ADDENDUM NO. _1_

Date _February 1, 2021_

City of Austin

Project Name ___**Red River Enhancement**_____

C.I.P. No. __7327.053_____ IFB No.: __CLMC837___

This Addendum forms a part of the Contract and corrects or modifies original Bid Documents, dated January 25, 2021. **Acknowledge receipt of this addendum in space provided on bid form.** Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:
   1. ADD to Volume 1 the attached Sections: City Standard Technical Specifications; Special Provisions to City Standard Technical Specifications; and Special Specifications. They were inadvertently omitted from the posted original Bid Documents Volume 1.

B. Drawing Revisions:
   1. DELETE Sheet G004 – General Construction Notes, in its entirety and replace with the attached revised Sheet G004 - General Construction Notes. The Notes 12 and 13 have been revised.

   2. DELETE Sheet L501 – Landscape Details, in its entirety and replace with the attached revised Sheet L501 - Landscape Details. The Standard Detail 1301S-1 – Granite Gravel Hike and Bike Trails has been added.

This addendum consists of _223_ page(s)/sheet(s).

Jose Ibarra Digitally signed by Jose Ibarra
Date: 2021.02.01 14:22:02 -06'00'
_____
Approved by OWNER

2021-02-01
_____
Approved by ENGINEER/ARCHITECT (as applicable per license requirements)

END

STATE OF TEXAS
KEVIN SWEAT
92023
LICENSED
PROFESSIONAL ENGINEER

2/1/2021

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

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° F +/- 2 o F (25°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°F (25°C), and 40% Relative Humidity

Elongation, minimum percent	1200
Durometer Hardness, Shore A, ASTM D 2240, min	15
Joint movement capability, percent	+100/-50
Tensile Strength, maximum elongation, percent	100
Peal strength, psi	25 (172 kPa)

I. Backer Rod

Backer Rod shall be expanded closed cell polyethylene foam compatible with sealant. No bond or reaction shall occur between rod and sealant. Backer Rod shall be of sufficient width to be in compression after placement.

J. Joint Filler

Boards for expansion joint filler and for contraction and longitudinal joints shall be of the size, shape and type indicated.

Board shall be obtained from Redwood, Cypress, Gum, Southern Yellow Pine or Douglas Fir timber. They shall be solid heartwood and shall be free from sapwood, knots, clustered birdseye, checks and splits. Occasional sound or hollow birdseye, when not in clusters, will be permitted provided the board is free from any other defects that will impair its usefulness as a joint filler. With the exception of Redwood and Cypress, all boards shall have a creosote or pentachlorophenol treatment of 6 pounds per cubic foot (96 kg/m3). When oven dried at 230°F (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. 414S
Concrete Retaining Walls

414S.1 Description

This item shall govern reinforced Portland cement concrete precast or cast-in-place retaining walls constructed in conformity with the lines, grades and details indicated on the Drawings or as directed by the Engineer or designated representative.

When indicated on the drawings or directed by the Engineer or designated representative, this item shall also govern any requirements for pumping, bailing, drainage and/or protection of workers in trenches in compliance with Standard Specification Item No. 509S, "Excavation Safety Systems".

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.

414S.2 Submittals

The submittal requirements of this specification item may include:

A. Type of concrete
B. Reinforcing steel type, size, area, lengths
C. Joint sealants and fillers type, manufacturer, fact sheets and application recommendations.
D. Curing compound: manufacturer, type compound material, batch number or symbol and appropriate fact sheets
E. Filter fabric manufacturer, fact sheets and test results.
F. Select Backfill source, gradation and test results.
G. Type and manufacturer of waterstops

414S.3 Materials

A. Concrete

Cast-in-place Portland cement concrete shall conform to the requirements of a Class C Concrete, as specified in Standard Specification Item No. 403S, "Concrete For Structures". Precast Portland cement concrete shall conform to the requirements of Standard Specification Item No. 403S, "Concrete for Structures" but shall have a minimum 28 day compressive strength of 4500 psi (31027 kPa).

B. Reinforcing Steel

Reinforcing steel shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

C. Joint Sealants and Fillers

Preformed Bituminous Fiber Material shall meet the requirements of ASTM D 1751. Joint sealant shall be a non-sag low-modulus silicone.

D. Membrane Curing Compound

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

E. Filter Fabric

Filter fabric shall conform to Standard Specification Item No. 620S, "Filter Fabric".

F. Select Backfill

Select backfill shall conform to Standard Specification Item No. 210S, "Flexible Base".

G. Waterstops

Waterstops, if shown on the Drawings, shall conform to Standard Specification Item 416S, “Waterstops”.

H. Pipe Underdrains

Pipe Underdrains, if shown on the Drawings, shall conform to Standard Specification Item 551, “Pipe Underdrains”.

414S.4 Construction Methods

A. General

All excavation shall be done in accordance with Standard Specification Item No. 401S, "Structural Excavation and Backfill".

All forms and forming, placement of reinforcement, placement of Portland cement concrete, form removal, finishing and curing shall conform to Standard Specification Item No. 410S, "Concrete Structures". Cast-in-place Portland cement concrete retaining walls shall be constructed in one continuous vertical pour from the top of the footing to the top of the wall unless intermediate horizontal construction joints are shown on the Drawings.

The height of the retaining wall will be determined by established grades or as directed by the Engineer or designated representative but and shall be such that water will not be trapped or ponded on private or public property.

Reinforcement for the wall shall be as indicated on the Drawings. The Contractor shall provide dowel bars of the proper size, shape and spacing, as indicated on the drawings.

Devices to release the hydrostatic head shall be installed as indicated on the drawings.

All exposed corners and edges shall be filleted with triangular chamfer strips measuring 3/4 inch (19 mm) on each side. Exposed horizontal surfaces shall be level and flat, and exposed vertical surfaces shall be plumb and flat, unless indicated otherwise on the Drawings.

B. Vertical Control Joints

Unless indicated otherwise on the Drawings, vertical control joints shall be constructed in the retaining wall stem (the vertical portion of the wall) to create planes of weakness to control cracking. Horizontal wall reinforcement shall extend through the vertical control joints. These joints shall be constructed at abrupt

changes in wall height and at a spacing not to exceed 20 feet (6 meters) in wall sections of uniform. The joints shall be formed by placing triangular chamfer strips to create grooves in both faces of the wall to a depth of at least ten percent of the wall thickness. Control joints shall be sealed, on the backfilled side of the retaining wall, with a non-sag low-modulus silicone sealant, or, alternatively, the joint may be covered with a waterproofing material consisting of an 18-inch (450-mm) wide strip of self-adhering polyethylene having a rubberized asphalt mastic, as approved by the Engineer or designated representative.

C. Vertical Expansion Joints

Vertical expansion joints shall conform to the applicable section of Standard Specification Item 410S, "Concrete Structures". These joints shall be constructed at a spacing not to exceed 60 feet (15 meters), unless indicated otherwise on the Drawings. They shall extend the full height and width of the wall, including the wall footing, and shall consist of sleeved dowels and 1/2-inch (13 mm) thick preformed bituminous fiber material. The edges and corners of the joints shall be formed by triangular chamfer strips measuring 3/4 inch (19 mm) on each side. The concrete on the two sides of an expansion joint shall be placed in two separate pours unless approved otherwise by the Engineer or designated representative.

D. Construction Joints

Construction joints shall conform to the applicable section of Standard Specification Item 410S, "Concrete Structures". Wall reinforcement shall extend through the construction joint unless indicated otherwise on the Drawings,

E. Waterstops

Waterstops shall be provided in construction and expansion joints in retaining walls where water-tightness is essential to the function of the structure, as in detention, retention, or water quality ponds or flood walls.

414S.5 Measurement

Accepted cast in place or precast Portland cement concrete work as prescribed by this item will be measured by the cubic yard for reinforced concrete retaining wall, complete in place.

All concrete quantities will be based on the dimensions indicated on the drawings.

414S.6 Payment

The cast-in-place or precast Portland cement concrete work performed as prescribed by this item will be paid for at the unit bid price per cubic yard for "Concrete Retaining Wall". The unit bid price shall include full compensation for all excavation, forms, concrete, curing, finishing, backfilling, sloping that is not part of an excavation safety system covered by Item No. 509S, and for all labor, tools, materials, equipment and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 414S-C: Cast-in-place Portland Cement Concrete Retaining Wall, Including Reinforcement - Per Cubic Yard.

Pay Item No. 414S-P: Precast Concrete Retaining Wall - Per Cubic Yard.

End

SPECIFIC CROSS REFERENCE MATERIALS
Standard Specification Item 414S, "Concrete Retaining Walls"

City of Austin Standard Specification Items

Designation	Description
Item No. 210S	Flexible Base
Item No. 401S	Structural Excavation and Backfill
Item No, 403S	Concrete for Structures
Item No. 406S	Reinforcing Steel
Item No, 409S	Membrane Curing
Item No. 410S	Concrete Structures
Item No. 416S	Waterstops
Item No. 509S	Excavation Safety Systens
Item No, 551	Pipe Underdrains
Item No. 620S	Filter Fabric

American Society for Testing and Materials, ASTM

Designation	Description
ASTM D 1751	Preformed Expansion Joint Filler for Concrete Paving and Structural Construction

RELATED CROSS REFERENCE MATERIALS
Standard Specification Item 414S, "Concrete Retaining Walls"

City of Austin Standard Specification Items

Designation	Description
Item No. 404S	Pneumatically Placed Concrete
Item No. 405S	Concrete Admixtures
Item No, 408S	Concrete Joint Materials
Item No. 411S	Surface Finishes for Concrete

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

Designation	Description
Item No. 360	Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Portland Cement Concrete
Item No. 427	Surface Finishes for Concrete
Item No. 431	Pneumatically Placed Concrete
Item No. 437	Concrete Admixtures
Item No. 520	Weighing and Measuring Equipment
Item No. 522	Portland Cement Concrete Plants
Item No. 524	Hydraulic Cement

Texas Department of Transportation: Departmental Material Specifications

Designation	Description
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. 504S
Adjusting Structures

504S.1 Description

This item shall govern the removal and replacement of surfacing, furnishing of materials, adjusting and/or repositioning existing structures, valve boxes, pull boxes, survey monument boxes and water meters in accordance with these specifications to the locations or elevations indicated on the Drawings or as directed by the Engineer or designated representative. This item shall also govern any pumping, bailing and drainage required to complete the Work and Standard Specification Item No. 509S, "Excavation Safety Systems" for trench walls when indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses

504S.2 Submittals

The submittal requirements of this specification item include:

A. Aggregate type, gradations and physical characteristics for the Portland cement concrete mix.

B. Proposed proportioning of materials for the mortar mix.

C. Type structures and proposed adjustment technique (lowering, raising, lateral displacement).

D. Type structure, repair technique and materials to be furnished (new replacement or reuse of existing) Type of mixing plant and associated equipage including chart indicating the calibration of each cold bin

504S.3 Materials

Precast reinforced concrete rings and castings in good condition, which are removed from the structures to be adjusted, may be reused with the written approval of the Engineer or designated representative. Additional materials required shall conform to the details indicated on the Drawings.

