.3. **Baghouse Fines**. Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.

2.4. **Asphalt Binder**. Furnish the type and grade of performance-graded (PG) asphalt specified on the plans.

2.5. **Tack Coat**. Furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, “Asphalts, Oils, and Emulsions.” Specialized or preferred tack coat materials may be allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

The Engineer will obtain at least one sample of the tack coat binder per project in accordance with Tex-500-C, Part III, and test it to verify compliance with Item 300, “Asphalts, Oils, and Emulsions.” The Engineer will obtain the sample from the asphalt distributor immediately before use.

2.6. **Additives**. Use the type and rate of additive specified when shown on the plans. Additives that facilitate mixing, compaction, or improve the quality of the mixture are allowed when approved. Provide the Engineer with documentation, such as the bill of lading, showing the quantity of additives used in the project unless otherwise directed.

2.6.1. **Lime and Liquid Antistripping Agent**. When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.

2.6.2. **Warm Mix Asphalt (WMA)**. Warm Mix Asphalt (WMA) is defined as HMA that is produced within a target temperature discharge range of 215°F and 275°F using approved WMA additives or processes from the Department's MPL.

WMA is allowed for use on all projects and is required when shown on the plans. When WMA is required, the maximum placement or target discharge temperature for WMA will be set at a value below 275°F.

Department-approved WMA additives or processes may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures above 275°F; however, such mixtures will not be defined as WMA.

2.7. **Recycled Materials**. Use of RAP and RAS is permitted unless otherwise shown on the plans. Do not exceed the maximum allowable percentages of RAP and RAS shown in Table 4. The allowable percentages shown in Table 4 may be decreased or increased when shown on the plans. Determine asphalt binder content and gradation of the RAP and RAS stockpiles for mixture design purposes in accordance with Tex-236-F. The Engineer may verify the asphalt binder content of the stockpiles at any time during production. Perform other tests on RAP and RAS when shown on the plans. Asphalt binder from RAP and RAS is designated as recycled asphalt binder. Calculate and ensure that the ratio of the recycled asphalt binder to total binder does not exceed the percentages shown in Table 5 during mixture design and HMA production when RAP or RAS is used. Use a separate cold feed bin for each stockpile of RAP and RAS during HMA production.

Surface, intermediate, and base mixes referenced in Tables 4 and 5 are defined as follows:

- **Surface**. The final HMA lift placed at or near the top of the pavement structure;
- **Intermediate**. Mixtures placed below an HMA surface mix and less than or equal to 8.0 in. from the riding surface; and
- **Base**. Mixtures placed greater than 8.0 in. from the riding surface.

2.7.1. **RAP**. RAP is salvaged, milled, pulverized, broken, or crushed asphalt pavement. Crush or break RAP so that 100% of the particles pass the 2 in. sieve. Fractionated RAP is defined as 2 or more RAP stockpiles, divided into coarse and fine fractions.

Use of Contractor-owned RAP, including HMA plant waste, is permitted unless otherwise shown on the plans. Department-owned RAP stockpiles are available for the Contractor's use when the stockpile locations are shown on the plans. If Department-owned RAP is available for the Contractor's use, the Contractor may use Contractor-owned fractionated RAP and replace it with an equal quantity of Department-owned RAP. This allowance does not apply to a Contractor using unfractionated RAP. Department-owned RAP generated through required work on the Contract is available for the Contractor's use when shown on the plans. Perform any necessary tests to ensure Contractor- or Department-owned RAP is appropriate for use. The Department will not perform any tests or assume any liability for the quality of the Department-owned RAP unless otherwise shown on the plans. The Contractor will retain ownership of RAP generated on the project when shown on the plans.

The coarse RAP stockpile will contain only material retained by processing over a 3/8-in. or 1/2-in. screen unless otherwise approved. The fine RAP stockpile will contain only material passing the 3/8-in. or 1/2-in. screen unless otherwise approved. The Engineer may allow the Contractor to use an alternate to the 3/8-in.

or 1/2-in. screen to fractionate the RAP. The maximum percentages of fractionated RAP may be comprised of coarse or fine fractionated RAP or the combination of both coarse and fine fractionated RAP.

Do not use Department- or Contractor-owned RAP contaminated with dirt or other objectionable materials. Do not use Department- or Contractor-owned RAP if the decantation value exceeds 5% and the plasticity index is greater than 8. Test the stockpiled RAP for decantation in accordance with Tex-406-A, Part I. Determine the plasticity index in accordance with Tex-106-E if the decantation value exceeds 5%. The decantation and plasticity index requirements do not apply to RAP samples with asphalt removed by extraction or ignition.

Do not intermingle Contractor-owned RAP stockpiles with Department-owned RAP stockpiles. Remove unused Contractor-owned RAP material from the project site upon completion of the project. Return unused Department-owned RAP to the designated stockpile location.

**Table 4**
**Maximum Allowable Amounts of RAP[1]**

| Maximum Allowable Fractionated RAP[2] (%) | | | Maximum Allowable Unfractionated RAP[3] (%) | | |
|---|---|---|---|---|---|
| **Surface** | **Intermediate** | **Base** | **Surface** | **Intermediate** | **Base** |
| 20.0 | 30.0 | 40.0 | 10.0 | 10.0 | 10.0 |

1. Must also meet the recycled binder to total binder ratio shown in Table 5.
2. Up to 5% RAS may be used separately or as a replacement for fractionated RAP.
3. Unfractionated RAP may not be combined with fractionated RAP or RAS.

2.7.2. **RAS**. Use of post-manufactured RAS or post-consumer RAS (tear-offs) is permitted unless otherwise shown on the plans. Up to 5% RAS may be used separately or as a replacement for fractionated RAP in accordance with Table 4 and Table 5. RAS is defined as processed asphalt shingle material from manufacturing of asphalt roofing shingles or from re-roofing residential structures. Post-manufactured RAS is processed manufacturer's shingle scrap by-product. Post-consumer RAS is processed shingle scrap removed from residential structures. Comply with all regulatory requirements stipulated for RAS by the TCEQ. RAS may be used separately or in conjunction with RAP.

Process the RAS by ambient grinding or granulating such that 100% of the particles pass the 3/8 in. sieve when tested in accordance with Tex-200-F, Part I. Perform a sieve analysis on processed RAS material before extraction (or ignition) of the asphalt binder.

Add sand meeting the requirements of Table 1 and Table 2 or fine RAP to RAS stockpiles if needed to keep the processed material workable. Any stockpile that contains RAS will be considered a RAS stockpile and be limited to no more than 5.0% of the HMA mixture in accordance with Table 4.

Certify compliance of the RAS with DMS-11000, "Evaluating and Using Nonhazardous Recyclable Materials Guidelines." Treat RAS as an established nonhazardous recyclable material if it has not come into contact with any hazardous materials. Use RAS from shingle sources on the Department's MPL. Remove substantially all materials before use that are not part of the shingle, such as wood, paper, metal, plastic, and felt paper. Determine the deleterious content of RAS material for mixture design purposes in accordance with Tex-217-F, Part III. Do not use RAS if deleterious materials are more than 0.5% of the stockpiled RAS unless otherwise approved. Submit a sample for approval before submitting the mixture design. The Department will perform the testing for deleterious material of RAS to determine specification compliance.

2.8. **Substitute Binders**. Unless otherwise shown on the plans, the Contractor may use a substitute PG binder listed in Table 5 instead of the PG binder originally specified, if the substitute PG binder and mixture made with the substitute PG binder meet the following:

- the substitute binder meets the specification requirements for the substitute binder grade in accordance with Section 300.2.10., "Performance-Graded Binders;" and
- the mixture has less than 10.0 mm of rutting on the Hamburg Wheel test (Tex-242-F) after the number of passes required for the originally specified binder. Use of substitute PG binders may only be allowed at the discretion of the Engineer if the Hamburg Wheel test results are between 10.0 mm and 12.5 mm.

**Table 5**
**Allowable Substitute PG Binders and Maximum Recycled Binder Ratios**

| Originally Specified PG Binder | Allowable Substitute PG Binder | Maximum Ratio of Recycled Binder[1] to Total Binder (%) | | |
|---|---|---|---|---|
| | | Surface | Intermediate | Base |
| **HMA** | | | | |
| 76-22[2] | 70-22 or 64-22 | 20.0 | 20.0 | 20.0 |
| | 70-28 or 64-28 | 30.0 | 35.0 | 40.0 |
| 70-22[2] | 64-22 | 20.0 | 20.0 | 20.0 |
| | 64-28 or 58-28 | 30.0 | 35.0 | 40.0 |
| 64-22[2] | 58-28 | 30.0 | 35.0 | 40.0 |
| 76-28[2] | 70-28 or 64-28 | 20.0 | 20.0 | 20.0 |
| | 64-34 | 30.0 | 35.0 | 40.0 |
| 70-28[2] | 64-28 or 58-28 | 20.0 | 20.0 | 20.0 |
| | 64-34 or 58-34 | 30.0 | 35.0 | 40.0 |
| 64-28[2] | 58-28 | 20.0 | 20.0 | 20.0 |
| | 58-34 | 30.0 | 35.0 | 40.0 |
| **WMA[3]** | | | | |
| 76-22[2] | 70-22 or 64-22 | 30.0 | 35.0 | 40.0 |
| 70-22[2] | 64-22 or 58-28 | 30.0 | 35.0 | 40.0 |
| 64-22[4] | 58-28 | 30.0 | 35.0 | 40.0 |
| 76-28[2] | 70-28 or 64-28 | 30.0 | 35.0 | 40.0 |
| 70-28[2] | 64-28 or 58-28 | 30.0 | 35.0 | 40.0 |
| 64-28[4] | 58-28 | 30.0 | 35.0 | 40.0 |

1. Combined recycled binder from RAP and RAS.
2. Use no more than 20.0% recycled binder when using this originally specified PG binder.
3. WMA as defined in Section 340.2.6.2., "Warm Mix Asphalt (WMA)."
4. When used with WMA, this originally specified PG binder is allowed for use at the maximum recycled binder ratios shown in this table.

## 3. EQUIPMENT

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

## 4. CONSTRUCTION

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a pre-paving meeting with the Engineer on or before the first day of paving unless otherwise directed.

4.1. **Certification**. Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 6. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist.

**Table 6**
**Test Methods, Test Responsibility, and Minimum Certification Levels**

| Test Description | Test Method | Contractor | Engineer | Level[1] |
|---|---|---|---|---|
| **1. Aggregate and Recycled Material Testing** | | | | |
| Sampling | Tex-221-F | ✓ | ✓ | 1A |
| Dry sieve | Tex-200-F, Part I | ✓ | ✓ | 1A |
| Washed sieve | Tex-200-F, Part II | ✓ | ✓ | 1A |
| Deleterious material | Tex-217-F, Parts I & III | ✓ | ✓ | 1A |
| Decantation | Tex-217-F, Part II | ✓ | ✓ | 1A |
| Los Angeles abrasion | Tex-410-A | | ✓ | TxDOT |
| Magnesium sulfate soundness | Tex-411-A | | ✓ | TxDOT |
| Micro-Deval abrasion | Tex-461-A | | ✓ | 2 |
| Crushed face count | Tex-460-A | ✓ | ✓ | 2 |
| Flat and elongated particles | Tex-280-F | ✓ | ✓ | 2 |
| Linear shrinkage | Tex-107-E | ✓ | ✓ | 2 |
| Sand equivalent | Tex-203-F | ✓ | ✓ | 2 |
| Organic impurities | Tex-408-A | ✓ | ✓ | 2 |
| **2. Asphalt Binder & Tack Coat Sampling** | | | | |
| Asphalt binder sampling | Tex-500-C, Part II | ✓ | ✓ | 1A/1B |
| Tack coat sampling | Tex-500-C, Part III | ✓ | ✓ | 1A/1B |
| ***3. Mix Design & Verification*** | | | | |
| Design and JMF changes | Tex-204-F | ✓ | ✓ | 2 |
| Mixing | Tex-205-F | ✓ | ✓ | 2 |
| Molding (TGC) | Tex-206-F | ✓ | ✓ | 1A |
| Molding (SGC) | Tex-241-F | ✓ | ✓ | 1A |
| Laboratory-molded density | Tex-207-F | ✓ | ✓ | 1A |
| VMA[2] (calculation only) | Tex-204-F | ✓ | ✓ | 2 |
| Rice gravity | Tex-227-F | ✓ | ✓ | 1A |
| Ignition oven correction factors[3] | Tex-236-F | ✓ | ✓ | 2 |
| Indirect tensile strength | Tex-226-F | ✓ | ✓ | 2 |
| Hamburg Wheel test | Tex-242-F | ✓ | ✓ | 2 |
| Boil test | Tex-530-C | ✓ | ✓ | 1A |
| **4. Production Testing** | | | | |
| Mixture sampling | Tex-222-F | ✓ | ✓ | 1A |
| Molding (TGC) | Tex-206-F | | ✓ | 1A |
| Molding (SGC) | Tex-241-F | | ✓ | 1A |
| Laboratory-molded density | Tex-207-F | | ✓ | 1A |
| VMA[2] (calculation only) | Tex-204-F | | ✓ | 1A |
| Rice gravity | Tex-227-F | | ✓ | 1A |
| Gradation & asphalt binder content[3] | Tex-236-F | | ✓ | 1A |
| Moisture content | Tex-212-F | | ✓ | 1A |
| Hamburg Wheel test | Tex-242-F | | ✓ | 2 |
| Boil test | Tex-530-C | | ✓ | 1A |
| **5. Placement Testing** | | | | |
| Trimming roadway cores | Tex-207-F | ✓ | ✓ | 1A/1B |
| In-place air voids | Tex-207-F | | ✓ | 1A/1B |
| Establish rolling pattern | Tex-207-F | ✓ | | 1B |
| Ride quality measurement | Tex-1001-S | ✓ | ✓ | Note 4 |

1. Level 1A, 1B, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.
2. Voids in mineral aggregates.
3. Refer to Section 340.4.8.3., "Production Testing," for exceptions to using an ignition oven.
4. Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.