A. Portland Cement Concrete

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

B. Mortar

Unless otherwise specified or approved by the Engineer or designated representative, the mortar for bedding castings shall consist of one (1) part Portland cement and three (3) parts sand, by volume based on dry materials. Sufficient water will be added to provide the desired consistency. The gradation of the fine aggregate shall meet the requirements for "Fine Aggregate" as given in Standard Specification Item No. 403S, "Concrete for Structures".

504S.4 Construction Methods

All adjustments shall be completed prior to the placement of the final surface.

Pull box and valve box components scheduled for reuse shall be carefully removed and the contact areas shall be cleaned of all mortar, concrete, grease and sealing compounds. Any items broken in the process of removal and cleaning shall be replaced in kind by the Contractor at its own expense.

If the adjustment involves slight lowering or raising a valve box or survey monument box, the outside shell of a slip or screw casing shall be excavated to its full length and adjusted to the proposed grade. Pipe castings shall be excavated to the depth required to cut from or weld a section to the casing as may be needed to adjust the ring to the proposed elevation. The ring shall be welded to the casing prior to pouring concrete around the casing.

If the adjustment involves a vertical (lowering or raising) or a horizontal reassignment of a water meter and the property owner's cut off valve, this work shall be completed in accordance with Standard Installation Details included in the City of Austin Standard Details Series (501S-1, 504S-3, 511S-13A, 511S-13B, etc.).

After the adjustments have been completed and cured, structures within the paved area shall be paved as indicated on the Drawings.

504S.5 Measurement

The work performed and materials furnished as prescribed by this item as indicated shall be measured per each.

504S.6 Payment

The work performed, materials furnished and measures as provided above, will be paid by the unit bid price per each. The price shall include full compensation for furnishing all materials, handling, placing, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 504S-1WM:	Adjusting Water Meters -	Per Each
Pay Item No. 504S-1RM:	Repositioning & Adjusting Water Meters -	Per Each
Pay Item No. 504S-3G:	Adjusting Gas Valve Boxes to Grade -	Per Each
Pay Item No. 504S-3S:	Adjusting Survey Monument Boxes to Grade -	Per Each
Pay Item No. 504S-3W:	Adjusting Water Valve Boxes to Grade -	Per Each
Pay Item No. 504S-4PB:	Adjusting Pull Boxes to Grade -	Per Each

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification 504S, "Adjusting Structures"

City of Austin Standard Specifications

Designation	Description
Item No. 403S	Concrete for Structures
Item No. 509S	Excavation Safety Systems

City of Austin Standard Details

Designation	Description
No. 501S-1	Encasement Detail W/ Casing Spacers
No. 504S-3	Gas Valve Casing Adjustment
No. 511S-13A	Water Valve Box Adjustment to Grade w/ Full Depth Concrete
No. 511S-13B	Water Valve Box Adjustment to Grade w/ Concrete and HMAC

RELATED CROSS REFERENCE MATERIALS
Specification 504S, "Adjusting Structures"

City of Austin Standard Specifications

Designation	Description
Item No. 501S	Jacking or Boring
Item No. 503S	Frames, Grates, Rings and Covers
Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 507S	Bulkheads
Item No. 508S	Miscellaneous Structures and Appurtenances
Item No. 511S	Water Valves

City of Austin Standard Details

Designation	Description
No. 1100S-1	Casting Adjustment
No. 725S-1	Monument, Type A Survey Identification Marker
No. 725S-2	Monument, Type B Survey Identification Marker
No. 725S-3	Monument, Type C Survey Identification Marker
No. 725S-7	Survey Identification Marker Non-Traffic Construction Detail
No. 725S-10	Survey Identification Marker Roadway Construction Detail
No. 725S-11	Adjustable Valve Box For Survey Monument

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

Designation	Description
Item No.421	Portland Cement Concrete

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

Item No. 508S
Miscellaneous Structures and Appurtenances

508S.1 Description

This item governs the construction of miscellaneous structures and appurtenances, complete in place or to the stage detailed and/or indicated in the Drawings, using the materials specified herein, including the excavation, installation, backfilling, placement of the concrete and when required, the furnishing and installation of frames, grates, rings, covers, safety end treatment and any concrete curb and gutter indicated on the Drawings.

This specification is applicable for projects or work involving either SI or inch-pound units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses

508S.2 Submittals

The submittal requirements of this specification item include:

A. Type of structure and appurtenances (inlets, headwalls, frames, grates, energy dissipators, etc.), construction methods and sequence (precast, cast in place), materials (bolts, nuts, plates, angles, etc.)

B. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix.

C. Proposed proportioning of materials for the mortar mix.

D. Analysis and thickness calculations for temporary steel covers.

508S.3 Types

The various types of structures and appurtenances such as inlets, headwalls, energy dissipators, etc., are designated on the Drawings by letter or by number for the particular design of structure to be constructed in accordance with the details indicated on the Drawings. Unless otherwise indicated on the Drawings, the Contractor may have the option of furnishing cast in place or precast structures.

508S.4 Materials

A. Portland Cement Concrete

The Portland cement concrete shall conform to Item No. 403S, "Concrete For Structures", with the following classes:

Cast in Place Concrete	Class A
Precast Concrete	Class C

B. Mortar

Mortar shall be composed of 1 part Portland cement and 2 parts clean, sharp mortar sand suitably graded for the purpose by conforming in other respects to the provisions

of Standard Specification Item No. 403S, "Concrete for Structures" for fine aggregate. Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight (mass) of the total dry mix.

C. Reinforcement and Steel

Reinforcing Steel shall conform to Standard Specification Item No. 406S,"Reinforcing Steel".

Structural Steel shall conform to Standard Specification Item No. 720S, "Metal for Structures".

D. Frames, Grates, Rings and Covers

Frames, grates, rings and covers shall conform to City of Austin Standard Specification Item No. 503S, “Frames, Grates, Rings and Covers".

E. Safety End Treatment for Structures

The safety end treatment for structures shall conform to TxDOT Specification Item No. 467, “Safety End Treatment”.

1. Bolts and Nuts. All bolts, nuts and associated hardware shall meet the specifications of ASTM A 307.
2. Plates and Angles. All plates and similar angles and brackets shall meet the specifications of ASTM A 36.
3. Pipe Runners. Pipe Runners shall conform to the requirements of ASTM A53, Grade B.
4. Galvanizing. All hardware including nuts, bolts and plates listed above shall be galvanized conforming to ASTM A 123 or A 153.

F. Miscellaneous Items

Cast iron for supports, steps and inlet units shall conform to the shape and dimensions indicated on the Drawings. The casting shall be clean and perfect, free from sand or blowholes or other defects. Cast iron castings shall meet the requirements of ASTM A 48, Class 30. Steel for temporary covers when used with stage construction shall be adequate for the loads imposed.

508S.5 Construction Methods

All concrete work shall be performed in accordance with Standard Specification Item No.410S, "Concrete Structures". Forms will be required for all cast-in-place concrete walls, except where the nature of the surrounding material is such that it can be trimmed to a smooth vertical face (the outside form for concrete bases). Where cast in place concrete is used in wall construction of storm sewers, the steps shall be cast into the wall when the concrete is placed.

The construction inlets shall be completed, as soon as is practicable after installation is complete of the sewer lines in the inlet. All sewer line shall be cut neatly at the inside face of the walls of the inlet and pointed up with mortar.

Bases for cast in place inlets may be placed prior to or at the Contractor's option after the sewer is constructed.

Bases for box sewers shall be cast as an integral part of the sewer. The manholes may be constructed prior to backfilling or if the Contractor so elects, the manhole opening may be covered temporarily with a steel plate to facilitate the compaction of backfill for the sewer as a whole. Thereafter, required excavation for the inlet shall be made and the inlet constructed and backfilled.

The inverts passing out or through an inlet shall be shaped and grouted across the floor of the inlet as indicated on the Drawings. This shaping may be accomplished by adding shaping mortar or concrete after the base is cast or by placing the required additional material with the base.

All miscellaneous structures shall be completed in accordance with the details indicated on the Drawings. Backfilling to original ground elevation shall be in accordance with the provisions of the appropriate items and as directed by the Engineer or designated representative.

Energy dissipators and headwalls shall be constructed in accordance with City of Austin Standard Detail 508S-13.

508S.6 Measurement

All miscellaneous structures and safety end treatments satisfactorily completed as indicated on the Drawings will be measured as completed units per each.

Concrete removal, excavation and backfill, riprap, pipe, headwalls, wing walls, collars and apron slabs will not be measured under this item but will be included in the unit price bid for the item of construction in which this item is used.

Frames, grates, rings, covers, safety end treatment and any concrete curb and gutter indicated will not be measured and paid for but shall be included in the unit price bid of one of the pay items identified in the contract bid form.

508S.7 Payment

A . Inlets

Payment for Inlets of the type indicated in place in accordance with these specifications and measured as prescribed above will be made at the unit bid price for each Inlet, of the type specified.

B. Energy Dissipators and Headwalls

Payment for special complete structures will be made at the unit price bid per each.

C Safety End Treatment

Payment for Safety End Treatment, complete in place, will be made at the unit bid price for each unit of the type indicated on the Drawings.

Payment will be made under one of the following:

Pay Item No. 508S-E:	Energy Dissipators, _____ In. Dia. -	Per Each.
Pay Item No. 508S-H:	Headwalls, Type _____, ___ In. Dia. Pipe -	Per Each.
Pay Item No. 508S-IG:	Inlet, Grated -	Per Each.
Pay Item No. 508S-SET	Safety End Treatment, Type ___ Size ___	Per Each
Pay Item No. 508S-I5R:	Inlet, Recessed -	Per Each.
Pay Item No. 508S-I10R:	Inlet, Recessed -	Per Each.
Pay Item No. 508S-I15R:	Inlet, Recessed -	Per Each.
Pay Item No. 508S-I20R:	Inlet, Recessed -	Per Each.
Pay Item No. 508S-I5S:	Inlet, Recessed -	Per Each.
Pay Item No. 508S-I10S:	Inlet, Standard -	Per Each.
Pay Item No. 508S-I15S:	Inlet, Standard -	Per Each.
Pay Item No. 508S-I20S:	Inlet, Standard -	Per Each.

End

SPECIFIED Cross Reference Materials
Standard Specification Item No. 508S, "Miscellaneous Structures and Appurtenances"

City of Austin Standard Specification Items

Designation	Description
Item No. 403S	Concrete For Structures
Item No. 406	Reinforcing Steel
Item No. 410	Concrete Structures
Item No. 720	Structural Steel
Item No. 503S	Frames, Grates, Rings and Covers

TxDOT Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges

Designation	Description
Item 467	Safety End Treatment

American Society for Testing and Materials (ASTM)

Designation	Description
ASTM A36/36M	Specification for Structural Steel
ASTM A48	Specification for Gray Iron Castings
ASTM A53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A307	Specifications for Carbon Steel Externally Threaded Standard Fasteners
ASTM C913	Specifications for Precast Concrete Water and Wastewater Structures

RELATED Cross Reference Materials

City of Austin Drainage Criteria Manual

Designation	Description
Section 6.6.0	Energy Dissipators

City of Austin Standard Specification Items

Designation	Description
Item No. 501S	Jacking or Boring Pipe
Item No. 504S	Adjusting Structures
Item No. 506	Manholes
Item No. 507S	Bulkheads
Item No. 510	Pipe

City of Austin Standard Details

Designation	Description
508S-13	Standard Headwall and Energy Dissipators
510S-1	Concrete Trench Cap

TxDOT Specifications

Designation	Description
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Section 421.2(5)	Fine Aggregate
Item 424	Precast Concrete Structures (Fabrication)
Item 440	Reinforcing Steel
Item 466	Headwalls and Wingwalls
Item 467	Safety End Treatment
Item 471	Frames, Grates, Rings and Covers
Item 529	Concrete Curb, Gutter and Combined Curb and Gutter

608S.1 Description

This item shall govern the provision of the specified plants and other materials, the initial installation of plants and other materials, the maintenance of plantings, transplanting and any replacement of trees, plants and ground cover which are damaged, diseased or otherwise unhealthy during the warranty period or as directed by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text, the inch-pound units are given preference followed by SI units shown within parentheses.

608S.2 Submittals

The submittal requirements for this specification item shall include:

A. A listing of each type of planting (tree, shrubs, plants, etc.), type of stock (containerized, ball and burlapped, bare root, bag grown, etc.), name (common and botanical) and size of planting (root diameter, height and spread);

B. A request, if necessary, for use by Contractor of collected stock on the site;

C. Specific information for each pesticide (including herbicide) associated with the listing including:

manufacturer,
product name,
description of chemical composition,
handling, storage and mixing requirements
application recommendations
documentation of licensed applicator(s), and
MSDS Sheets

D. Type, chemical analysis and rate of application of fertilizer

E. Proposed tree dressing, trunk wrapping and flagging tape;

F. Type, chemical analysis and rate of application of proposed transpirants

G. Documentation of irrigator license, if irrigation is required at the site.

608S.3 General

A. Plant Standards

Unless shown otherwise on the Drawings, the following published standards will apply. Standards for nursery stock will be as stated in the "American Standard for Nursery Stock", as published by the American Association of Nurserymen, Incorporated. Botanical names as shown on the Drawings will be as stated in the "Standardized Plant Names" as identified by the American Joint Committee on Horticultural Nomenclature or other referenced text including the "Manual of the

Vascular Plants of Texas for Native Flora". Pruning standards will be as established by the National Arborist Association in the "Pruning Standards for Shade Trees".

B. License Requirements

1. Pesticide.

   The Contractor shall be a licensed pesticide applicator or shall employ a licensed pesticide applicator for the treatment of insects, diseases, animals as required by the Texas Pesticide Laws and Regulations of the Texas Department of Agriculture. The Engineer or designated representative may request documentation of such certification.

2. Herbicide.

   The Contractor shall possess a permit or employ a person who possesses a permit to apply herbicide as required by the Texas Herbicide Law of the Texas Department of Agriculture. The Engineer or designated representative may request documentation of such certification.

3. Irrigation.

   The Contractor shall possess an irrigator's license issued by the State of Texas and the Texas Board of Irrigators or employ such a licensed irrigator to perform the irrigation system maintenance. The irrigation system shall be maintained under the supervision of the licensed irrigator who shall be available on the site as required by the Engineer or designated representative.

The Engineer may request documentation of such license. The Contractor shall verify and adhere to the requirements and codes of any controlling utility authorities.

608S.4 Materials

A. Plant Material

Plant material shall be first class grade, true to name and of the size indicated on the Drawings. All plants shall be healthy nursery grown unless otherwise indicated on the Drawings. When the Engineer or designated representative is furnished sufficient evidence that a specified plant cannot practically be obtained, the Engineer or designated representative may approve in writing the use of collected native material.

Nursery grown stock, either in containers or in the field, shall be nursery grown in accordance with accepted horticultural practices and under climatic conditions similar to those of the work site for at least twelve (12) months, unless specifically authorized otherwise by the Engineer or designated representative.

1. Container plants.

   Soil volume for containers shall be three-fourths (3/4) the depth of the container or greater and contain roots of the plants throughout the root ball.

   (a) Containerized Stock.

   This stock will be defined as nursery plant stock transplanted from a growing site with a ball of soil, containing an intact root system, and placed in a container and grown in that container continuously long enough for the new fibrous roots to have developed so that the root mass retains its shape and holds together after removal from the container. Containerized stock shall

have been grown in the delivered containers for at least six (6) months, but not over two (2) years.

(b) Container Grown Stock.

This stock will be defined as nursery plant stock, which has been planted in a container as a liner, seed or by other propagation method, and that:

(1) has been systematically replanted or stepped up in larger containers as required,

(2) has developed a root system in a planting medium capable of sustaining acceptable plant growth, and

(3) has become established in the container and exhibits a well-rooted condition as evidenced by the soil ball remaining intact when removed from its container.

2. Balled and Burlapped Stock.

This stock will be defined as nursery plant stock which has been removed from the growing site with a ball of soil, containing the intact root system, and encased in burlap (or other approved similar material) to hold the soil in place. Ball sizes for balled and burlapped stock shall be as shown on the Drawings.

3. Bare Root Stock.

This stock will be defined as nursery plant stock, which has been removed from the growing site with the root system substantially free of soil. The approved minimum root spread and condition shall be as shown on the Drawings.

4. Collected Stock.

This stock will be defined as nursery plant stock, which has been removed from its original native habitat. All collected stock shall specific approval of the Engineer or designated representative before it can be removed from its existing habitat. Ball sizes for collected stock shall be as shown on the Drawings and shall have sufficient diameter and depth to encompass enough fibrous and feeding root system as necessary for the full recovery of the plant. Collection may be by hand or mechanical method. For balled and burlapped or mechanical transplanting of collected plant material refer to article 608S.5.

5. Bag Grown Stock.

This stock will be defined as nursery plant stock which has been transplanted into a nonwoven fabric container which has been placed in the ground and the plant grown under nursery field conditions continuously long enough [normally one (1) month for each inch (25 mm) of bag diameter i.e., a plant with a 24 inch (600 mm) diameter bag, grown in its original planted location for 24 months] for the fibrous roots to have developed so that the root mass retains its shape and holds together after removal of the bag. The root ball shall be flat bottomed and straight sided. Ball sizes for bag grown stock shall be as shown on the Drawings. Bag grown stock shall not be pruned before delivery.

6. Other Plant Materials.

Other plant materials shall be as shown on the Drawings.

B. Rejection of Plants.

Plant material having any of the following features will be subject to rejection:

1. Undue or excessive abrasions of the bark.
2. Dried or damaged root system.
3. Dried or damaged top wood of deciduous plants or dried or damaged foliage and top woods of evergreens.
4. Prematurely opened or damaged buds or buds stripped off.
5. Disease or insect infestation, including eggs or larvae.
6. Dry, loose, cracked, broken and/or undersized balls or containers, which do not conform to sizes indicated on the Drawings.
7. Evidence of heating, molding, wind burn, sunscald, freezing, etc.
8. Container plants that are overgrown or root bound.
9. Plants with bench balls (roots repacked with soil).
10. Plant balls encased in non-bio-degradeable plastic or other impervious material.
11. Field grown or collected plants transplanted into containers less than six (6) months or more than two (2) years.
12 Trees that have been damaged, pruned, crooked or multiple leaders, unless multiple leaders are specified or are normal for the species.
13. Plants with disfiguring knots or fresh cuts of limbs over 3/4 inch (20 mm) that have not completely callused.
14. Plants that do not posses a normal balance between height and spread for the species.
15. Plant containers that are not structurally sound (tracked, bent, etc.).
16. Plants in containers less than three-fourths (3/4) planting medium depth;
17. Any endangered or threatened plants; or plants of historical significance that have been collected;
18. Any other physical damage or adverse conditions that would prevent thriving growth or cause an unacceptable appearance; or
19. Plants that do not meet the standards shown on the Drawings.

C. Delivery and Receipt of Plants

Material shall not be delivered to the project until ordered to do so in writing by the Engineer or designated representative. When the delivery order is issued, the Engineer or designated representative shall be notified of a proposed delivery of plant material at least 48 hours prior to its arrival at the project. The entire plant shall be properly protected from sun and air damage during the time period from initiation of digging until delivery on the project

Each plant material shipment shall be accompanied by an invoice indicating the number, size and name (common and botanical) of each of the kinds of plant material included in the shipment. Each kind of plant in the shipment shall be adequately identified by tags. All plants shall be individually tagged with nursery name tags designating the genus, species and variety of the plant.