4.2. **Reporting, Testing, and Responsibilities**. Use Department-provided templates to record and calculate all test data pertaining to the mixture design. The Engineer will use Department templates for any production and placement testing. Obtain the current version of the templates at http://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html or from the Engineer.

The maximum allowable time for the Engineer to exchange test data with the Contractor is as given in Table 7 unless otherwise approved. The Engineer will immediately report to the Contractor any test result that requires suspension of production or placement or that fails to meet the specification requirements.

Subsequent mix placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Article 5.3., "Conformity with Plans, Specifications, and Special Provisions."

**Table 7**
**Reporting Schedule**

| Description | Reported By | Reported To | To Be Reported Within |
|---|---|---|---|
| ***Production Testing*** | | | |
| Gradation | Engineer | Contractor | 1 working day of completion of the test |
| Asphalt binder content | | | |
| Laboratory-molded density | | | |
| VMA (calculation) | | | |
| Hamburg Wheel test | | | |
| Moisture content | | | |
| Boil test | | | |
| Binder tests | | | |
| ***Placement Testing*** | | | |
| In-place air voids | Engineer | Contractor | 1 working day of completion of the test[1] |

1. 2 days are allowed if cores cannot be dried to constant weight within 1 day.

4.3. **Mixture Design**.

4.3.1. **Design Requirements**. The Contractor may design the mixture using a Texas Gyratory Compactor (TGC) or a Superpave Gyratory Compactor (SGC) unless otherwise shown on the plans. Use the dense-graded design procedure provided in Tex-204-F. Design the mixture to meet the requirements listed in Tables 1, 2, 3, 4, 5, 8, 9, and 10.

4.3.1.1. **Target Laboratory-Molded Density When The TGC Is Used**. Design the mixture at a 96.5% target laboratory-molded density. Increase the target laboratory-molded density to 97.0% or 97.5% at the Contractor's discretion or when shown on the plans or specification.

4.3.1.2. **Design Number of Gyrations (Ndesign) When The SGC Is Used**. Design the mixture at 50 gyrations (Ndesign). Use a target laboratory-molded density of 96.0% to design the mixture; however, adjustments can be made to the Ndesign value as noted in Table 9. The Ndesign level may be reduced to no less than 35 gyrations at the Contractor's discretion.

Use an approved laboratory from the Department's MPL to perform the Hamburg Wheel test in accordance with Tex-242-F, and provide results with the mixture design, or provide the laboratory mixture and request that the Department perform the Hamburg Wheel test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test results on the laboratory mixture design.

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF1) before the Contractor can begin production.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- asphalt binder content and aggregate gradation of RAP and RAS stockpiles;
- the target laboratory-molded density (or Ndesign level when using the SGC);
- results of all applicable tests;

- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

**Table 8**
**Master Gradation Limits (% Passing by Weight or Volume) and VMA Requirements**

| Sieve Size | A Coarse Base | B Fine Base | C Coarse Surface | D Fine Surface | F Fine Mixture |
|---|---|---|---|---|---|
| 2" | 100.0[1] | – | – | – | – |
| 1-1/2" | 98.0–100.0 | 100.0[1] | – | – | – |
| 1" | 78.0–94.0 | 98.0–100.0 | 100.0[1] | – | – |
| 3/4" | 64.0–85.0 | 84.0–98.0 | 95.0–100.0 | 100.0[1] | – |
| 1/2" | 50.0–70.0 | – | – | 98.0–100.0 | 100.0[1] |
| 3/8" | – | 60.0–80.0 | 70.0–85.0 | 85.0–100.0 | 98.0–100.0 |
| #4 | 30.0–50.0 | 40.0–60.0 | 43.0–63.0 | 50.0–70.0 | 70.0–90.0 |
| #8 | 22.0–36.0 | 29.0–43.0 | 32.0–44.0 | 35.0–46.0 | 38.0–48.0 |
| #30 | 8.0–23.0 | 13.0–28.0 | 14.0–28.0 | 15.0–29.0 | 12.0–27.0 |
| #50 | 3.0–19.0 | 6.0–20.0 | 7.0–21.0 | 7.0–20.0 | 6.0–19.0 |
| #200 | 2.0–7.0 | 2.0–7.0 | 2.0–7.0 | 2.0–7.0 | 2.0–7.0 |
| **Design VMA, % Minimum** | | | | | |
| – | 12.0 | 13.0 | 14.0 | 15.0 | 16.0 |
| **Production (Plant-Produced) VMA, % Minimum** | | | | | |
| – | 11.5 | 12.5 | 13.5 | 14.5 | 15.5 |

1. Defined as maximum sieve size. No tolerance allowed.

**Table 9**
**Laboratory Mixture Design Properties**

| Mixture Property | Test Method | Requirement |
|---|---|---|
| Target laboratory-molded density, % (TGC) | Tex-207-F | 96.5[1] |
| Design gyrations (Ndesign for SGC) | Tex-241-F | 50[2] |
| Indirect tensile strength (dry), psi | Tex-226-F | 85–200[3] |
| Boil test[4] | Tex-530-C | – |

1. Increase to 97.0% or 97.5% at the Contractor's discretion or when shown on the plans or specification.
2. Adjust within a range of 35–100 gyrations when shown on the plans or specification or when mutually agreed between the Engineer and Contractor.
3. The Engineer may allow the IDT strength to exceed 200 psi if the corresponding Hamburg Wheel rut depth is greater than 3.0 mm and less than 12.5 mm.
4. Used to establish baseline for comparison to production results. May be waived when approved.

**Table 10**
**Hamburg Wheel Test Requirements**

| High-Temperature Binder Grade | Test Method | Minimum # of Passes @ 12.5 mm[1] Rut Depth, Tested @ 50°C |
|---|---|---|
| PG 64 or lower | Tex-242-F | 10,000[2] |
| PG 70 | | 15,000[3] |
| PG 76 or higher | | 20,000 |

1. When the rut depth at the required minimum number of passes is less than 3 mm, the Engineer may require the Contractor to increase the target laboratory-molded density (TGC) by 0.5% to no more than 97.5% or lower the Ndesign level (SGC) to no less than 35 gyrations.
2. May be decreased to no less than 5,000 passes when shown on the plans.
3. May be decreased to no less than 10,000 passes when shown on the plans.

4.3.2. **Job-Mix Formula Approval**. The job-mix formula (JMF) is the combined aggregate gradation, target laboratory-molded density (or Ndesign level), and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When

WMA is used, JMF1 may be designed and submitted to the Engineer without including the WMA additive. When WMA is used, document the additive or process used and recommended rate on the JMF1 submittal. Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide approximately 10,000 g of the design mixture and request that the Department perform the Hamburg Wheel test if opting to have the Department perform the test. The Engineer will verify JMF1 based on plant-produced mixture from the trial batch unless otherwise determined. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. Provide split samples of the mixtures and blank samples used to determine the ignition oven correction factors. The Engineer will determine the aggregate and asphalt correction factors from the ignition oven used for production testing in accordance with Tex-236-F.

The Engineer will use a TGC calibrated in accordance with Tex-914-K in molding production samples. Provide an SGC at the Engineer's field laboratory for use in molding production samples if the SGC is used to design the mix.

The Engineer may perform Tex-530-C and retain the tested sample for comparison purposes during production. The Engineer may waive the requirement for the boil test.

4.3.3. **JMF Adjustments**. If JMF adjustments are necessary to achieve the specified requirements, the adjusted JMF must:

- be provided to the Engineer in writing before the start of a new lot;
- be numbered in sequence to the previous JMF;
- meet the mixture requirements in Table 4 and Table 5;
- meet the master gradation limits shown in Table 8; and
- be within the operational tolerances of the current JMF listed in Table 11.

The Engineer may adjust the asphalt binder content to maintain desirable laboratory density near the optimum value while achieving other mix requirements.

**Table 11**
**Operational Tolerances**

| Description | Test Method | Allowable Difference Between Trial Batch and JMF1 Target | Allowable Difference from Current JMF Target |
|---|---|---|---|
| Individual % retained for #8 sieve and larger | Tex-200-F or Tex-236-F | Must be within master grading limits in Table 8 | ±5.0[1,2] |
| Individual % retained for sieves smaller than #8 and larger than #200 | | | ±3.0[1,2] |
| % passing the #200 sieve | | | ±2.0[1,2] |
| Asphalt binder content, % | Tex-236-F | ±0.5 | ±0.3[2] |
| Laboratory-molded density, % | Tex-207-F | ±1.0 | ±1.0 |
| VMA, %, min | Tex-204-F | Note 3 | Note 3 |

1. When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 will be considered out of tolerance when outside the master grading limits.
2. Only applies to mixture produced for Lot 1 and higher.
3. Mixture is required to meet Table 8 requirements.

4.4. **Production Operations**. Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification. Submit a new mix design and perform a new trial batch when the asphalt binder content of:

- any RAP stockpile used in the mix is more than 0.5% higher than the value shown on the mixture design report; or
- RAS stockpile used in the mix is more than 2.0% higher than the value shown on the mixture design report.

4.4.1. **Storage and Heating of Materials**. Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless

otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.

4.4.2. **Mixing and Discharge of Materials**. Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F (or 275°F for WMA) and is not lower than 215°F. The Department will not pay for or allow placement of any mixture produced above 350°F.

Produce WMA within the target discharge temperature range of 215°F and 275°F when WMA is required. Take corrective action any time the discharge temperature of the WMA exceeds the target discharge range. The Engineer may suspend production operations if the Contractor's corrective action is not successful at controlling the production temperature within the target discharge range. Note that when WMA is produced, it may be necessary to adjust burners to ensure complete combustion such that no burner fuel residue remains in the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. The Engineer may determine the moisture content by oven-drying in accordance with Tex-212-F, Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. The Engineer will obtain the sample immediately after discharging the mixture into the truck, and will perform the test promptly.

4.5. **Hauling Operations**. Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent shown on the Department's MPL to coat the inside bed of the truck when necessary.

Use equipment for hauling as defined in Section 340.4.6.3.2., "Hauling Equipment." Use other hauling equipment only when allowed.

4.6. **Placement Operations**. Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour, or as directed. Use a hand-held thermal camera or infrared thermometer to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket unless otherwise directed. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Offset longitudinal joints of successive courses of hot-mix by at least 6 in. Place mixture so that longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly.

Place the mixture at the rate or thickness shown on the plans. The Engineer will use the guidelines in Table 12 to determine the compacted lift thickness of each layer when multiple lifts are required. The thickness determined is based on the rate of 110 lb./sq. yd. for each inch of pavement unless otherwise shown on the plans.