No shipment of plant material shall be accepted, planted and/or heeled-in by the Contractor until such material has been inspected and accepted by the Engineer or designated representative. The Contractor shall assist the Engineer or designated representative in the inspection of material. Any plants rejected shall be immediately removed from the project and replaced.

Unless plants are placed in predug holes and planted as specified herein, they shall be heeled-in and inspected again prior to planting. If delivered to predug planting holes, balled and burlapped plants shall be planted within 1 to 6 hours depending upon the drying effect of the wind and sun. No bare rooted plants shall be placed in predug holes from the delivery truck unless actual planting occurs immediately after removal from its moist packing.

D. Plant Size

Plants will be measured when branches are in their normal position. Height and spread dimensions shown on the Drawings refer to the main body of the plant and not branch tip to tip. Plants with a spreading or semi-spreading habit will be measured by the average diameter of the spread. Plant heights will be measured by the mean height from the ground line to the top of the canopy. Caliper measurements will be taken at a point on the trunk six (6) inches [150 mm] above natural ground for trees up to four (4) inches [100 mm] in caliper and at a point twelve (12) inches [300 mm] above natural ground for trees over four (4) inches [100 mm} in caliper. The caliper size for multi-trunked plants will be determined by adding the calipers of the largest cane and one-half (1/2) the caliper(s) of the second and third largest cane(s).

When a range of size is shown on the Drawings, no plant shall be less than the minimum size and at least 40% of the plants shall be as large as the maximum size shown on the Drawings. The required measurements are the minimum sizes acceptable and are the measurements after pruning, when pruning is required.

Sizes of plants or plant types such as palms, roses, vines, groundcovers, seedings, bulbs, corms, tubers, young plants, understock, etc., will be measured in accordance with the plant standards or as indicated on the Drawings.

Container-grown plants which are well established in adequate size containers and are of equal quality and size to the specified balled plants may be accepted in lieu of balled plants; likewise, balled plants of equal quality and size may be substituted for container-grown plants when permitted by the Engineer or designated representative. Soil shall be approximately 3/4 depth of container and contain roots of the plant throughout the soil.

The ball size for a balled and burlapped plant shall be firm natural balls equal to or in excess of the ball sizes indicated on the Drawings. Collected plant material substituted for a nursery-grown plant shall have a ball or root system 1/4 greater in both diameter and depth than the nursery-grown plant for which it is substituted. The ball size shall be the average of the diameters measured 90 degrees apart.

E. Mulch

Unless indicated otherwise on the Drawings, mulch material shall consist of loose organic residue derived from plants or other granular material approved by the Engineer or designated representative. It shall be of such nature that adequate protection is provided against sun baking and quick drying out of the soil and shall not impede aeration or water penetration nor deplete the soil nitrogen. Mulch material shall be free of excess amounts of large leaves and sticks that would prevent proper dressing of the mulched surface, free of harmful substances and free of detrimental amounts of soil or other foreign matter that would promote early compaction, matting or deterioration of the mulch.

F. Peat Moss

Peat Moss shall be of sphagnum origin of commercial quality.

G. Planting Soil Mixture

The planting soil mixture shall consist of a soil mixture of 3/4 fine sandy loam, 1/8 peat moss and 1/8 leaf mold. The sandy loam shall be taken from a well drained, arable site. It shall be free of subsoil, stones, clay, roots, weeds, grass or other objectionable debris, matter or toxic wastes.

H. 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 plants and the areas irrigated.

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).

I. Fertilizer

Fertilizer shall be applied uniformly conforming to City of Austin Standard Specification tem No. 606S, "Fertilizer" at the rate indicated.

J. Pesticides including Herbicides

Pesticides including herbicides shall be of the types that are commercially available selected for the species planted or as indicated on the Drawings and shall be applied in accordance with the manufacturer's recommendations upon approval of the Engineer or designated representative.

K. Stakes and Guys

Stakes shall be 2 x 2 x 18 inch (50 x 50 x 450 mm) sound hardwood or treated pine with tapered point and chamfered tops. Guys wires shall be 2 strand 12 ga. (2.7 mm) galvanized steel wire with 1/2 inch (12.5 mm) diameter reinforced plastic or rubber hose trunk bushings and yellow plastic flagging.

L. Bracing

Bracing shall be 2 x 4 inch (50x100 mm) hardwood or metal fence posts, 6 ft. (1.8 meters) in length with guys and bushings.

M. Flagging Tape

Flagging tape shall be highly reflective, visible at night, and approved by the Engineer or designated representative.

N. Trunk Wrapping

Trunk wrapping shall be 4 inch (100 mm) wide commercial trees wrapping paper with asphalt core or the type shown on the Drawings.

O. Anti-transpirants

Anti-transpirants, intended to prevent evaporation, shall be of the types that are commercially available and approved by the Engineer or designated representative.

608S.5 Construction Methods

Immediately following delivery and acceptance at the job, all plants shall be planted or heeled-in in properly moistened material. All plants heeled-in shall be properly maintained by the Contractor until planted. The utmost care shall be exercised in handling plants to prevent injuries to the plants. The solidity of the ball or balled and burlapped plants shall be carefully preserved and such plants shall not be handled by the stems.

Plants with exposed roots shall be protected from drying out during the time the plants are removed from the heeling-in bed and until actually planted.

A. Staking of Planting Locations.

All locations of trees, shrubs and beds shall be staked in the field by the Contractor. All locations will be approved by the Engineer or designated representative prior to any excavation of plant beds or bed preparation. Stakes shall be placed and coded to denote the type of plant material.

B. Excavation of Planting Pits

1. General.

The Contractor shall not excavate plant pits more than 24 hours in advance of planting operations. Any plant pits left unattended for any length of time which may present a hazard shall be covered and/or clearly flagged as approved by the Engineer or designated representative. The walls and bottoms of all plant pits shall be scarified immediately prior to the placement of plants.

2 Pit Sizes.

Planting holes may be dug by hand or by mechanical means and shall be circular or square (according to the shape of the root ball) with vertical sides, unless otherwise indicated on the Drawings. Trimming of the sides or bottom of the hole to uniform shape will not be required. Planting pit sizes shall be as follows, unless indicated otherwise on the Drawings:

(a) A minimum horizontal dimension of twelve (12) inches [300 mm] between the root ball and the sides of the planting pit for the following plant specifications:

(1) Containers of fifteen (15) gallons or larger [56 liters or larger],

(2) Boxes of fourteen (14) inches or larger [350 mm or larger] and

(3) Root ball diameter of Balled and burlapped or bag grown plants larger than fourteen (14) inches [350 mm].

(b) A minimum horizontal dimension of two (2) times the diameter of the root ball for the following plant specifications:

(1) Containers less than fifteen (15) gallons [less than 56 liters]

(2) Root ball diameter of Balled and burlapped or bag grown plants fourteen (14) inches or less [350 mm or less]

(c) A minimum diameter for bare-root plants to permit the roots to spread without crowding or curving around the walls of the pit.

(d) Planting pits shall be excavated to a depth of at least 4 inches (100 mm) but not more than 8 inches (200 mm) greater than the depth of the root ball of balled and burlapped, containerized, container grown or bag grown plants; or the depth of the root system of bare-root plants. Pits dug to excess depths shall be backfilled and compacted to bring the pits to the specified depth. The depth of pits on slopes shall be measured at the lower side.

(e) When performing mechanical transplanting, the receiving plant pit shall be excavated with the same type of equipment used to remove the plant material or as approved by the Engineer or designated representative.

(f) Special sized holes shall be shown on Drawings.

(g) Where holes are dug with an augur and the sides of the holes become plastered or glazed, this plastered or glazed surface shall be scarified.

C. Planting Season

All planting shall be performed as shown below, indicated on the Drawings or as approved by the Engineer or designated representative.

Planting Stock	Planting dates
Containerized or Container grown	None specified
Balled and burlapped	November 15 to March 15
Bare root	January 15 to March 15
Bag grown	September 15 to April 15
Collected	As shown on the Drawings or as approved by the Engineer or designated representative

D. Backfilling

Topsoil from the planting hole may be used for backfilling provided it is kept separate from subsoil and rendered loose and friable. Additional topsoil required to backfill the holes shall be furnished in the amount directed in Subarticle 608S.4.G, 'Planting Soil Mixture' and from a source approved by the Engineer or designated representative.

E. Pruning Roots

Root pruning shall be limited to the amount necessary to prune away broken and badly damaged roots.

F. Pruning of Tops

Pruning of plants shall conform to the best horticultural practice and shall be appropriate to the various types of plants and the special requirements of each. Deciduous (non-evergreen) shrubs and trees with heavy tops shall have about 1/3 to 1/2 of the top growth removed. Plants otherwise acceptable, but with broken or badly bruised branches, shall have such branches removed with a clean cut. All cut surfaces over 1 inch (25 mm) in diameter shall be painted with an approved tree pruning compound.

G. Planting and Backfilling

In general the top of root ball shall stand after settlement of the backfill approximately level with the finish grade. When shown on the Drawings, fertilizer of the type and quantity specified shall be added on the backfill material prior to backfilling. Unless indicated otherwise on the Drawings or approved otherwise by the Engineer or designated representative, planting and backfilling shall be as follows:

1. Plant Basin

A basin, 8 to 10 inches (200 to 250 mm) deep, shall be formed by constructing a neat levee around the planting pit. The inside measurement of the basin shall be

at least the diameter of the growing plant, unless noted otherwise on the Drawings. On slopes the backfill on the lower side shall be graded in such a manner that an adequate basin will be provided.

As shown on the Drawings, either material excavated from the planting pit (excluding any rocks) or Backfill, as specified in Subarticle 608S.5.D may be used to form a basin around the plant. Excess excavated material may be scattered thinly and leveled off provided it is of such consistency and character that it can be readily scattered in an acceptable manner. If scattering of the material may interfere with drainage or mowing, all such material shall be removed and disposed of as approved by the Engineer or designated representative.

2. Depth of Transplanting

In general, plants shall be installed and covered with top soil approximately one (1) inch (25 mm) above the top of the root ball or container soil surface.

3. Bare Root Plants

After the backfill in the bottom of the planting pit has been firmed and the plant placed in the proper position, as shown on the Drawings, loose friable backfill (Subarticle 608S.5.D) or planting soil mixture (608S.4.G) shall be worked about the roots and thoroughly settled with water as the backfill is made. Care shall be taken to avoid bruising or breaking the roots. Sticks, sod, clods or other material which may form large air pockets in the soil or backfill shall not be included in the backfill.

4. Balled and Burlapped Plants

Plants of this type shall not be handled by the stems nor in such manner that the soil of the ball may be loosened. A saddle around the ball should be used for lifting. The burlap shall not be removed from the ball. After the backfill in the bottom of the pit has been firmed and the plant placed in the proper position, as shown on the Drawings, loose friable backfill shall be worked about the ball in 12 inch (300 mm) until the pit is two-thirds (2/3 full). The burlap shall then be opened on top of the root ball to expose the top one-third (1/3) of the root ball. The pit shall then be filled with water and the backfilling completed, working the backfill and water well to prevent any air pockets.

For ball supporting devices such as wire baskets, the basket shall not be removed. The plant shall be placed in the prepared planting pit in the proper position and backfill shall be placed around the ball until the pit is about one-third (1/3) full. The basket shall be carefully removed to just above the backfill, leaving the bottom portion intact. Backfilling shall be completed as described above.

5. Containerized or Container Grown Plants

At the time of planting the root ball and plant shall be carefully removed from the container to prevent damage to the plant and root ball. If in the opinion of the Engineer or designated representative a sufficient amount of soil has fallen off or the ball has been broken to such an extent as to reduce the chances of the plant to grow, the plant will be rejected. Container plants shall be acclimated to outside growing conditions. Container plants shall be placed and backfilled in the same manner as balled and burlapped plants.

6. Bag Grown Plants

Prior to planting, the fabric bag shall be removed by using a knife to cut the side of the bag from top to bottom in three or four places of equidistant around the root

ball. The bag shall be carefully peeled down and roots that do not easily peel away from the bag shall be pruned. The plastic bag shall then be pulled from under the root ball. Bag grown plants shall be placed and backfilled in the same manner as balled and burlapped plants.

H. Vegetative Watering

During the planting operations, the Contractor shall keep the ground and backfill material moist to at least 12 inches (300 mm) around the root ball. The Contractor shall be required to meet the minimum watering requirements shown on the Drawings for all circumstances by a method approved by the Engineer or designated representative. When an irrigation system is shown on the Drawings, the Contractor shall coordinate all work to insure that the irrigation system is operational as the plants are installed.

I. Anti-transpirants

When shown on the Drawings, the Contractor shall apply anti-transpirants in accordance with the manufacturer's recommendations and as approved by the Engineer or designated representative.

J. Pruning

Plants shall not be pruned immediately before delivery to the work site, unless shown otherwise on the Drawings or as approved by the Engineer or designated representative. Common nursery pruning practices are acceptable. Any necessary pruning shall be done at the time of planting as approved by the Engineer or designated representative and shall be appropriate to the various types of plants and the special requirements of each.

From 20 to 40 percent of all foliage of mechanically transplanted plants shall be removed by pruning interior branching, entangled limbs and small branches. Structural branching shall not be removed prior to planting. Branch tips shall not be removed to attain the above percentage.

K. Plant Supports and Bracing Trees

Plant supports such as staking, guying and bracing shall be as shown on the Drawings or as required by the Engineer or designated representative.

Trees shall be staked, guyed or braced for support during the same day as planted. Unless shown otherwise on the Drawings, the plants shall stand approximately vertical after staking, guying or bracing. The Contractor shall be responsible for material remaining approximately vertical and straight for all given conditions and shall repair plant supports as often as required until final acceptance of the work.

All trees 1 1/4 inches (38 mm) and greater in caliper shall be adequately braced immediately after the plants have settled. Unless otherwise indicated on the Drawings, trees 1 1/4 to 2 inches (38 to 50 mm) in diameter shall be braced with 1 brace of sawed lumber, 2 x 2 inches (50 x 50 mm), nominal size, firmly fastened to the tree at a point 5 to 6 feet (1.5 to 1.8 meters) above ground or as directed by the Engineer or designated representative. Fastening shall not be accomplished by nails, staples, wire or other materials that may damage tree. Braces shall be of sufficient length to provide bracing when firmly driven into the ground. The tree trunk shall be adequately padded with a section of flexible hose at the point of attachment with a figure 8 tie. Trees, that are 2 inches to 4 inches (50 to 100 mm) in diameter, shall be

braced with wires at a height of 6 to 8 feet (1.8 to 2.4 meters) above ground. The wires shall be firmly attached to 3 equally spaced concentric stakes that are firmly driven into the ground. The trunk of the tree shall be adequately and securely padded with rubber at the point of attachment of the wire to prevent damage. Wire shall be number 16 gauge (1.5 mm) galvanized.

Trees larger than 4 inches (100 mm) in diameter shall be braced in accordance with notes on Drawings. The Contractor shall repair braces as often as required until acceptance of the project for "Plant Establishment".

L. Safety Flagging Tape

Staking, guying or bracing, which present a hazard shall be clearly flagged as shown on the Drawings or directed by the Engineer or designate representative.

M. Tree Trunk Protection

All trees indicated on the Drawings to be wrapped shall be neatly and securely wrapped with a commercial tree wrapping material approved by the Engineer or designated representative. The tree wrapping shall begin at the base of the trunk and extend upward with a 50 percent overlap to the second whorl of branches. The tree wrapping material shall be secured at the top of wrap with soft twine or weatherproof type tape or any suitable method, approved by the Engineer or designated representative. Wire, metal bands or other material for this purpose that may cause injury or damage to plants shall not be used.

N. Mulching

All plants shall receive mulching to a depth of 2 to 3 inches (50 to 75 mm) within the water basin or across the beds unless indicated otherwise on the Drawings. A small amount of backfill shall be sprinkled on top of organic mulch to hold it in place if directed by the Engineer or designated representative. If hay is used, the depth shall be 4 inches (100 mm) loose measurement.

O. Plant Material Removal and Replacement

A plant shall be removed and replaced as directed by the Engineer or designated representative at any time during execution of the work under this Item including the Establishment Period if, in the judgement of the Engineer or designated representative, a plant is found to be in any of the following conditions:

1. Dead;
2. Dying;
3. Wilted for 48 hours or more; or
4. Any other signs of detrimental consequence.

All replacement plants shall be the same species, size and quality as originally specified. The Contractor shall make every effort to ensure that the replacement material receives any additional care and maintenance required for the replacement plants to become well established. The Engineer will require replacement of plant material until satisfied that all of the plants on the work are in a healthy, vigorous condition.

P. Maintenance and Initial Plant Replacement

The Contractor shall water the plants as often as necessary, cut the weeds and grass around the planted area including the plant basin and bracing, prune the plants, treat the plants in accordance with approved methods of horticultural practice where

insects or disease affect the plants after planting and repair or replace the bracing as may be required or as ordered by the Engineer or designated representative until the planting project has been accepted for "Plant Establishment".

If the Contractor completes the initial planting prior to March 1 for balled and burlapped and bare root plants or April 1 for bag grown plants, the Contractor will be required to replant all material found to be missing, damaged or dead during this time. This replanting shall be done between March 1 and March 15 for balled and burlapped and bare root plants, between April 1 and April 15 for bag grown plants or as directed by the Engineer or designated representative.

In the event that the planting project is not completed by March 15 for balled and burlapped and bare root plants, or by April 15 for bag grown plants and no further planting is permitted until the following "Planting Season", the partial planting will be cared for as prescribed under "Plant Establishment".

608S.6 Plant Establishment

"Plant Establishment" shall commence with the notice of substantial completion and shall extend to the following November 15 for those plantings that are completed in accordance with Subarticle 608S.5.P, ' Maintenance and Initial Plant Replacement'. In those instances where planting 'out of season' is allowed in writing by the Engineer or designated representative, "Plant Establishment" shall commence with notice of substantial completion and shall extend for a minimum of six (6) months or to the following November 15, which ever results in a later date.

For the work of "Plant Establishment", all possible means shall be employed to preserve the plants in a healthy and vigorous growing condition to insure their successful establishment. The Contractor shall perform all of the activities listed below during placement of all the plants. After the completion of the installation, as shown on the Drawings and as approved by the Engineer or designated representative, the Contractor shall perform the following activities for a period of 90 calendar days:

A. Mulching, Plant Basin and Bed Maintenance

The Contractor shall reshape or reform the existing plant basins and beds as necessary to conform to the Drawings, and as approved by the Engineer or designated representative. As a part of the plant basin and bed maintenance, weeds and grass shall be removed prior to the application of mulch. Unless otherwise shown the Drawings, the mulch shall be maintained to a minimum depth of 2 to 3 inches (50 to 75 mm).

The Contractor shall maintain the plant basins, beds and site fixtures generally free of weeds and grass or other materials detrimental to the growth of the plants or the appearance of the site. Herbicides, if approved by the Engineer or designated representative and used by the Contractor, shall be limited to the plant basin and perimeter thereof or around site fixtures as approved by the Engineer or designated representative. Extreme care shall be taken to insure that the herbicide does not come into contact with any part of the desirable plants. Under no circumstances shall the herbicide be used on days where the wind could cause drift hazard to desirable plants. The Contractor shall also follow the manufacturer's instruction for the use and application of any herbicide.

B. Plant Irrigation

The Contractor shall be required to meet the minimum watering requirements for all circumstances by a method approved by the Engineer or designated representative as stated under Subarticle 608S.5.H and/or as shown on the Drawings.

Watering equipment other than an existing irrigation system shall have adequate and accurate measuring devices as approved by the Engineer or designated representative.

C. Mowing and Trimming

The Contractor shall mow and trim the areas identified on the Drawings. The work shall be performed at the frequency as shown on the Drawings. The initial cycle shall begin when directed by the Engineer or designated representative. Mowing heights shall be as shown on the Drawings or approved by the Engineer or designated representative.

The Contractor shall use power equipment as approved by the Engineer or designated representative. Nylon cord trimmers shall not be used inside the plant basins or beds around plant material.

D. Restaking, Reguying and Rebracing of Plants.

Any damaged or destroyed stakes, guys or braces shall be replaced by the Contractor in accordance with the details shown on the Drawings. This shall include any adjustment to the staking or guying to prevent girdling of plants.