**Table 12**
**Compacted Lift Thickness and Required Core Height**

| Mixture Type | Compacted Lift Thickness Guidelines | | Minimum Untrimmed Core Height (in.) Eligible for Testing |
|---|---|---|---|
| | Minimum (in.) | Maximum (in.) | |
| A | 3.00 | 6.00 | 2.00 |
| B | 2.50 | 5.00 | 1.75 |
| C | 2.00 | 4.00 | 1.50 |
| D | 1.50 | 3.00 | 1.25 |
| F | 1.25 | 2.50 | 1.25 |

4.6.1. **Weather Conditions**. Place mixture when the roadway surface temperature is at or above 60°F unless otherwise approved. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. The Engineer may allow mixture placement to begin before the roadway surface reaches the required temperature if conditions are such that the roadway surface will reach the required temperature within 2 hr. of beginning placement operations. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the ambient temperature is likely to drop below 32°F within 12 hr. of paving.

4.6.2. **Tack Coat**. Clean the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply the tack coat in a uniform manner to avoid streaks and other irregular patterns. Apply a thin, uniform tack coat to all contact surfaces of curbs, structures, and all joints. Allow adequate time for emulsion to break completely before placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Roll the tack coat with a pneumatic-tire roller to remove streaks and other irregular patterns when directed.

4.6.3. **Lay-Down Operations**.

4.6.3.1. **Windrow Operations**. Operate windrow pickup equipment so that when hot-mix is placed in windrows substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

4.6.3.2. **Hauling Equipment**. Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture; however, with exception of paving miscellaneous areas, end dump trucks are only allowed when used in conjunction with an MTD with remixing capability unless otherwise allowed.

4.6.3.3. **Screed Heaters**. Turn off screed heaters, to prevent overheating of the mat, if the paver stops for more than 5 min.

4.7. **Compaction**. Compact the pavement uniformly to contain between 3.8% and 8.5% in-place air voids.

Furnish the type, size, and number of rollers required for compaction as approved. Use a pneumatic-tire roller to seal the surface unless excessive pickup of fines occurs. Use additional rollers as required to remove any roller marks. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.

Use the control strip method shown in Tex-207-F, Part IV, on the first day of production to establish the rolling pattern that will produce the desired in-place air voids unless otherwise directed.

Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

Complete all compaction operations before the pavement temperature drops below 160°F unless otherwise allowed. The Engineer may allow compaction with a light finish roller operated in static mode for pavement temperatures below 160°F.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

4.8. **Production Acceptance**.

4.8.1. **Production Lot**. Each day of production is defined as a production lot. Lots will be sequentially numbered and correspond to each new day of production. Note that lots are not subdivided into sublots for this specification.

4.8.2. **Production Sampling**.

4.8.2.1. **Mixture Sampling**. The Engineer may obtain mixture samples in accordance with Tex-222-F at any time during production.

4.8.2.2. **Asphalt Binder Sampling**. The Engineer may obtain or require the Contractor to obtain 1 qt. samples of the asphalt binder at any time during production from a port located immediately upstream from the mixing drum or pug mill in accordance with Tex-500-C, Part II. The Engineer may test any of the asphalt binder samples to verify compliance with Item 300, "Asphalts, Oils, and Emulsions."

4.8.3. **Production Testing**. The Engineer will test at the frequency listed in the Department's *Guide Schedule of Sampling and Testing* and this specification. The Engineer may suspend production if production tests do not meet specifications or are not within operational tolerances listed in Table 11. Take immediate corrective action if the Engineer's laboratory-molded density on any sample is less than 95.0% or greater than 98.0%, to bring the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

The Engineer may use alternate methods for determining the asphalt binder content and aggregate gradation if the aggregate mineralogy is such that Tex-236-F does not yield reliable results. Use the applicable test procedure if an alternate test method is selected.

**Table 13**
**Production and Placement Testing**

| Description | Test Method |
|---|---|
| Individual % retained for #8 sieve and larger | Tex-200-F or Tex-236-F |
| Individual % retained for sieves smaller than #8 and larger than #200 | |
| % passing the #200 sieve | |
| Laboratory-molded density | Tex-207-F |
| Laboratory-molded bulk specific gravity | |
| In-Place air voids | |
| VMA | Tex-204-F |
| Moisture content | Tex-212-F, Part II |
| Theoretical maximum specific (Rice) gravity | Tex-227-F |
| Asphalt binder content | Tex-236-F |
| Hamburg Wheel test | Tex-242-F |
| Recycled Asphalt Shingles (RAS)[1] | Tex-217-F, Part III |
| Asphalt binder sampling and testing | Tex-500-C |
| Tack coat sampling and testing | Tex-500-C, Part III |
| Boil test | Tex-530-C |

1. Testing performed by the Construction Division or designated laboratory.

4.8.3.1. **Voids in Mineral Aggregates (VMA)**. The Engineer may determine the VMA for any production lot. Take immediate corrective action if the VMA value for any lot is less than the minimum VMA requirement for production listed in Table 8. Suspend production and shipment of the mixture if the Engineer's VMA result is more than 0.5% below the minimum VMA requirement for production listed in Table 8. In addition to suspending production, the Engineer may require removal and replacement or may allow the lot to be left in place without payment.

4.8.3.2. **Hamburg Wheel Test**. The Engineer may perform a Hamburg Wheel test at any time during production, including when the boil test indicates a change in quality from the materials submitted for JMF1. In addition to testing production samples, the Engineer may obtain cores and perform Hamburg Wheel tests on any areas of the roadway where rutting is observed. Suspend production until further Hamburg Wheel tests meet the specified values when the production or core samples fail the Hamburg Wheel test criteria in Table 10. Core samples, if taken, will be obtained from the center of the finished mat or other areas excluding the vehicle wheel paths. The Engineer may require up to the entire lot of any mixture failing the Hamburg Wheel test to be removed and replaced at the Contractor's expense.

If the Department's or Department-approved laboratory's Hamburg Wheel test results in a "remove and replace" condition, the Contractor may request that the Department confirm the results by re-testing the failing material. The Construction Division will perform the Hamburg Wheel tests and determine the final disposition of the material in question based on the Department's test results.

4.8.4. **Individual Loads of Hot-Mix**. The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances shown in Table 11, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.

4.9. **Placement Acceptance**.

4.9.1. **Placement Lot**. A placement lot is defined as the area placed during a production lot (one day's production). Placement lot numbers will correspond with production lot numbers.

4.9.2. **Miscellaneous Areas**. Miscellaneous areas include areas that typically involve significant handwork or discontinuous paving operations, such as temporary detours, driveways, mailbox turnouts, crossovers, gores, spot level-up areas, and other similar areas. Miscellaneous areas also include level-ups and thin overlays when the layer thickness specified on the plans is less than the minimum untrimmed core height eligible for testing shown in Table 12. The specified layer thickness is based on the rate of 110 lb./sq. yd. for each inch of pavement unless another rate is shown on the plans. Compact miscellaneous areas in accordance with Section 340.4.7., "Compaction." Miscellaneous areas are not subject to in-place air void determination except for temporary detours when shown on the plans.

4.9.3. **Placement Sampling**. Provide the equipment and means to obtain and trim roadway cores on site. On site is defined as in close proximity to where the cores are taken. Obtain the cores within one working day of the time the placement lot is completed unless otherwise approved. Obtain two 6-in. diameter cores side-by-side at each location selected by the Engineer for in-place air void determination unless otherwise shown on the plans. For Type D and Type F mixtures, 4-in. diameter cores are allowed. Mark the cores for identification, measure and record the untrimmed core height, and provide the information to the Engineer. The Engineer will witness the coring operation and measurement of the core thickness.

Visually inspect each core and verify that the current paving layer is bonded to the underlying layer. Take corrective action if an adequate bond does not exist between the current and underlying layer to ensure that an adequate bond will be achieved during subsequent placement operations.

Trim the cores immediately after obtaining the cores from the roadway in accordance with Tex-207-F if the core heights meet the minimum untrimmed value listed in Table 12. Trim the cores on site in the presence of the Engineer. Use a permanent marker or paint pen to record the date and lot number on each core as well as the designation as Core A or B. The Engineer may require additional information to be marked on the core and may choose to sign or initial the core. The Engineer will take custody of the cores immediately after they are trimmed and will retain custody of the cores until the Department's testing is completed. Before turning the trimmed cores over to the Engineer, the Contractor may wrap the trimmed cores or secure them in a manner that will reduce the risk of possible damage occurring during transport by the Engineer. After testing, the Engineer will return the cores to the Contractor.

The Engineer may have the cores transported back to the Department's laboratory at the HMA plant via the Contractor's haul truck or other designated vehicle. In such cases where the cores will be out of the Engineer's possession during transport, the Engineer will use Department-provided security bags and the Roadway Core Custody protocol located at http://www.txdot.gov/business/specifications.htm to provide a secure means and process that protects the integrity of the cores during transport.

Instead of the Contractor trimming the cores on site immediately after coring, the Engineer and the Contractor may mutually agree to have the trimming operations performed at an alternate location such as a field laboratory or other similar location. In such cases, the Engineer will take possession of the cores immediately after they are obtained from the roadway and will retain custody of the cores until testing is completed. Either the Department or Contractor representative may perform trimming of the cores. The Engineer will witness all trimming operations in cases where the Contractor representative performs the trimming operation.

Dry the core holes and tack the sides and bottom immediately after obtaining the cores. Fill the hole with the same type of mixture and properly compact the mixture. Repair core holes with other methods when approved.

4.9.4. **Placement Testing**. The Engineer may measure in-place air voids at any time during the project to verify specification compliance.

4.9.4.1. **In-Place Air Voids**. The Engineer will measure in-place air voids in accordance with Tex-207-F and Tex-227-F. Cores not meeting the height requirements in Table 12 will not be tested. Before drying to a constant weight, cores may be pre-dried using a Corelok or similar vacuum device to remove excess moisture. The Engineer will use the corresponding theoretical maximum specific gravity to determine the air void content of each core. The Engineer will use the average air void content of the 2 cores to determine the in-place air voids at the selected location.

The Engineer will use the vacuum method to seal the core if required by Tex-207-F. The Engineer will use the test results from the unsealed core if the sealed core yields a higher specific gravity than the unsealed core. After determining the in-place air void content, the Engineer will return the cores and provide test results to the Contractor.

Take immediate corrective action when the in-place air voids exceed the range of 3.8% and 8.5% to bring the operation within these tolerances. The Engineer may suspend operations or require removal and replacement if the in-place air voids are less than 2.7% or greater than 9.9%. The Engineer will allow paving to resume when the proposed corrective action is likely to yield between 3.8% and 8.5% in-place air voids. Areas defined in Section 340.9.2., "Miscellaneous Areas," are not subject to in-place air void determination.

4.9.5. **Irregularities**. Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. If the Engineer determines that the irregularity will adversely affect pavement performance, the Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities and areas where the mixture does not bond to the existing pavement. If irregularities are detected, the Engineer may require the Contractor to immediately suspend operations or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.

4.9.6. **Ride Quality**. Use Surface Test Type A to evaluate ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

## 5. MEASUREMENT

Hot mix will be measured by the ton of composite hot-mix, which includes asphalt, aggregate, and additives. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."

## 6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under Article 340.5., "Measurement," will be paid for at the unit bid price for "Dense Graded Hot-Mix Asphalt (SQ)" of the mixture type, SAC, and binder specified. These prices are full compensation for surface preparation, materials including tack coat, placement, equipment, labor, tools, and incidentals.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality, if applicable, will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."

# Item 347
# Thin Overlay Mixtures

## 1. DESCRIPTION

Construct a thin surface course composed of a compacted mixture of aggregate and asphalt binder mixed hot in a mixing plant. Produce a thin overlay mixture (TOM) with a minimum lift thickness of 1/2 in. for a Type F mixture and 3/4 in. for a Type C mixture.

## 2. MATERIALS

Furnish uncontaminated materials of uniform quality that meet the requirements of the plans and specifications.

Notify the Engineer of all material sources and before changing any material source or formulation. The Engineer will verify that the specification requirements are met when the Contractor makes a source or formulation change, and may require a new laboratory mixture design, trial batch, or both. The Engineer may sample and test project materials at any time during the project to verify specification compliance in accordance with Item 6, "Control of Materials."

2.1. **Aggregate**. Furnish aggregates from sources that conform to the requirements shown in Table 1 and as specified in this Section. Aggregate requirements in this Section, including those shown in Table 1, may be modified or eliminated when shown on the plans. Additional aggregate requirements may be specified when shown on the plans. Provide aggregate stockpiles that meet the definitions in this Section for coarse, intermediate, or fine aggregate. Do not use reclaimed asphalt pavement (RAP) or recycled asphalt shingles (RAS). Supply aggregates that meet the definitions in Tex-100-E for crushed gravel or crushed stone. The Engineer will designate the plant or the quarry as the sampling location. Provide samples from materials produced for the project. The Engineer will establish the Surface Aggregate Classification (SAC) and perform Los Angeles abrasion, magnesium sulfate soundness, and Micro-Deval tests. Perform all other aggregate quality tests listed in Table 1. Document all test results on the mixture design report. The Engineer may perform tests on independent or split samples to verify Contractor test results. Stockpile aggregates for each source and type separately. Determine aggregate gradations for mixture design and production testing based on the washed sieve analysis given in Tex-200-F, Part II.

2.1.1. **Coarse Aggregate**. Coarse aggregate stockpiles must have no more than 20% material passing the No. 8 sieve. Aggregates from sources listed in the Department's *Bituminous Rated Source Quality Catalog* (BRSQC) are preapproved for use. Use only the rated values for hot-mix listed in the BRSQC. Rated values for surface treatment (ST) do not apply to coarse aggregate sources used in hot-mix asphalt.

For sources not listed on the Department's BRSQC:

- build an individual stockpile for each material;
- request the Department test the stockpile for specification compliance; and
- once approved, do not add material to the stockpile unless otherwise approved.

Provide aggregate from non-listed sources only when tested by the Engineer and approved before use. Allow 30 calendar days for the Engineer to sample, test, and report results for non-listed sources.

2.1.1.1. **Blending Class A and Class B Aggregates**. Class B aggregate meeting all other requirements in Table 1 may be blended with a Class A aggregate to meet requirements for Class A materials; however, Class B aggregate may be disallowed when shown on the plans. Ensure that at least 50% by weight, or volume if required, of the material retained on the No. 8 sieve comes from the Class A aggregate source when

blending Class A and B aggregates to meet a Class A requirement. Blend by volume if the bulk specific gravities of the Class A and B aggregates differ by more than 0.300.

The Engineer may perform tests at any time during production, when the Contractor blends Class A and B aggregates to meet a Class A requirement, to ensure that at least 50% by weight, or volume if required, of the material retained on the No. 8 sieve comes from the Class A aggregate source. The Engineer will use the Department's mix design template, when electing to verify conformance, to calculate the percent of Class A aggregate retained on the No. 8 sieve by inputting the bin percentages shown from readouts in the control room at the time of production and stockpile gradations measured at the time of production. The Engineer may determine the gradations based on either washed or dry sieve analysis from samples obtained from individual aggregate cold feed bins or aggregate stockpiles. The Engineer may perform spot checks using the gradations supplied by the Contractor on the mixture design report as an input for the template; however, a failing spot check will require confirmation with a stockpile gradation determined by the Engineer.

2.1.1.2. **Micro-Deval Abrasion**. The Engineer will perform a minimum of one Micro-Deval abrasion test in accordance with Tex-461-A for each coarse aggregate source used in the mixture design that has a Rated Source Soundness Magnesium (RSSM) loss value greater than 15 as listed in the BRSQC. The Engineer will perform testing before the start of production and may perform additional testing at any time during production. The Engineer may obtain the coarse aggregate samples from each coarse aggregate source or may require the Contractor to obtain the samples. The Engineer may waive all Micro-Deval testing based on a satisfactory test history of the same aggregate source.

The Engineer will estimate the magnesium sulfate soundness loss for each coarse aggregate source, when tested, using the following formula:

$$Mg_{est.} = (RSSM)(MD_{act.}/RSMD)$$

where:
$Mg_{est}$ = magnesium sulfate soundness loss
$MD_{act}$ = actual Micro-Deval percent loss
$RSMD$ = Rated Source Micro-Deval

When the estimated magnesium sulfate soundness loss is greater than the maximum magnesium sulfate soundness loss specified, the coarse aggregate source will not be allowed for use unless otherwise approved. The Engineer will consult the Geotechnical, Soils, and Aggregates Branch of the Construction Division, and additional testing may be required before granting approval.

2.1.2. **Intermediate Aggregate**. Aggregates not meeting the definition of coarse or fine aggregate will be defined as intermediate aggregate. Supply intermediate aggregates, when used that are free from organic impurities. The Engineer may test the intermediate aggregate in accordance with Tex-408-A to verify the material is free from organic impurities. Supply intermediate aggregate from coarse aggregate sources, when used that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve and verify that it meets the requirements in Table 1 for crushed face count (Tex-460-A) and flat and elongated particles (Tex-280-F).

2.1.3. **Fine Aggregate**. Fine aggregates consist of manufactured sands and screenings. Natural sands are not allowed in any mixture. Fine aggregate stockpiles must meet the gradation requirements in Table 2. Supply fine aggregates that are free from organic impurities. The Engineer may test the fine aggregate in accordance with Tex-408-A to verify the material is free from organic impurities. Use fine aggregate from coarse aggregate sources that meet the requirements shown in Table 1 unless otherwise approved.

Test the stockpile if 10% or more of the stockpile is retained on the No. 4 sieve and verify that it meets the requirements shown in Table 1 for crushed face count (Tex-460-A) and flat and elongated particles (Tex-280-F).

**Table 1**
**Aggregate Quality Requirements**

| Property | Test Method | Requirement |
|---|---|---|
| **Coarse Aggregate** | | |
| SAC | Tex-499-A (AQMP) | A[1] |
| Deleterious material, %, Max | Tex-217-F, Part I | 1.5 |
| Decantation, %, Max | Tex-217-F, Part II | 1.5 |
| Micro-Deval abrasion, % | Tex-461-A | Note 2 |
| Los Angeles abrasion, %, Max | Tex-410-A | 30 |
| Magnesium sulfate soundness, 5 cycles, %, Max | Tex-411-A | 20 |
| Crushed face count,[3] %, Min | Tex-460-A, Part I | 95 |
| Flat and elongated particles @ 5:1, %, Max | Tex-280-F | 10 |
| **Fine Aggregate** | | |
| Linear shrinkage, %, Max | Tex-107-E | 3 |
| **Combined Aggregate[4]** | | |
| Sand equivalent, %, Min | Tex-203-F | 45 |

1. Surface Aggregate Classification of "A" is required unless otherwise shown on the plans.
2. Used to estimate the magnesium sulfate soundness loss in accordance with Section 347.2.1.1.2., "Micro-Deval Abrasion."
3. Only applies to crushed gravel.
4. Aggregates, without mineral filler or additives, combined as used in the job-mix formula (JMF).

**Table 2**
**Gradation Requirements for Fine Aggregate**

| Sieve Size | % Passing by Weight or Volume |
|---|---|
| 3/8" | 100 |
| #8 | 70–100 |
| #200 | 0–30 |

2.2. **Mineral Filler**. Mineral filler consists of finely divided mineral matter such as agricultural lime, crusher fines, hydrated lime, or fly ash. Mineral filler is allowed unless otherwise shown on the plans. Use no more than 2% hydrated lime unless otherwise shown on the plans. Test all mineral fillers except hydrated lime and fly ash in accordance with Tex-107-E to ensure specification compliance. The plans may require or disallow specific mineral fillers. Provide mineral filler, when used, that:

- is sufficiently dry, free-flowing, and free from clumps and foreign matter as determined by the Engineer;
- does not exceed 3% linear shrinkage when tested in accordance with Tex-107-E; and
- meets the gradation requirements in Table 3.

**Table 3**
**Gradation Requirements for Mineral Filler**

| Sieve Size | % Passing by Weight or Volume |
|---|---|
| #8 | 100 |
| #200 | 55–100 |

2.3. **Baghouse Fines**. Fines collected by the baghouse or other dust-collecting equipment may be reintroduced into the mixing drum.

2.4. **Asphalt Binder**. Furnish performance-graded (PG) asphalt binder with a high temperature grade of PG 76 or 70 and a low temperature grade as shown on the plans, in accordance with Section 300.2.10., "Performance-Graded Binders."

2.5. **Tack Coat**. Furnish CSS-1H, SS-1H, or a PG binder with a minimum high-temperature grade of PG 58 for tack coat binder in accordance with Item 300, "Asphalts, Oils, and Emulsions." Specialized or preferred tack coat materials may be allowed or required when shown on the plans. Do not dilute emulsified asphalts at the terminal, in the field, or at any other location before use.

The Engineer will obtain at least one sample of the tack coat binder per project in accordance with Tex-500-C, Part III, and test it to verify compliance with Item 300, "Asphalts, Oils, and Emulsions." The Engineer will obtain the sample from the asphalt distributor immediately before use.

2.6. **Additives**. Use the type and rate of additive specified when shown on the plans. Additives that facilitate mixing, compaction, or improve the quality of the mixture are allowed when approved. Provide the Engineer with documentation such as the bill of lading showing the quantity of additives used in the project unless otherwise directed.

2.6.1. **Lime and Liquid Antistripping Agent**. When lime or a liquid antistripping agent is used, add in accordance with Item 301, "Asphalt Antistripping Agents." Use no more than 1% hydrated lime when using crushed gravel. Do not add lime directly into the mixing drum of any plant where lime is removed through the exhaust stream unless the plant has a baghouse or dust collection system that reintroduces the lime into the drum.

2.6.2. **Warm Mix Asphalt (WMA)**. Warm Mix Asphalt (WMA) is defined as HMA that is produced within a target temperature discharge range of 215°F and 275°F using approved WMA additives or processes from the Department's MPL.

WMA is allowed for use on all projects and is required when shown on the plans. When WMA is required, the maximum placement or target discharge temperature for WMA will be set at a value below 275°F. Department-approved WMA additives may be used to facilitate mixing and compaction of HMA produced at target discharge temperatures greater than 275°F; however, such mixtures will not be defined as WMA.

2.7. **Recycled Materials**. Recycled materials are not allowed for use.

## 3. EQUIPMENT

Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement."

## 4. CONSTRUCTION

Produce, haul, place, and compact the specified paving mixture. In addition to tests required by the specification, Contractors may perform other QC tests as deemed necessary. At any time during the project, the Engineer may perform production and placement tests as deemed necessary in accordance with Item 5, "Control of the Work." Schedule and participate in a mandatory pre-paving meeting with the Engineer on or before the first day of paving unless otherwise shown on the plans.

4.1. **Certification**. Personnel certified by the Department-approved hot-mix asphalt certification program must conduct all mixture designs, sampling, and testing in accordance with Table 4. Supply the Engineer with a list of certified personnel and copies of their current certificates before beginning production and when personnel changes are made. Provide a mixture design developed and signed by a Level 2 certified specialist. Provide Level 1A certified specialists at the plant during production operations. Provide Level 1B certified specialists to conduct placement tests.