E. Pruning

When directed by the Engineer or designated representative or shown on the Drawings, plants shall be pruned by the Contractor to the satisfaction of the Engineer or designated representative. Dead or damaged limbs on trees and shrubs, including suckergrowth on trunks of trees, shall be removed. All pruning shall be accomplished with tools specifically designed for this purpose. All pruned material shall become the property of the Contractor and shall be disposed of in a manner approved by the Engineer or designated representative.

F. Insect, Disease and Animal Control

The Contractor shall treat the plants and/or the planted areas in accordance with accepted methods of horticultural practices and the Texas Department of Agriculture guidelines regarding the use of pesticides. The Contractor shall also follow the manufacturer's instructions for the use and application of any pesticides.

G. Litter Pick-Up

Unless shown otherwise on the Drawings, the Contractor shall collect and dispose of all litter within the landscaped areas. The work shall be performed at the frequency shown on the Drawings or as directed by the Engineer or designated representative.

All litter shall become the property of the Contractor and shall be disposed of in a manner acceptable to the Engineer or designated representative.

H. Fertilization

During the 90-day establishment period, the Contractor shall furnish and apply fertilizer only to those plants as shown on the Drawings. The analysis, times and rates of application shall be as shown on the Drawings. The type of fertilizer and method of application shall be as shown on the Drawings or as approved by the Engineer or designated representative.

I. Plant Removal

In the judgement of the Engineer or designated representative, any plant that is dead or dying for reasons beyond the control of the Contractor and is not to be replaced shall be removed by the Contractor to the satisfaction of the Engineer or designated representative. This shall include repair of the plant pit and the surrounding area.

608S.7 Acceptability of Plants

Between 90 to 100 days following the initial planting and initial plant replacement, the Engineer or designated representative will make an inspection of the project to determine the acceptability of the plant material. At this time, an inventory of missing, dead or rejected plant material will be made and the Contractor notified that the plants on the inventory are to be replanted the following planting season between November 15 and December 15 or as specifically permitted by the Engineer or designated representative. Plant material for the replacement planting shall meet all the requirements specified for the original plant material and shall be planted in accordance with the planting instructions listed under "Construction Methods", except that no further plant replacement will be required. Working days stated in the Contract shall apply to the initial construction period only and will not include the time necessary for replanting. A final inspection shall be made within 10 days after the replacement planting is completed.

608S.8 Measurement

Work and accepted material as prescribed for this item including "Plant Establishment" will be measured as each plant of the type and size complete and in place.

608S.9 Payment

Work performed and accepted material as prescribed by this item, measured as provided under “Measurement", will be paid for at the unit bid price bid for each plant of the type and size specified, complete and in place. The unit bid price shall include full compensation for furnishing all labor, pruning, mowing, insect control, disease control, animal control, watering, fertilizing, herbiciding, litter pickup, maintenance, tools, equipment, materials, supplies and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 608S-1:	Planting Type ___, Size in inches____	Per Each.
Pay Item No. 608S-2:	Irrigation System	Lump Sum

End

SPECIFIC CROSS REFERENCE MATERIALS

City of Austin Standard Specifications

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

City of Austin Environmental Criteria Manual

Designation	*Description*
Section 1	Water Quality Management
Section 1.4.4	Vegetative Practices
Section 1.5.0	Vegetation Criteria
Section 1.5.3	Impact Minimization and Restoration Planning
Section 1.5.3.D.6	Discussion-Plant Protection
Section 1.5.3.D.8	Salvaging Trees and Shrubs
Section 1.5.3.D.9	Transplanting Procedure
Section 2	Landscape
Section 2.4.1	Street Yard
Section 2.4 1.D	Street Yard Trees
Section 2.4 6	Irrigation of Landscape Areas
Section 2.4 6.A.1	'Owner responsibility for irrigation .....'
Section 2.7.0	Hill Country Roadway Landscape Criteria
Section 2.7.2	Design Criteria
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Section 3	Tree and Natural Area Preservation
Section 3.3.2	General Tree Survey Standards
Section 3.3.2.A.1	Diameter
Section 3.5.4.A.6	Mitigation Measures-Enforcement Criteria
Section 3.5.0	Design Criteria
Section 3.5.4	Mitigative Measures
Section 3.5.4.E	Transplanting
Section 5	Construction in Parks
Section 5.3.0	Route Selection
Section 5.3.1	Tree Survey
Appendix K	Arboricultural Practices - Parks
Appendix K, I	Tree Protection
Appendix K, II	Treatment of Minor Wounds or Breakage
Appendix N	Professional Plant List
Appendix O	Site Development Permit-Irrigation Notes
Appendix P-2	Standard Notes for Trees and Natural Area Protection
Figure 1-27	Grasses
Figure 1-33	Rare Plants in the Austin Area

City of Austin Transportation Criteria Manual

Designation	*Description*
Section 1.4.3	Classification Design Criteria-
Section 6.2.3	Transportation Criteria for Landscaping

City of Austin Standard Specifications

Designation	*Description*
Item No. 101S	Preparing Right of Way
Item No. 111S	Excavation
Item No. 601S	Salvaging and Placing Topsoil

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. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 170	Irrigation System
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. 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

Item No. 710S
Bicycle Racks

710S.1 Description

This item shall govern Class II and Class III bicycle racks and associated support medium as indicated on the Drawings.

A Class II bicycle rack shall be a rack where both wheels and the frame of a bicycle can be secured with one (1) user-supplied lock without the requirement for wheel removal. The design, type and capacity of a Class II bicycle rack shall be approved by the Engineer or designated representative

A Class III bicycle rack shall be a rack where both one wheel and the frame can be secured with a user supplied lock (see Standard Detail 710S-1, "Class III Style Bicycle Parking"). The Class III rack shall consist of either a single U/Hoop (Rack 1), multiple inverted U/Hoop (Rack 2), single post (Rack 3), or other Rack approved 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.

710S.2 Submittals

The submittal requirements of this specification item include:

A. Class (i.e. II or III) Type and capacity of bicycle rack (i.e. number of bicycles served).

B. Fabrication and installation details, color and finish of the rack(s).

C. Support medium (i.e. existing slab, new pad, concrete filled excavation, etc.) and details of installation.

D. Complete manufacturer's warranty against defects for a period not less than one year from date of installation.

710S.3 Materials

A. Steel elements.

All steel shall be ASTM A-36 1010-1018 low carbon prime steel and the screws, nuts and bolts shall be tamper proof and plated with commercial zinc. The bicycle racks shall be hot dipped galvanized (ASTM A 123) unless the Drawings indicate that the rack assembly shall be provided in a specific color with a polyester-vinyl coated finish, a powder coated finish, or a polyvinyl thermoplastic finish.

B. 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".

C. Reinforcement

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

D. Expansion Joint Materials

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

E. Membrane Curing Compound

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

710S.4 Construction of Racks

A. Class II Bicycle Rack.

The Class II Rack shall consist of a locking system, which will secure both bicycle wheels and the frame with one (1) lock without the removal of either wheel.

B. Class III Bicycle Rack.

1. The Class III Rack Type 1 (Standard Detail 710S-1, sheet 1 of 3) shall consist of a one piece welded inverted U/Hoop assembly of Schedule 40 steel pipe with an minimum outside diameter (OD) of 1.5 inches (38 mm) on a minimum .25” (6.35 mm) thick base plate.

2. The Class III Rack Type 2 (Standard Detail 710S-1, sheet 2 of 3) shall consist of a single Schedule 40 steel pipe with an minimum outside diameter (OD) of 2 3/8 (60 mm) set in Portland cement concrete below the ground surface as indicated on the Drawings. The steel pipe shall be topped with a 7 1/2 inch (190 mm) polymer molded sphere that is secured with a hardened steel pin.

3. The Class III Rack Type 3 (Standard Detail 710S-1, sheet 3 of 3) shall consist of a one piece welded inverted U/Hoop assemble of Schedule 40 steel pipe with an minimum outside diameter (OD) of 2 3/8 inches (60 mm) supported with a minimum .25” (6.35 mm) thick circular base plate at one end of the rack and an in ground anchor mount on the other end.

4. The base plates can be round, square, or rectangular. If round, the diameter of the base plate must be at least 6” (150 mm) with a 4.5” (114 mm) bolt circle. If square, the base plate must be at least 4” by 4” (100 mm by 100 mm). If rectangular, the base plate must be 6” by 2” (150 mm by 50 mm). All base plates must be pre-drilled with two 3/8” (9.5 mm) diameter holes per plate for mounting. Each entire unit shall be hot dip galvanized after fabrication.

C. The bicycle racks shall be supported as indicated on the Drawings. The Class II racks and the Class III Rack Type 1 shall be supported on either existing or newly placed Portland cement concrete slabs. The Class III, Rack Types 2 and 3, can be placed on either existing or new slabs; however, these racks require additional underslab support of the steel pipe with p.c. concrete encasement as indicated in Standard Detail 710S-1 (sheets 2 and 3).

The construction of the new slabs shall be completed in accordance with Standard Specification Item Number 432S, “Concrete Sidewalks”. Unless noted otherwise on the Drawings, the slab shall be 4 inches (100 mm) in thickness.

710S.5 Installation of Bicycle Racks

Bicycle parking racks shall be installed in existing paver sidewalks, new paver sidewalks and concrete sidewalks in accordance with Standard Details 710S-3, 710S-4 and 710S-5, respectively.

710S.6 Measurement

Bicycle Parking Racks shall be measured per each, complete and in place and any new p.c. concrete slab will be measured by the square foot (square meter: 1 square meter is equal to 10.764 square feet) of surface area of "Bicycle Parking Concrete Pad".

710S.7 Payment

The installation of Bicycle Parking Racks, as described by this Specification Item, will be paid for at the unit bid price per each. The construction of a p.c. concrete bicycle-parking pad will be paid for at the unit bid price per square foot for "Concrete Bicycle Parking Pad".

The unit bid prices shall include full compensation for the specified equipment items; the excavation, removal and disposal of existing sidewalk, location, placement and installation of parking racks; all materials, including all steel pipe and plate, screws, nuts and bolts, reinforcing steel and concrete; placing and finishing the concrete pad, and all labor, tools, and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 710S-A:	Class II Bicycle Rack	Per Each.
Pay Item No. 710S-B:	Class III, Type 1 Bicycle Rack	Per Each.
Pay Item No. 710S-C:	Class III, Type 2 Bicycle Rack	Per Each.
Pay Item No. 710S-D:	Class III, Type 3 Bicycle Rack	Per Each.
Pay Item No. 710S-E:	Class III, Other Type Bicycle Rack	Per Each.
Pay Item No. 710S-F:	4 inch Concrete Bicycle Parking Pad	Per Square Foot.