**Table 4**
**Test Methods, Test Responsibility, and Minimum Certification Levels**

| Test Description | Test Method | Contractor | Engineer | Level[1] |
|---|---|---|---|---|
| ***1. Aggregate Testing*** | | | | |
| Sampling | Tex-221-F | ✓ | ✓ | 1A |
| Dry sieve | Tex-200-F, Part I | ✓ | ✓ | 1A |
| Washed sieve | Tex-200-F, Part II | ✓ | ✓ | 1A |
| Deleterious material | Tex-217-F, Part I | ✓ | ✓ | 1A |
| Decantation | Tex-217-F, Part II | ✓ | ✓ | 1A |
| Los Angeles abrasion | Tex-410-A | | ✓ | TxDOT |
| Magnesium sulfate soundness | Tex-411-A | | ✓ | TxDOT |
| Micro-Deval abrasion | Tex-461-A | | ✓ | 2 |
| Crushed face count | Tex-460-A | ✓ | ✓ | 2 |
| Flat and elongated particles | Tex-280-F | ✓ | ✓ | 2 |
| Linear shrinkage | Tex-107-E | ✓ | ✓ | 2 |
| Sand equivalent | Tex-203-F | ✓ | ✓ | 2 |
| Organic impurities | Tex-408-A | ✓ | ✓ | 2 |
| ***2. Asphalt Binder & Tack Coat Sampling*** | | | | |
| Asphalt binder sampling | Tex-500-C, Part II | ✓ | ✓ | 1A/1B |
| Tack coat sampling | Tex-500-C, Part III | ✓ | ✓ | 1A/1B |
| ***3. Mix Design & Verification*** | | | | |
| Design and JMF changes | Tex-204-F | ✓ | ✓ | 2 |
| Mixing | Tex-205-F | ✓ | ✓ | 2 |
| Molding (TGC) | Tex-206-F | ✓ | ✓ | 1A |
| Molding (SGC) | Tex-241-F | ✓ | ✓ | 1A |
| Laboratory-molded density | Tex-207-F | ✓ | ✓ | 1A |
| VMA[2] (calculation only) | Tex-204-F | ✓ | ✓ | 2 |
| Rice gravity | Tex-227-F | ✓ | ✓ | 1A |
| Drain-down | Tex-235-F | ✓ | ✓ | 1A |
| Ignition oven correction factors[3] | Tex-236-F | ✓ | ✓ | 2 |
| Indirect tensile strength | Tex-226-F | ✓ | ✓ | 2 |
| Overlay test | Tex-248-F | | ✓ | TxDOT |
| Hamburg Wheel test | Tex-242-F | ✓ | ✓ | 2 |
| Boil test | Tex-530-C | ✓ | ✓ | 1A |
| ***4. Production Testing*** | | | | |
| Selecting production random numbers | Tex-225-F, Part I | | ✓ | 1A |
| Mixture sampling | Tex-222-F | ✓ | ✓ | 1A |
| Molding (TGC) | Tex-206-F | ✓ | ✓ | 1A |
| Molding (SGC) | Tex-241-F | ✓ | ✓ | 1A |
| Laboratory-molded density | Tex-207-F | ✓ | ✓ | 1A |
| VMA[2] (calculation only) | Tex-204-F | ✓ | ✓ | 1A |
| Rice gravity | Tex-227-F | ✓ | ✓ | 1A |
| Gradation & asphalt binder content[3] | Tex-236-F | ✓ | ✓ | 1A |
| Drain-down | Tex-235-F | ✓ | ✓ | 1A |
| Control charts | Tex-233-F | ✓ | ✓ | 1A |
| Moisture content | Tex-212-F | ✓ | ✓ | 1A |
| Hamburg Wheel test | Tex-242-F | ✓ | ✓ | 2 |
| Overlay test | Tex-248-F | ✓ | ✓ | TxDOT |
| Micro-Deval abrasion | Tex-461-A | | ✓ | 2 |
| Boil test | Tex-530-C | ✓ | ✓ | 1A |
| Abson recovery | Tex-211-F | | ✓ | TxDOT |
| ***5. Placement Testing*** | | | | |
| Establish rolling pattern | Tex-207-F | ✓ | | 1B |
| Control charts | Tex-233-F | ✓ | ✓ | 1A |
| Ride quality measurement | Tex-1001-S | ✓ | ✓ | Note 4 |
| Thermal profile | Tex-244-F | ✓ | ✓ | 1B |
| Water flow | Tex-246-F | ✓ | ✓ | 1B |

5. Level 1A, 1B, and 2 are certification levels provided by the Hot Mix Asphalt Center certification program.
6. Voids in mineral aggregates.
7. Refer to Section 347.4.9.2.3., "Production Testing" for exceptions to using an ignition oven.
8. Profiler and operator are required to be certified at the Texas A&M Transportation Institute facility when Surface Test Type B is specified.

4.2. **Reporting and Responsibilities**. Use Department-provided templates to record and calculate all test data, including mixture design, production and placement QC/QA, control charts, and thermal profiles. Obtain the current version of the templates at http://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html or from the Engineer. The Engineer and the Contractor will provide any available test results to the other party when requested. The maximum allowable time for the Contractor and Engineer to exchange test data is as given in Table 5 unless otherwise approved. The Engineer and the Contractor will immediately report to the other party any test result that requires suspension of production or placement or that fails to meet the specification requirements. Record and electronically submit all test results and pertinent information on Department-provided templates.

Subsequent sublots placed after test results are available to the Contractor, which require suspension of operations, may be considered unauthorized work. Unauthorized work will be accepted or rejected at the discretion of the Engineer in accordance with Article 5.3., "Conformity with Plans, Specifications, and Special Provisions."

**Table 5**
**Reporting Schedule**

| Description | Reported By | Reported To | To Be Reported Within |
|---|---|---|---|
| ***Production Quality Control*** | | | |
| Gradation[1] | Contractor | Engineer | 1 working day of completion of the sublot |
| Asphalt binder content[1] | | | |
| Laboratory-molded density[2] | | | |
| Moisture content[3] | | | |
| Boil test[3] | | | |
| ***Production Quality Assurance*** | | | |
| Gradation[3] | Engineer | Contractor | 1 working day of completion of the sublot |
| Asphalt binder content[3] | | | |
| Laboratory-molded density[1] | | | |
| Hamburg Wheel test[2] | | | |
| Overlay test[2] | | | |
| Boil test[2] | | | |
| Binder tests[2] | | | |
| ***Placement Quality Control*** | | | |
| Thermal profile[1] | Contractor | Engineer | 1 working day of completion of the lot |
| Water flow[1] | | | |
| ***Placement Quality Assurance*** | | | |
| Thermal profile[2] | Engineer | Contractor | 1 working day of completion of the lot |
| Aging ratio[2] | | | |
| Water flow | | | |

9. These tests are required on every sublot.
10. Optional test. To be reported as soon as results become available.
11. To be performed at the frequency specified on the plans.

Use the procedures described in Tex-233-F to plot the results of all quality control (QC) and quality assurance (QA) testing. Update the control charts as soon as test results for each sublot become available. Make the control charts readily accessible at the field laboratory. The Engineer may suspend production for failure to update control charts.

4.3. **Quality Control Plan (QCP)**. Develop and follow the QCP in detail. Obtain approval for changes to the QCP made during the project. The Engineer may suspend operations if the Contractor fails to comply with the QCP.

Submit a written QCP before the mandatory pre-paving meeting. Receive approval of the QCP before beginning production. Include the following items in the QCP:

4.3.1. **Project Personnel**. For project personnel, include:

- a list of individuals responsible for QC with authority to take corrective action;
- current contact information for each individual listed; and
- current copies of certification documents for individuals performing specified QC functions.

4.3.2. **Material Delivery and Storage**. For material delivery and storage, include:

- the sequence of material processing, delivery, and minimum quantities to assure continuous plant operations;
- aggregate stockpiling procedures to avoid contamination and segregation;
- frequency, type, and timing of aggregate stockpile testing to assure conformance of material requirements before mixture production; and
- procedure for monitoring the quality and variability of asphalt binder.

4.3.3. **Production**. For production, include:

- loader operation procedures to avoid contamination in cold bins;
- procedures for calibrating and controlling cold feeds;
- procedures to eliminate debris or oversized material;
- procedures for adding and verifying rates of each applicable mixture component (e.g., aggregate, asphalt binder, lime, liquid antistrip, WMA);
- procedures for reporting job control test results; and
- procedures to avoid segregation and drain-down in the silo.

4.3.4. **Loading and Transporting**. For loading and transporting, include:

- type and application method for release agents; and
- truck loading procedures to avoid segregation.

4.3.5. **Placement and Compaction**. For placement and compaction, include:

- proposed agenda for mandatory pre-paving meeting, including date and location;
- proposed paving plan (e.g., paving widths, joint offsets, and lift thicknesses);
- type and application method for release agents in the paver and on rollers, shovels, lutes, and other utensils;
- procedures for the transfer of mixture into the paver, while avoiding segregation and preventing material spillage;
- process to balance production, delivery, paving, and compaction to achieve continuous placement operations and good ride quality;
- paver operations (e.g., operation of wings, height of mixture in auger chamber) to avoid physical and thermal segregation and other surface irregularities; and
- procedures to construct quality longitudinal and transverse joints.

4.4. **Mixture Design**.

4.4.1. **Design Requirements**. The Contractor may design the mixture using a Texas Gyratory Compactor (TGC) or a Superpave Gyratory Compactor (SGC) unless otherwise shown on the plans. Use the typical weight design example given in Tex-204-F, Part I, when using a TGC. Use the Superpave mixture design procedure provided in Tex-204-F, Part IV, when using a SGC. Design the mixture to meet the requirements listed in Tables 1, 2, 3, 6, and 7.

4.4.1.1. **Target Laboratory-Molded Density When The TGC Is Used**. Design the mixture at a 97.5% target laboratory-molded density or as noted in Table 7.

4.4.1.2. **Design Number of Gyrations (Ndesign) When The SGC Is Used**. Design the mixture at 50 gyrations (Ndesign). Use a target laboratory-molded density of 96.0% to design the mixture; however, adjustments can be made to the Ndesign value as noted in Table 7. The Ndesign level may be reduced to no less than 35 gyrations at the Contractor's discretion.

Use an approved laboratory from the Department's MPL to perform the Hamburg Wheel test, and the Department will perform the Overlay test and provide results with the mixture design, or provide the

laboratory mixture and request that the Department perform the Hamburg Wheel test and Overlay test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test and Overlay test results on the laboratory mixture design.

The Engineer will provide the mixture design when shown on the plans. The Contractor may submit a new mixture design at any time during the project. The Engineer will verify and approve all mixture designs (JMF1) before the Contractor can begin production.

Provide the Engineer with a mixture design report using the Department-provided template. Include the following items in the report:

- the combined aggregate gradation, source, specific gravity, and percent of each material used;
- the target laboratory-molded density (or Ndesign level when using the SGC);
- results of all applicable tests;
- the mixing and molding temperatures;
- the signature of the Level 2 person or persons that performed the design;
- the date the mixture design was performed; and
- a unique identification number for the mixture design.

**Table 6**
**Master Gradation Limits (% Passing by Weight or Volume) and Volumetric Requirements**

| Sieve Size | Coarse (TOM-C) | Fine (TOM-F) |
|---|---|---|
| 1/2" | 100.0[1] | 100.0[1] |
| 3/8" | 95.0–100.0 | 98.0–100.0 |
| #4 | 40.0–60.0 | 70.0–95.0 |
| #8 | 17.0–27.0 | 40.0–65.0 |
| #16 | 5.0–27.0 | 20.0–45.0 |
| #30 | 5.0–27.0 | 10.0–35.0 |
| #50 | 5.0–27.0 | 10.0–20.0 |
| #200 | 5.0–9.0 | 2.0–12.0 |
| **Asphalt Binder Content,[2] % Min** | | |
| - | 6.0 | 6.5 |
| **Design VMA,[3] % Min** | | |
| - | 16.0 | 16.5 |
| **Production (Plant-Produced) VMA,[3] % Min** | | |
| - | 15.5 | 16.0 |

12. Defined as maximum sieve size. No tolerance allowed.
13. Unless otherwise shown on the plans or approved by the Engineer.
14. Voids in Mineral Aggregates (VMA).

**Table 7**
**Laboratory Mixture Design Properties**

| Mixture Property | Test Method | Requirement |
|---|---|---|
| Target laboratory-molded density, % (TGC) | Tex-207 F | 97.5[1] |
| Design gyrations (Ndesign for SGC) | Tex-241-F | 50[2] |
| Hamburg Wheel test, passes at 12.5 mm rut depth for PG 70 mixtures | Tex-242-F | 15,000 Min |
| Hamburg Wheel test, passes at 12.5 mm rut depth for PG 76 mixtures | Tex-242-F | 20,000 Min |
| Tensile strength (dry), psi. | Tex-226-F | 85–200 |
| Overlay test, number of cycles | Tex-248-F | 300 Min |
| Drain-down, % | Tex-235-F | 0.20 Max |

15. Unless otherwise shown on the plans or approved by the Engineer.
16. May be adjusted within the range of 35–100 gyrations when shown on the plans or specification or when mutually agreed between the Engineer and Contractor.

4.4.2. **Job-Mix Formula Approval**. The job-mix formula (JMF) is the combined aggregate gradation, target laboratory-molded density (or Ndesign level), and target asphalt percentage used to establish target values for hot-mix production. JMF1 is the original laboratory mixture design used to produce the trial batch. When WMA is used, JMF1 may be designed and submitted to the Engineer without including the WMA additive. When WMA is used, document the additive or process used and recommended rate on the JMF1 submittal. The Engineer and the Contractor will verify JMF1 based on plant-produced mixture from the trial batch

unless otherwise approved. The Engineer may accept an existing mixture design previously used on a Department project and may waive the trial batch to verify JMF1. The Department may require the Contractor to reimburse the Department for verification tests if more than 2 trial batches per design are required.