End

SPECIFIC CROSS REFERENCE MATERIALS
Standard Specification Item Number 710S, “Bicycle Racks”

City of Austin Standard Specifications

Designation	Description
Item No. 403S	Concrete for Structures
Item No. 406*S*	Reinforcing Steel
Item No. 407S	Fibrous Concrete
Item No. 408	Expansion Joint Materials
Item No. 409	Membrane Curing

Item No. 410	Concrete Structures
Item No. 432S	Concrete Sidewalks

SPECIFIC CROSS REFERENCE MATERIALS - Continued
Standard Specification Item Number 710S, "Bicycle Racks"

City of Austin Standard Details

Designation	Description
710S-1	Class III Style Bicycle Parking
710S-2	Class II Style Bicycle Parking
710S-3	Bicycle Rack Installation in Concrete Paver Sidewalk – Alternate 1
710S-4	Bicycle Rack Installation in Concrete Sidewalk – Alternate 1
710S-5	Bicycle Rack Installation in Sidewalk – Alternate 2

American Society for Testing and Materials (ASTM)

Designation	Description
ASTM A 36	Specification for Structural Steel
ASTM A 123	Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products

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 Standard Specifications

Designation	Description
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 405	Concrete Admixtures
Item No. 406	Reinforced Steel Tolerances
Item No. 411	Surface Finishes for Concrete
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 642S	Silt Fence

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

Designation	Description
Item 420	Concrete Structures
Item 421	Hydraulic Cement Concrete
Item 427	Surface Finishes for Concrete
Item 437	Concrete Admixtures
Item 440	Reinforcing Steel

American Society for Testing and Materials (ASTM)

Designation	Description
A-496	Standard Specification for Steel Wire, Deformed for Concrete Reinforcement
A-615/615M	Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

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. 831S
Traffic Signal Drilled Shaft Foundations

831S.1 Description

This item shall govern furnishing and installation of traffic signal foundations in accordance with the specifications herein, Standard Detail 831S-1, “Traffic Signal Drilled Shaft Foundation”, Standard Detail No. 831S-2, “Solar Powered Flasher Assembly, the Drawings and/or as approved by the Engineer or designated representative.

Traffic signal pole foundation types shall be as designated on the Drawings and shall be one of the following:

Type 1	30”	(760-mm) diameter drilled shaft
Type 2	36”	(915-mm) diameter drilled shaft
Type 3	42”	(1070-mm) diameter drilled shaft
Type 4	48”	(1220-mm) diameter drilled shaft
Type 5	4”	(100-mm) pedestrian signal pole foundation

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.

831S.2 Submittals

The submittal requirements of this specification item may include:

A. The foundation plan and drilling/excavation details;
B. Class A p.c. concrete mix design;
C. Anchor bolt plan and details;
D. Reinforcing steel details and placement drawings and
E. Casing plan and details (if required).

831S.3 Materials

A. General

All Portland cement (p.c.) concrete, materials, anchor bolts, ground rod, conduits and construction methods shall conform to Standard Detail 831S-1, "Traffic Signal Drilled Shaft Foundation Details".

B. Traffic Signal Pole Types 1, 2, 3 and 4

Materials for Types 1,2,3, and 4 pole foundations include p.c. concrete, anchor bolt assemblies, reinforcing steel, conduits, and copper clad ground rod.

Additional information on the types of material for use in Types 1,2,3, and 4 pole foundations is provided in Standard Detail No. 831S-1 "Traffic Signal Drilled Shaft Foundation".

C. Pedestrian Signal Pole Type 5

Materials for Type 5 pedestrian signal pole foundations include p.c. concrete, 4” (100-mm) threaded coupling, 10’ X 4” (3-meter X 100-mm) intermediate metal pole (for

pedestrian signals) or a 10’ X 4” (3-meter X 100-mm) intermediate metal pole (for vehicle signals), and 4” (100-mm) rigid metal sweep with plug.
Additional information on the types of material for use in Type 5 pedestrian pole foundation is provided in Standard Detail No. 831S-2 "Solar Powered Flasher Assembly".

D. Portland Cement Concrete

The p.c. concrete for foundations shall be Class A, conforming to Standard Specification Item No. 403S, "Concrete for Structures". The p.c. concrete mix design shall consist of a minimum of 5 sacks of cement per cubic yard (280 kilograms of cement per cubic meter) and shall attain a minimum compressive strength of 3000 psi (20.7 mPa) at 28 days unless noted otherwise on the Drawings. Slump of the p.c. concrete shall be between 4" and 5" (100 mm and 125 mm).

The fine and coarse aggregate shall meet the requirements of Standard Specification Item No. 403S, "Concrete for Structures". The maximum nominal size of coarse aggregate shall be 1 1/2 inches (38 mm). The cement shall meet the requirements for a Type 1 of ASTM C-150. The water shall be clear, potable and free of all substances, which may be harmful to the p.c. concrete. A retarder or water reducing agent (Standard Specification Item 405S, "Concrete Admixtures") will be required in all p.c. concrete when casing is required in unstable soil conditions.

E. Reinforcing Steel

Reinforcing steel, when required shall conform to the sizes and dimensions shown on the Drawings. The reinforcing steel shall be new domestic deformed billet steel conforming to ASTM A-615/615M, grade 60 (SI grade 400) and shall conform to Standard Specification Item No. 406S, "Reinforcing Steel". If necessary the reinforcing steel may be spliced as long as the splice involves overlapping a minimum of 40 bar diameters.

F. Anchor Bolts

Unless noted otherwise on the Drawings, anchor bolts shall be medium strength, mild steel or alloy steel with maximum design yield strength of 55 ksi (380 mPa). Alloy anchor bolts shall conform to the requirements of ASTM A 193 Grade B7. Medium strength, mild steel anchor bolts shall conform to the requirements of a modified ASTM A-36 [with a 55 ksi (380 mPa) yield strength] or ASTM A 572.

Welded splicing of rod material for anchor bolts will not be permitted.

Each anchor bolt shall have a 6-inch (150-mm) “L” bend at the bottom end and shall be threaded at the top end. The anchor bolts shall have the threaded end galvanized a minimum of 12 inches (300-mm).

Threads for anchor bolts shall be rolled or cut threads of unified coarse thread series in accordance with ANSI B1.1. For rolled threads, the diameter of the unthreaded portion shall not be less than the minimum pitch diameter nor more than the maximum major diameter of the threads.

All threads for bolts and nuts shall have Class 2 fit tolerances in accordance with ANSI B1.1.

Each high strength steel anchor bolt assembly shall include the following parts:

One (1) 1-3/4” X 90” (45-mm X 2.29-meter) anchor bolt;

Two (2) 1-3/4” (45-mm) heavy hex nuts;

Two (2) 1-3/4” (45-mm) hardened flat washers;

One (1) 1-3/4” (45-mm) split lock washer.

G. Nuts and washers

Nuts for alloy steel anchor bolts shall conform to ASTM A-194 Grade 2H or ASTM A-563, heavy hex, Class 12. Nuts for medium strength, mild steel anchor bolts shall conform to ASTM A-194 Grade 2H or ASTM A-563, Grade D or better. All threads for nuts shall have a Class 2b tolerance in accordance with ANSI B1.1. When nuts are to be galvanized, the untapped blanks shall be galvanized prior to cutting the threads.

Exposed nuts shall be galvanized or coated with a zinc-rich coating if the anchor bolts are not galvanized.

Washers installed with anchor bolts of any type shall conform to the requirements of ASTM F-436 and shall have the same finish or coating as the bolt and nut.

H. Grout Cap

The cement grout cap to cover the anchor bolts and conduit shall consist of a mixture of 5 sacks of sand for every 1 sack of cement.

831S.4 Construction Methods

A. General

The traffic signal drilled shaft foundation shall be constructed in accordance with the details and instructions provided on the Drawings, in conformance with Standard Specification Item No Standard Detail 831S-1, "Traffic Signal Drilled Shaft Foundation" and in accordance with the specification requirements described herein.

B. Foundation Location

The foundation shall be located as shown on the Drawings; however the Engineer or designated representative may within design guidelines shift a foundation where necessary to secure a more desirable location or to avoid conflict with utilities. Unless otherwise indicated on the Drawings, the Contractor shall stake and the Engineer or designated representative will verify all foundation locations.

C. Safety

Construction near any underground or overhead utilities shall be accomplished using established industry and utility safety practices.

D. Construction Requirements.

The Contractor shall adhere to the following requirements:

1. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.
2. The use of explosives will not be permitted.

3. Any damage to utilities and/or structures, that occurs as a result of any construction activity performed by the Contractor, shall be repaired by the Contractor at the Contractor's sole expense. Foundations shall only be paid for once, regardless of extra work caused by obstructions and/or Contractor damage.
4. All loose material shall be removed from the bottom of the excavation before p.c. concrete is placed. Any water, that accumulates in the bottom of the excavated foundation, shall be removed by pumping or bailing, prior to p.c. concrete placement.
5. Anchor bolts, posts, conduits, ground rods or other hardware to be embedded in the foundation shall be held in place with templates during p.c. concrete placement or by other means approved by the Engineer or designated representative. Conduit when used shall be capped prior to placement of p.c. concrete. Conduit shall be reamed to remove burrs and sharp edges. Bell ends or bushings shall be installed on the conduit.
6. The p.c. concrete shall be placed as soon as possible after excavation is completed, the reinforcing steel placed and other hardware (anchor bolts, conduits, ground rod, etc.) installed. Reinforcing steel and concrete shall be placed during the same work day that the drilled shaft is excavated. Drilled shafts that cannot be completed the same work day as they are excavated shall be backfilled that same day with material removed from the excavation, subject to the approval of the Engineer or designated representative. Unless permission is provided by the Engineer or designated representative the p.c. concrete shall not be placed when the atmospheric temperature (temperature reading taken in the shade away from artificial heat) drops below 35^0F (2^0C).
7. The p.c. concrete shall be continuously placed in the drilled shaft until the construction joint indicated on the Drawings is attained. The p.c. concrete shall be placed with a suitable tremie or tube at a free fall height limited to 3 to 4 feet (0.9 to 1.2 meters). A mechanical vibrator shall be used for consolidating the wet p.c. concrete. During consolidation of the p.c. concrete, the Contractor shall insure that there is minimal contact of the vibrator with the reinforcing steel.
8. After p.c. concrete placement is completed and the top struck off, the exposed surface shall be cured for a minimum of 96 hours using wet cotton or burlap mats. All external bracing and templates for anchor bolts shall also remain in place for 96 hours after the p.c. concrete is placed. During this curing time, anchor bolts and conduit shall not be subjected to any applied strain. Springing or racking of anchor bolts or posts to secure proper alignment shall not be permitted.
9. Placement and compaction of backfill shall be performed in accordance with Standard Specifications Item Nos. 201S, "Subgrade Preparation" and 132S, "Embankment". Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. 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 leveled with suitable equipment to insure uniform compaction over the entire layer.
10. Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches (200 mm) or less in loose measure, for the full width of the individual cross section in a length that is best suited to the sprinkling and compaction methods utilized, while rock embankments shall be constructed in

successive layers of 18 inches (450 mm) or less in thickness for the full width of the cross section.