4.4.2.1. **Contractor's Responsibilities**.

4.4.2.1.1. **Providing Gyratory Compactor**. Use a TGC calibrated in accordance with Tex-914-K when electing or required to design the mixture in accordance with Tex-204-F, Part I, for molding production samples. Furnish an SGC calibrated in accordance with Tex-241-F when electing or required to design the mixture in accordance with Tex-204-F, Part IV, for molding production samples. Locate the SGC if used, at the Engineer's field laboratory and make the SGC available to the Engineer for use in molding production samples.

4.4.2.1.2. **Gyratory Compactor Correlation Factors**. Use Tex-206-F, Part II, to perform a gyratory compactor correlation when the Engineer uses a different gyratory compactor. Apply the correlation factor to all subsequent production test results.

4.4.2.1.3. **Submitting JMF1**. Furnish a mix design report (JMF1) with representative samples of all component materials and request approval to produce the trial batch. Provide approximately 25 lb. of the design mixture if opting to have the Department perform the Hamburg Wheel test on the laboratory mixture, and request that the Department perform the test. Provide approximately 50 lb. of the design mixture to perform the Overlay test.

4.4.2.1.4. **Supplying Aggregates**. Provide approximately 40 lb. of each aggregate stockpile unless otherwise directed.

4.4.2.1.5. **Supplying Asphalt**. Provide at least 1 gal. of the asphalt material and sufficient quantities of any additives proposed for use.

4.4.2.1.6. **Ignition Oven Correction Factors**. Determine the aggregate and asphalt correction factors from the ignition oven in accordance with Tex-236-F. Provide the Engineer with split samples of the mixtures before the trial batch production, including all additives (except water), and blank samples used to determine the correction factors for the ignition oven used for QA testing during production. Correction factors established from a previously approved mixture design may be used for the current mixture design if the mixture design and ignition oven are the same as previously used unless otherwise directed.

4.4.2.1.7. **Boil Test**. Perform the test and retain the tested sample from Tex-530-C until completion of the project or as directed. Use this sample for comparison purposes during production. The Engineer may waive the requirement for the boil test.

4.4.2.1.8. **Trial Batch Production**. Provide a plant-produced trial batch upon receiving conditional approval of JMF1 and authorization to produce a trial batch, including the WMA additive or process, if applicable, for verification testing of JMF1 and development of JMF2. Produce a trial batch mixture that meets the requirements in Table 8. The Engineer may accept test results from recent production of the same mixture instead of a new trial batch.

Obtain and provide approximately 50 lb. of trial batch mixture in a sealed container, box, or bags labeled with the CSJ number, mixture type, and date for the Overlay test.

4.4.2.1.9. **Trial Batch Production Equipment**. Use only equipment and materials proposed for use on the project to produce the trial batch.

4.4.2.1.10. **Trial Batch Quantity**. Produce enough quantity of the trial batch to ensure that the mixture meets the specification requirements.

4.4.2.1.11. **Number of Trial Batches**. Produce trial batches as necessary to obtain a mixture that meets the specification requirements.

4.4.2.1.12. **Trial Batch Sampling**. Obtain a representative sample of the trial batch and split it into 3 equal portions in accordance with Tex-222-F. Label these portions as "Contractor," "Engineer," and "Referee." Deliver samples to the appropriate laboratory as directed.

4.4.2.1.13. **Trial Batch Testing**. Test the trial batch to ensure the mixture produced using the proposed JMF1 meets the mixture requirements in Table 8. Ensure the trial batch mixture is also in compliance with the Hamburg Wheel test, Overlay test, and drain-down requirements listed in Table 7. Use a Department-approved laboratory to perform the Hamburg Wheel test on the trial batch mixture or request that the Department perform the Hamburg Wheel test. Obtain and provide approximately 50 lb. of trial batch mixture in sealed containers, boxes, or bags labeled with the CSJ, mixture type, lot, and sublot number for the Overlay test. The Engineer will be allowed 10 working days to provide the Contractor with Hamburg Wheel test and Overlay test results on the trial batch. Provide the Engineer with a copy of the trial batch test results.

4.4.2.1.14. **Development of JMF2**. Evaluate the trial batch test results after the Engineer grants full approval of JMF1 based on results from the trial batch, determine the optimum mixture proportions, and submit as JMF2. Adjust the asphalt binder content or gradation to achieve the specified target laboratory-molded density. The asphalt binder content established for JMF2 is not required to be within any tolerance of the optimum asphalt binder content established for JMF1; however, mixture produced using JMF2 must meet the voids in mineral aggregates (VMA) requirements for production shown in Table 6. If the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1, the Engineer may perform or require the Contractor to perform Tex-226-F on Lot 1 production to confirm the indirect tensile strength does not exceed 200 psi and the Overlay test exceeds 300 cycles.

4.4.2.1.15. **Mixture Production**. Use JMF2 to produce Lot 1 after receiving approval for JMF2 and a passing result from the Department's or a Department-approved laboratory's Hamburg Wheel test and the Department's Overlay test on the trial batch. If desired, proceed to Lot 1 production, once JMF2 is approved, at the Contractor's risk without receiving the results from either the Department's Hamburg Wheel test or Overlay test on the trial batch.

Notify the Engineer if electing to proceed without Hamburg Wheel test and Overlay test results from the trial batch. Note that the Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel test or Overlay test to be removed and replaced at the Contractor's expense.

4.4.2.1.16. **Development of JMF3**. Evaluate the test results from Lot 1, determine the optimum mixture proportions, and submit as JMF3 for use in Lot 2.

4.4.2.1.17. **JMF Adjustments**. If JMF adjustments are necessary to achieve the specified requirements, make the adjustments before beginning a new lot. The adjusted JMF must:

- be provided to the Engineer in writing before the start of a new lot;
- be numbered in sequence to the previous JMF;
- meet the master gradation limits shown in Table 6; and
- be within the operational tolerances of JMF2 listed in Table 8.

4.4.2.1.18. **Requesting Referee Testing**. Use referee testing, if needed, in accordance with Section 347.4.9.1., "Referee Testing," to resolve testing differences with the Engineer.

**Table 8**
**Operational Tolerances**

| Description | Test Method | Allowable Difference between Trial Batch and JMF1 Target | Allowable Difference from Current JMF Target | Allowable Difference between Contractor and Engineer[1] |
|---|---|---|---|---|
| Individual % retained for #8 sieve and larger | Tex-200-F or Tex-236-F | Must be Within Master Grading Limits in Table 6 | ±3.0[2,3] | ±5.0 |
| Individual % retained for sieves smaller than #8 and larger than #200 | | | ±3.0[2,3] | ±3.0 |
| % passing the #200 sieve | | | ±2.0[2,3] | ±1.6 |
| Asphalt binder content, %[4] | Tex-236-F | ±0.3 | ±0.3[3] | ±0.3 |
| Laboratory-molded density, % | Tex-207-F | ±1.0 | ±1.0 | ±1.0 |
| Laboratory-molded bulk specific gravity | | N/A | N/A | ±0.020 |
| VMA, % min | Tex-204-F | Note 4 | Note 4 | N/A |
| Theoretical maximum specific (Rice) gravity | Tex-227-F | N/A | N/A | ±0.020 |
| Drain-down, % | Tex-235-F | Note 5 | Note 5 | N/A |

17. Contractor may request referee testing only when values exceed these tolerances.
18. When within these tolerances, mixture production gradations may fall outside the master grading limits; however, the % passing the #200 will be considered out of tolerance when outside the master grading limits.
19. Only applies to mixture produced for Lot 1 and higher.
20. Binder content is not allowed to be outside the limits shown in Table 6. May be obtained from asphalt meter readouts.
21. Test and verify that Table 7 requirements are met.

4.4.2.2. **Engineer's Responsibilities**.

4.4.2.2.1. **Gyratory Compactor**. For mixtures designed in accordance with Tex-204-F, Part I, the Engineer will use a Department TGC, calibrated in accordance with Tex-914-K, to mold samples for trial batch and production testing. The Engineer will make the Department TGC and the Department field laboratory available to the Contractor for molding verification samples, if requested by the Contractor.

For mixtures designed in accordance with Tex-204-F, Part IV, the Engineer will use a Department SGC, calibrated in accordance with Tex-241-F, to mold samples for laboratory mixture design verification. For molding trial batch and production specimens, the Engineer will use the Contractor-provided SGC at the field laboratory or provide and use a Department SGC at an alternate location. The Engineer will make the Contractor-provided SGC in the Department field laboratory available to the Contractor for molding verification samples.

4.4.2.2.2. **Conditional Approval of JMF1 and Authorizing Trial Batch**. The Engineer will review and verify conformance of the following information within 2 working days of receipt:

- the Contractor's mix design report (JMF1);
- the Department-provided Overlay test results;
- the Contractor-provided Hamburg Wheel test results;
- all required materials including aggregates, asphalt, and additives; and
- the mixture specifications.

The Engineer will grant the Contractor conditional approval of JMF1 if the information provided on the paper copy of JMF1 indicates that the Contractor's mixture design meets the specifications. When the Contractor does not provide Hamburg Wheel test and Overlay test results with laboratory mixture design, 10 working days are allowed for conditional approval of JMF1. The Engineer will base full approval of JMF1 on test results on mixture from the trial batch.

Unless waived, the Engineer will determine the Micro-Deval abrasion loss in accordance with Section 347.2.1.1.2., "Micro-Deval Abrasion." If the Engineer's test results are pending after 2 working days, conditional approval of JMF1 will still be granted within 2 working days of receiving JMF1. When the Engineer's test results become available, they will be used for specification compliance.

After conditionally approving JMF1, including either Contractor- or Department-supplied Hamburg Wheel test results, the Contractor is authorized to produce a trial batch.

4.4.2.2.3. **Hamburg Wheel and Overlay Testing of JMF1**. If the Contractor requests the option to have the Department perform the Hamburg Wheel test on the laboratory mixture, the Engineer will mold samples in accordance with Tex-242-F to verify compliance with the Hamburg Wheel test requirement in Table 7. The Engineer will perform the Overlay test and mold samples in accordance with Tex-248-F to verify compliance with the Overlay test requirements in Table 7.

4.4.2.2.4. **Ignition Oven Correction Factors**. The Engineer will use the split samples provided by the Contractor to determine the aggregate and asphalt correction factors for the ignition oven used for QA testing during production in accordance with Tex-236-F.

4.4.2.2.5. **Testing the Trial Batch**. Within 1 full working day, the Engineer will sample and test the trial batch to ensure that the mixture meets the requirements in Table 8. The Engineer will mold samples in accordance with Tex-242-F if the Contractor requests the option to have the Department perform the Hamburg Wheel test on the trial batch mixture to verify compliance with Hamburg Wheel test requirements in Table 7. The Engineer will mold samples for the Overlay test in accordance with Tex-248-F to verify compliance with the Overlay test requirement in Table 7.

The Engineer will have the option to perform the following tests on the trial batch:

- Tex-226-F, to verify that the indirect tensile strength meets the requirement shown in Table 8; and
- Tex-530-C, to retain and use for comparison purposes during production.

4.4.2.2.6. **Full Approval of JMF1**. The Engineer will grant full approval of JMF1 and authorize the Contractor to proceed with developing JMF2 if the Engineer's results for the trial batch meet the requirements in Table 7. The Engineer will notify the Contractor that an additional trial batch is required if the trial batch does not meet these requirements.

4.4.2.2.7. **Approval of JMF2**. The Engineer will approve JMF2 within one working day if the gradation meets the master grading limits shown in Table 6 and is within the operational tolerances of JMF1 listed in Table 8. The asphalt binder content established for JMF2 is not required to be within any tolerance of the optimum asphalt binder content established for JMF1; however, mixture produced using JMF2 must meet the VMA requirements shown in Table 6. The Engineer may perform or require the Contractor to perform Tex-226-F on Lot 1 production to confirm the indirect tensile strength does not exceed 200 psi if the optimum asphalt binder content for JMF2 is more than 0.5% lower than the optimum asphalt binder content for JMF1.

4.4.2.2.8. **Approval of Lot 1 Production**. The Engineer will authorize the Contractor to proceed with Lot 1 production (using JMF2) as soon as a passing result is achieved from the Department's or a Department-approved laboratory's Hamburg Wheel test and from the Department's Overlay test. The Contractor may proceed at its own risk with Lot 1 production without the results from the Hamburg Wheel test and Overlay test on the trial batch.

If the Department's or Department-approved laboratory's sample from the trial batch fails the Hamburg Wheel test or Overlay test, the Engineer will suspend production until further Hamburg Wheel tests or Overlay tests meet the specified values. The Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel test or Overlay test to be removed and replaced at the Contractor's expense.

4.4.2.2.9. **Approval of JMF3 and Subsequent JMF Changes**. JMF3 and subsequent JMF changes are approved if they meet the master grading limits shown in Table 6, mixture requirements shown in Table 7, and are within the operational tolerances of JMF2 shown in Table 8.

4.5. **Production Operations**. Perform a new trial batch when the plant or plant location is changed. Take corrective action and receive approval to proceed after any production suspension for noncompliance to the specification.

4.5.1. **Storage and Heating of Materials**. Do not heat the asphalt binder above the temperatures specified in Item 300, "Asphalts, Oils, and Emulsions," or outside the manufacturer's recommended values. Provide the Engineer with daily records of asphalt binder and hot-mix asphalt discharge temperatures (in legible and discernible increments) in accordance with Item 320, "Equipment for Asphalt Concrete Pavement," unless otherwise directed. Do not store mixture for a period long enough to affect the quality of the mixture, nor in any case longer than 12 hr. unless otherwise approved.

4.5.2. **Mixing and Discharge of Materials**. Notify the Engineer of the target discharge temperature and produce the mixture within 25°F of the target. Monitor the temperature of the material in the truck before shipping to ensure that it does not exceed 350°F (or 275°F for WMA) and is not lower than 215°F. The Department will not pay for or allow placement of any mixture produced above 350°F.

Produce WMA within the target discharge temperature range of 215°F and 275°F when WMA is required. Take corrective action any time the discharge temperature of the WMA exceeds the target discharge range. The Engineer may suspend production operations if the Contractor's corrective action is not successful at controlling the production temperature within the target discharge range. Note that when WMA is produced, it may be necessary to adjust burners to ensure complete combustion such that no burner fuel residue remains in the mixture.

Control the mixing time and temperature so that substantially all moisture is removed from the mixture before discharging from the plant. Determine the moisture content, if requested, by oven-drying in accordance with Tex-212-F, Part II, and verify that the mixture contains no more than 0.2% of moisture by weight. Obtain the sample immediately after discharging the mixture into the truck, and perform the test promptly.

4.6. **Hauling Operations**. Clean all truck beds before use to ensure that mixture is not contaminated. Use a release agent shown on the Department's MPL to coat the inside bed of the truck when necessary.

Use equipment for hauling as defined in Section 347.4.7.3.3., "Hauling Equipment." Use other hauling equipment only when allowed.

4.7. **Placement Operations**. Collect haul tickets from each load of mixture delivered to the project and provide the Department's copy to the Engineer approximately every hour, or as directed. Use a hand-held thermal camera or infrared thermometer, when a thermal imaging system is not used, to measure and record the internal temperature of the mixture as discharged from the truck or Material Transfer Device (MTD) before or as the mix enters the paver and an approximate station number or GPS coordinates on each ticket. Calculate the daily yield and cumulative yield for the specified lift and provide to the Engineer at the end of paving operations for each day unless otherwise directed. The Engineer may suspend production if the Contractor fails to produce and provide haul tickets and yield calculations by the end of paving operations for each day.

Prepare the surface by removing raised pavement markers and objectionable material such as moisture, dirt, sand, leaves, and other loose impediments from the surface before placing mixture. Remove vegetation from pavement edges. Place the mixture to meet the typical section requirements and produce a smooth, finished surface with a uniform appearance and texture. Place mixture so that longitudinal joints on the surface course coincide with lane lines, or as directed. Ensure that all finished surfaces will drain properly. Place the mixture at the rate or thickness shown on the plans. The Engineer will use the guidelines in Table 9 to determine the compacted lift thickness. The thickness determined is based on the rate of 110–115 lb./sq. yd. for each inch of pavement unless otherwise shown on the plans.

**Table 9**
**Compacted Lift Thickness**

| | Compacted Lift Thickness[1] | |
|---|---|---|
| **Mixture Type** | **Minimum (in.)** | **Maximum (in.)** |
| TOM-C | 0.75 | 1.25 |
| TOM-F | 0.5 | 0.75 |

22. Compacted target lift thickness will be specified on the plans.

4.7.1. **Weather Conditions**.

4.7.1.1. **When Using a Thermal Imaging System**. The Contractor may pave any time the roadway is dry and the roadway surface temperature is at least 32°F; however, the Engineer may restrict the Contractor from paving surface mixtures if the ambient temperature is likely to drop below 32°F within 12 hr. of paving. Provide output data from the thermal imaging system to demonstrate to the Engineer that no recurring severe thermal segregation exists in accordance with Section 347.4.7.3.1.2., "Thermal Imaging System."

4.7.1.2. **When Not Using a Thermal Imaging System**. Place mixture when the roadway surface temperature is at or above 60°F unless otherwise approved. Measure the roadway surface temperature with a hand-held thermal camera or infrared thermometer. The Engineer may allow mixture placement to begin before the roadway surface reaches the required temperature requirements if conditions are such that the roadway surface will reach the required temperature within 1 hr. of beginning placement operations. Place mixtures only when weather conditions and moisture conditions of the roadway surface are suitable as determined by the Engineer. The Engineer may restrict the Contractor from paving if the air temperature is 70°F and falling.

Produce mixture with a Department approved WMA additive or process to facilitate compaction when the roadway surface temperature is below 60°F or when the air temperature is 60°F and falling. Produce the mixture with the WMA additive or process at a target discharge temperature higher than 300°F.

4.7.2. **Tack Coat**. Clean the surface before placing the tack coat. The Engineer will set the rate between 0.04 and 0.10 gal. of residual asphalt per square yard of surface area. Apply a uniform tack coat at the specified rate unless otherwise directed. Apply a uniform tack coat to all contact surfaces of curbs, structures, and all joints. Allow adequate time for emulsion to break completely before placing any material. Prevent splattering of tack coat when placed adjacent to curb, gutter, and structures. Roll the tack coat with a pneumatic-tire roller to remove streaks and other irregular patterns when directed. The Engineer may suspend paving operations until there is adequate coverage.

4.7.3. **Lay-Down Operations**.

4.7.3.1. **Thermal Profile**. Use a hand-held thermal camera or a thermal imaging system to obtain a continuous thermal profile in accordance with Tex-244-F.

4.7.3.1.1. **Thermal Segregation**.

4.7.3.1.1.1. **Moderate**. Any areas that have a temperature differential greater than 25°F, but not exceeding 50°F, are deemed as having moderate thermal segregation.

4.7.3.1.1.2. **Severe**. Any areas that have a temperature differential greater than 50°F are deemed as having severe thermal segregation.

4.7.3.1.2. **Thermal Imaging System**. Review the output results when a thermal imaging system is used, and provide the automated report described in Tex-244-F to the Engineer daily unless otherwise directed. Modify the paving process as necessary to eliminate any recurring (moderate or severe) thermal segregation identified by the thermal imaging system. The Engineer may suspend paving operations if the Contractor cannot successfully modify the paving process to eliminate recurring severe thermal segregation. Density profiles are not required and not applicable when using a thermal imaging system. Provide the Engineer with electronic copies of all daily data files that can be used with the thermal imaging system software to generate temperature profile plots upon completion of the project or as requested by the Engineer.

4.7.3.1.3. **Thermal Camera**. Take immediate corrective action to eliminate recurring moderate thermal segregation when a hand-held thermal camera is used. Evaluate areas with moderate thermal segregation by performing water flow testing in accordance to Tex-246-F and verify the water flow is greater than 120 sec. Provide the Engineer with the thermal profile of every sublot within one working day of the completion of each lot. Report the results of each thermal profile in accordance with Section 347.4.2., "Reporting and Responsibilities." The Engineer will use a hand-held thermal camera to obtain a thermal profile at least once per project. Suspend operations and take immediate corrective action to eliminate severe thermal segregation unless otherwise

directed. Resume operations when the Engineer determines that subsequent production will meet the requirements of this Section. Evaluate areas with severe thermal segregation by performing water flow testing in accordance to Tex-246-F and verify the water flow is greater than 120 sec. Remove and replace the material in any areas that have both severe thermal segregation and a failing result for water flow test unless otherwise directed.

4.7.3.2. **Windrow Operations**. Operate windrow pickup equipment so that when hot-mix is placed in windrows, substantially all the mixture deposited on the roadbed is picked up and loaded into the paver.

4.7.3.3. **Hauling Equipment**. Use belly dumps, live bottom, or end dump trucks to haul and transfer mixture. End dump trucks are only allowed when used in conjunction with an MTD with remixing capability unless otherwise allowed.

4.7.3.4. **Screed Heaters**. Turn off screed heaters to prevent overheating of the mat if the paver stops for more than 5 min. The Engineer may evaluate the suspect area in accordance with Section 347.4.9.3.1.1., "Recovered Asphalt Dynamic Shear Rheometer (DSR)," if the screed heater remains on for more than 5 min. while the paver is stopped.

4.8. **Compaction**. Roll the freshly placed mixture with a steel-wheeled roller without excessive breakage of the aggregate to provide a smooth surface and uniform texture. Operate the roller in static mode for TOM-F mixtures only. Do not use pneumatic-tire rollers. Use the control strip method given in Tex-207-F, Part IV, to establish the rolling pattern. Thoroughly moisten the roller drums with a soap and water solution to prevent adhesion. Use only water or an approved release agent on rollers, tamps, and other compaction equipment unless otherwise directed.

Use tamps to thoroughly compact the edges of the pavement along curbs, headers, and similar structures and in locations that will not allow thorough compaction with rollers. The Engineer may require rolling with a trench roller on widened areas, in trenches, and in other limited areas.

Use Tex-246-F to measure water flow to verify the mixture is adequately compacted. Measure the water flow once per sublot at locations directed by the Engineer. Take additional water flow measurements when both of the following conditions occur:

- the temperature of the mixture before compaction is below 275°F; and
- WMA is not used.

The water flow rate should be greater than 120 sec. Adjust the mix design or construction methods, when directed, if the water flow rate is less than 120 sec.

Allow the compacted pavement to cool to 160°F or lower before opening to traffic unless otherwise directed. Sprinkle the finished mat with water or limewater, when directed, to expedite opening the roadway to traffic.

4.9. **Acceptance Plan**. Sample and test the hot-mix asphalt on a lot and sublot basis. Suspend production if production test results fail to meet the operational tolerance requirements in Table 8 for any material property for 4 consecutive sublots until test results or other information indicates to the satisfaction of the Engineer that the next material produced or placed will meet specification requirements.

4.9.1. **Referee Testing**. The Construction Division is the referee laboratory. The Contractor may request referee testing if the differences between Contractor and Engineer test results exceed the maximum allowable difference shown in Table 8 and the differences cannot be resolved. The Contractor may also request referee testing if the Engineer's test results require suspension of production and the Contractor's test results are within specification limits. Make the request within 5 working days after receiving test results from the Engineer. Referee tests will be performed only on the sublot in question and only for the particular tests in question. Allow 10 working days from the time the referee laboratory receives the samples for test results to be reported. The Department may require the Contractor to reimburse the Department for referee tests if more than 3 referee tests per project are required and the Engineer's test results are closer to the referee test results than the Contractor's test results.

The Construction Division will determine the laboratory-molded density based on the molded specific gravity and the maximum theoretical specific gravity of the referee sample.

4.9.2. **Production Acceptance**.

4.9.2.1. **Production Lot**. A production lot consists of 4 equal sublots. The default quantity for Lot 1 is 500 tons; however, when requested by the Contractor, the Engineer may increase the quantity for Lot 1 to no more than 2,000 tons. The Engineer will select subsequent lot sizes based on the anticipated daily production such that approximately 3 to 4 sublots are produced each day. The lot size will be between 500 tons and 2,000 tons. The Engineer may change the lot size before the Contractor begins any lot.

4.9.2.1.1. **Incomplete Production Lots**. If a lot is begun but cannot be completed, such as on the last day of production or in other circumstances deemed appropriate, the Engineer may close the lot. Close all lots within 5 working days unless otherwise allowed.

4.9.2.2. **Production Sampling**.

4.9.2.2.1. **Mixture Sampling**. Obtain hot-mix samples from trucks at the plant in accordance with Tex-222-F. The sampler will split each sample into 3 equal portions in accordance with Tex-200-F and label these portions as "Contractor," "Engineer," and "Referee." The Engineer will perform or witness the sample splitting and take immediate possession of the samples labeled "Engineer" and "Referee." The Engineer will maintain the custody of the samples labeled "Engineer" and "Referee" until the Department's testing is completed.

4.9.2.2.1.1. **Random Sample**. At the beginning of the project, the Engineer will select random numbers for all production sublots. Determine sample locations in accordance with Tex-225-F. Take one sample for each sublot at the randomly selected location. The Engineer will perform or witness the sampling of production sublots.

4.9.2.2.1.2. **Blind Sample**. For one sublot per lot, the Engineer will obtain and test a "blind" sample instead of the random sample collected by the Contractor. Test either the "blind" or the random sample; however, referee testing (if applicable) will be based on a comparison of results from the "blind" sample. The location of the Engineer's "blind" sample will not be disclosed to the Contractor. The Engineer's "blind" sample may be randomly selected in accordance with Tex-225-F for any sublot or selected at the discretion of the Engineer. The Engineer will use the Contractor's split sample for sublots not sampled by the Engineer.

4.9.2.2.2. **Asphalt Binder Sampling**. Obtain a 1-qt. sample of the asphalt binder for each lot of mixture produced. Obtain the sample at approximately the same time the mixture random sample is obtained. Sample from a port located immediately upstream from the mixing drum or pug mill in accordance with Tex-500-C, Part II. Label the can with the corresponding lot and sublot numbers, and deliver the sample to the Engineer. The Engineer may also obtain independent samples. If obtaining an independent asphalt binder sample, the Engineer will split a sample of the asphalt binder with the Contractor. The Engineer will test at least one asphalt binder sample per project to verify compliance with Item 300, "Asphalts, Oils, and Emulsions."

4.9.2.3. **Production Testing**. The Contractor and Engineer must perform production tests in accordance with Table 10. The Contractor has the option to verify the Engineer's test results on split samples provided by the Engineer. Determine compliance with operational tolerances listed in Table 8 for all sublots.

Take immediate corrective action if the Engineer's laboratory-molded density on any sublot is less than 95.0% or greater than 98.0% when using the SGC or less than 96.5% or greater than 98.5%, to bring the mixture within these tolerances. The Engineer may suspend operations if the Contractor's corrective actions do not produce acceptable results. The Engineer will allow production to resume when the proposed corrective action is likely to yield acceptable results.

The Engineer may allow alternate methods for determining the asphalt binder content and aggregate gradation if the aggregate mineralogy is such that Tex-236-F does not yield reliable results. Provide evidence that results from Tex-236-F are not reliable before requesting permission to use an alternate method unless otherwise directed. Use the applicable test procedure as directed if an alternate test method is allowed.

**Table 10**
**Production and Placement Testing Frequency**

| Description | Test Method | Minimum Contractor Testing Frequency | Minimum Engineer Testing Frequency |
|---|---|---|---|
| Individual % retained for #8 sieve and larger | Tex-200-F or Tex-236-F | 1 per sublot | 1 per 12 sublots |
| Individual % retained for sieves smaller than #8 and larger than #200 | | | |
| % passing the #200 sieve | | | |
| Laboratory-molded density | Tex-207-F | N/A | 1 per sublot |
| Laboratory-molded bulk specific gravity | | | |
| VMA | Tex-204-F | | |
| Moisture content | Tex-212-F, Part II | When directed | |
| Theoretical maximum specific (Rice) gravity | Tex-227-F | N/A | 1 per sublot |
| Asphalt binder content | Tex-236-F | 1 per sublot | 1 per lot |
| Overlay test[1] | Tex-248-F | N/A | 1 per project |
| Cantabro loss[1] | Tex-245-F | N/A | 1 per project |
| Hamburg Wheel test | Tex-242-F | N/A | 1 per project |
| Thermal profile | Tex-244-F | 1 per sublot | |
| Asphalt binder sampling and testing[1] | Tex-500-C | 1 per sublot (sample only) | |
| Boil test[2] | Tex-530-C | 1 per sublot | |
| Water flow | Tex-246-F | | |

23. Testing performed by the Construction Division or as directed by the Engineer. Cantabro Loss is for informational purposes only.
24. The Engineer may reduce or waive the sampling and testing requirements based on a satisfactory test history.

4.9.2.4. **Operational Tolerances**. Control the production process within the operational tolerances listed in Table 8. When production is suspended, the Engineer will allow production to resume when test results or other information indicates the next mixture produced will be within the operational tolerances.

4.9.2.4.1. **Gradation**. Suspend operation and take corrective action if any aggregate is retained on the maximum sieve size shown in Table 6. A sublot is defined as out of tolerance if either the Engineer's or the Contractor's test results are out of operational tolerance. Suspend production when test results for gradation exceed the operational tolerances for 3 consecutive sublots on the same sieve or 4 consecutive sublots on any sieve unless otherwise directed. The consecutive sublots may be from more than one lot.

4.9.2.4.2. **Asphalt Binder Content**. A sublot is defined as out of operational tolerance if either the Engineer's or the Contractor's test results exceed the values listed in Table 8. Suspend production when 2 or more sublots within a lot are out of operational tolerance or below the minimum asphalt binder content specified in Table 6 unless otherwise directed. Suspend production and shipment of mixture if the Engineer's or Contractor's asphalt binder content deviates from the current JMF by more than 0.5% for any sublot.

4.9.2.4.3. **Voids in Mineral Aggregates (VMA)**. The Engineer will determine the VMA for every sublot. For sublots when the Engineer does not determine asphalt binder content, the Engineer will use the asphalt binder content results from QC testing performed by the Contractor to determine VMA.

Take immediate corrective action if the VMA value for any sublot is less than the minimum VMA requirement for production listed in Table 6. Suspend production and shipment of the mixture if the Engineer's VMA results on 2 consecutive sublots are below the minimum VMA requirement for production listed in Table 6.

Suspend production and shipment of the mixture if the Engineer's VMA result is more than 0.5% below the minimum VMA requirement for production listed in Table 6. In addition to suspending production, the Engineer may require removal and replacement or may allow the sublot to be left in place without payment.

4.9.2.4.4. **Hamburg Wheel and Overlay Test**. The Engineer may perform a Hamburg Wheel or Overlay test at any time during production, including when the boil test indicates a change in quality from the materials submitted for JMF1. The Engineer may obtain cores and perform the Hamburg Wheel test on any area of the roadway where rutting is observed in addition to testing production samples. Suspend production until further Hamburg Wheel or Overlay tests meet the specified values when the production or core samples fail to meet the Hamburg Wheel or Overlay test criteria in Table 7. Core samples, if taken, will be obtained from the

center of the finished mat or other areas excluding the vehicle wheel paths. The Engineer may require up to the entire sublot of any mixture failing the Hamburg Wheel or Overlay test to be removed and replaced at the Contractor's expense.

If the Department's Hamburg Wheel or Overlay test or Department-approved laboratory's Hamburg Wheel test results in a "remove and replace" condition, the Contractor may request that the Department confirm the results by re-testing the failing material. The Construction Division will perform the Hamburg Wheel and Overlay tests and determine the final disposition of the material in question based on the Department's test results.

4.9.2.5. **Individual Loads of Hot-Mix**. The Engineer can reject individual truckloads of hot-mix. When a load of hot-mix is rejected for reasons other than temperature, contamination, or excessive uncoated particles, the Contractor may request that the rejected load be tested. Make this request within 4 hr. of rejection. The Engineer will sample and test the mixture. If test results are within the operational tolerances shown in Table 8, payment will be made for the load. If test results are not within operational tolerances, no payment will be made for the load.

4.9.3. **Placement Acceptance**.

4.9.3.1. **Placement Lot**. A placement lot consists of 4 placement sublots. A placement sublot consists of the area placed during a production sublot.

4.9.3.1.1. **Recovered Asphalt Dynamic Shear Rheometer (DSR)**. The Engineer may take production samples or cores from suspect areas of the project to determine recovered asphalt properties. Asphalt binders with an aging ratio greater than 3.5 do not meet the requirements for recovered asphalt properties and may be deemed defective when tested and evaluated by the Construction Division. The aging ratio is the DSR value of the extracted binder divided by the DSR value of the original unaged binder. Obtain DSR values in accordance with AASHTO T 315 at the specified high temperature performance grade of the asphalt. The Engineer may require removal and replacement of the defective material at the Contractor's expense. The asphalt binder will be recovered for testing from production samples or cores in accordance with Tex-211-F.

4.9.3.1.2. **Irregularities**. Identify and correct irregularities including segregation, rutting, raveling, flushing, fat spots, mat slippage, irregular color, irregular texture, roller marks, tears, gouges, streaks, uncoated aggregate particles, or broken aggregate particles. The Engineer may also identify irregularities, and in such cases, the Engineer will promptly notify the Contractor. The Engineer may require the Contractor to remove and replace (at the Contractor's expense) areas of the pavement that contain irregularities and areas where the mixture does not bond to the existing pavement if the Engineer determines that the irregularity will adversely affect pavement performance. The Engineer may require the Contractor to immediately suspend operations if irregularities are detected or may allow the Contractor to continue operations for no more than one day while the Contractor is taking appropriate corrective action.

4.9.4. **Exempt Production**. When the anticipated daily production is less than 100 tons, all QC and QA sampling and testing are waived. The Engineer may deem the mixture as exempt production for the following conditions:

- anticipated daily production is more than 100 tons but less than 250 tons;
- total production for the project is less than 2,500 tons;
- when mutually agreed between the Engineer and the Contractor; or
- when shown on the plans.

For exempt production, the Contractor is relieved of all production and placement sampling and testing requirements. All other specification requirements apply, and the Engineer will perform acceptance tests for production and placement listed in Table 10.

For exempt production:

- produce, haul, place, and compact the mixture as directed by the Engineer; and
- control mixture production to yield a laboratory-molded density that is within ±1.0% of the target density as tested by the Engineer.

4.9.5. **Ride Quality**. Measure ride quality in accordance with Item 585, "Ride Quality for Pavement Surfaces," unless otherwise shown on the plans.

## 5. MEASUREMENT

TOM will be measured by the ton of composite mixture. The composite mixture is defined as the asphalt, aggregate, and additives. The weights of asphalt and aggregate will be calculated based on the measured weight of TOM and the target percentage of asphalt and aggregate. Measure the weight on scales in accordance with Item 520, "Weighing and Measuring Equipment."

5.1. **Asphalt**. The asphalt weight in tons will be determined from the total weight of TOM. Measured asphalt percentage will be obtained using Tex-236-F or asphalt flow meter readings, as determined by the Engineer. Provide the Engineer with a daily summary of the asphalt mass flow meter readings when used for measuring asphalt percentage unless otherwise directed.

5.1.1. **Target Percentage**. The JMF target asphalt percentage will be used to calculate the weight of asphalt binder unless the measured asphalt binder percentage is more than 0.3 percentage points below the JMF target asphalt percentage or less than the minimum percentage specified in Table 6. Volumetric meter readings will be adjusted to 140°F and converted to weight.

5.1.2. **Measured Percentage**. The average measured asphalt percentage from each sublot will be used for payment for that lot's production when the measured percentage for any sublot is more than 0.3 percentage points below the JMF target asphalt percentage or less than the minimum percentage specified in Table 6.

5.2. **Aggregate**. The aggregate weight in tons will be determined from the total weight of TOM less the weight of the asphalt.

## 6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under Section 347.5., "Measurement," will be paid for at the unit bid price for "TOM (Asphalt)" of the binder specified and for "TOM (Aggregate)" of the grade and SAC specified. These prices are full compensation for surface preparation, materials including tack coat, placement, equipment, labor, tools, and incidentals.

Trial batches will not be paid for unless they are included in pavement work approved by the Department.

Payment adjustment for ride quality will be determined in accordance with Item 585, "Ride Quality for Pavement Surfaces."