11. Where excavation is undertaken in the roadway shoulder, the shoulder shall be replaced with material equal to the original composition. All backfill shall be completed prior to erection of any structure on the foundation.
12. All excavated material, not required for backfill, shall be known as "Waste" and shall become the property of the Contractor. It shall be the Contractors responsibility to promptly remove and dispose of the material outside the limits of the project. The work site shall be kept clean and neat at all times.
13. A cap of cement grout shall completely cover the anchor bolts and conduits on traffic signal pole foundations (Standard Detail 831S-1) that have been earmarked to receive such protection on the individual project drawings. Anchor bolts and conduits shall be covered with plastic film prior to construction of the dome to prevent the cement grout from adhering to these items.

831S.5 Measurement

Traffic signal drilled shaft foundations shall be measured by each type of traffic signal pole foundation, complete in place:

Type 1	30” (760-mm) diameter traffic signal pole foundation
Type 2	36” (914-mm) diameter traffic signal pole foundation
Type 3	42” (1067-mm) diameter traffic signal pole foundation
Type 4	48” (1220-mm) diameter traffic signal pole foundation
Type 5	4” (100-mm) signal pole foundation

831S.6 Payment

Traffic signal pole foundations will be paid for at the unit bid price per each. The unit bid price shall include full compensation for a) locating utilities, b) all excavations, c) any necessary removal of loose material and pumping of standing water; d) proper disposal of waste materials, e) furnishing and installation of anchor bolts, conduits and ground rods, f) placement and removal of required casings; g) furnishing and placing all p.c. concrete and reinforcing steel, h) all backfilling, i) procurement of materials and covering the foundation with a grout cap (if required), j) curing of exposed p.c. concrete and k) furnishing all tools, labor, equipment and incidentals necessary to complete the work.

All foundations will be paid for only once, regardless of the need to abandon and reinstall a foundation due to unforeseen utility conflicts or any other reason

Extra payment will <u>not</u> be made for casings left in place.

Payment will be made under:

Pay Item No. 831S-1:	30” diameter Traffic Signal Drilled Shaft Foundations 8’ Depth	per Each.
Pay Item No. 831S-2:	36” diameter Traffic Signal Drilled Shaft Foundations 10’ Depth	per Each.
Pay Item No. 831S-3:	42” diameter Traffic Signal Drilled Shaft Foundations 12’ Depth	per Each.

Pay Item No. 831S-4: 48” diameter Traffic Signal Drilled Shaft Foundations 14’ Depth per Each.

Pay Item No. 831S-5: 4” diameter Pedestrian Signal Foundation per Each.

Pay Item No. 831S-1C: 30” diameter Traffic Signal Drilled Shaft Foundations 8’ Depth with casing per Each.

Pay Item No. 831S-2C: 36” diameter Traffic Signal Drilled Shaft Foundations 10’ Depth with casing per Each.

Pay Item No. 831S-3C: 42” diameter Traffic Signal Drilled Shaft Foundations 12’ Depth with casing per Each.

Pay Item No. 831S-4C: 48” diameter Traffic Signal Drilled Shaft Foundations 14’ Depth with casing per Each.

Pay Item No. 831S-5C: 4” diameter Pedestrian Signal Foundation with casing per Each.

End

SPECIFIC Cross Reference Materials
Standard Specification Item No. 831S, "Traffic Signal Drilled Shaft Foundations”

City of Austin Standard Specifications

Designation	Description
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 403S	Concrete for Structures
Item No. 405S	Concrete Admixtures
Item No. 406S	Reinforcing Steel

City of Austin Standard Details

Designation	Description
Detail No. 831S-1	Traffic Signal Drilled Shaft Foundation
Detail No. 831S-2	Solar Powered Flasher Assembly

American Society for Testing and Materials, ASTM

Designation	Description
A 36	Standard Specification for Carbon Structural Steel
A 193/193M	Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service
A 194/194M	Specification for Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and for High Temperature Service
A 563/563M	Specification for Carbon and Alloy-Steel Nuts
A 572/572M	Specification for High-Strength Low-Alloy Columbium-Vanadium Steels of Structural Quality
A 615/615M	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
C-150/150M	Specification for Portland Cement
F 436	Hardened Steel Washers

American National Standards Institute (ANSI) and ANSI/ASME/AWWA

Designation	Description
ANSI/ASME B1.1	Unified Inch Screw Threads (UN and UNR Thread Form)

RELATED Cross Reference Materials
Standard Specification Item No. 831S, "Traffic Signal Drilled Shaft Foundations"

City of Austin Standard Specifications

Designation	Description
Item No. 104S	Removing Concrete
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 401S	Structural Excavation Backfill
Item No. 410S	Concrete Structures
Item No. 420S	Drilled Shaft Foundations
Item No. 430S	Concrete Curb and Gutter
Item No. 432S	Concrete Sidewalks
Item No. 433S	Concrete Driveways

Item No. **833S**
Pedestrian Push Button Assembly

833S.1 Description

This item shall govern furnishing and installation of, pedestrian push button assemblies in accordance with the specifications contained herein, Standard Detail No. 839S-1, "Pedestrian and Vehicular Signal Installation Details", No. 839S-2, "Wood Pole Span Wire Details", No. 839S-4, "Traffic Signal Structures: Mast Arm Details", No. 839S-5, "Traffic Signal Structures: Span Wire Details ", manufacturer recommendations, the Drawings and/or written instructions from the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

833S.2 Submittals

The submittal requirements of this specification item include:

A. Wire size, characteristics and designation for each wire application (i.e. traffic signal, pedestrian signal and/or pedestrian push button),
B. Catalog cut and Manufacturer installation recommendations for required items.

833S.3 Materials

A. General

The pedestrian push button assembly shall be weather-tight and tamper-proof. The assembly shall be designed to prevent an electrical shock under any weather condition and shall have provisions for grounding in accordance with the National Electrical Code (NEC).

Pedestrian push button housing shall be cast from aluminum alloy, free of voids, pits dents, molding, sand and excessive grinding marks. All design radii shall be smooth and intact. Exterior surface finish shall be smooth and cosmetically acceptable and free of blemishes. The manufacturer's name or trademark shall be located on the housing.

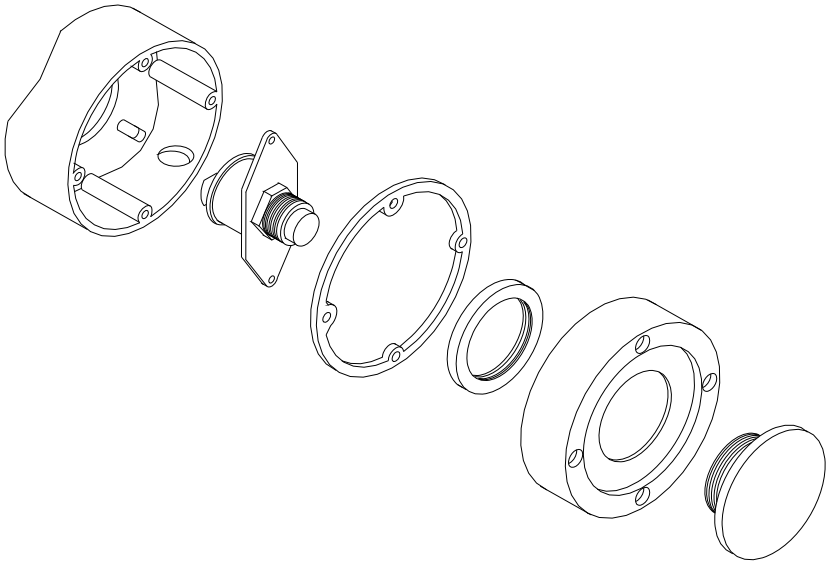
B. Design

The Push button assembly shall be fabricated with design characteristics shown in Figure 1

The bottom of the push button housing shall be tapped for and provided with a ½ inch (12.5-mm) NPT threaded conduit plug. The back of the push button housing shall be provided with a hole capable of being threaded for a ½ inch (12.5-mm) NPT threaded conduit plug and capped with a non-threaded ½ inch (12.5-mm) plastic plug. The back portion of the housing shall be designed to accommodate pole diameters from 3" to 14" (76-mm to 356-mm). The push button housing shall be tapped and provided with (4) hex nut, mounting positions, as shown to

accommodate the push button cover. A neoprene 0-ring as shown shall be provided for a weather tight seal between the housing and cover.

The push button switch shall be actuated by a minimum 2” (50-mm) diameter plunger. The plunger shall have an integral shaft to actuate the switch and have a clear anodized finish. The assembly shall be designed so that the maximum plunger travel does not exceed the switch travel. A spring shall be installed between the plunger and switch. The spring shall provide an operating force of less than 5 lbs (22.2 newtons). A protective shroud shall encircle the plunger to deter vandalism. The shroud shall be cast as an integral part of the cover. There shall be a moisture barrier between the plunger and the switch. The assembly shall conform to all minimum requirements set forth with the American with Disabilities Act.



EXPLODED VIEW OF PUSH BUTTON ASSEMBLY

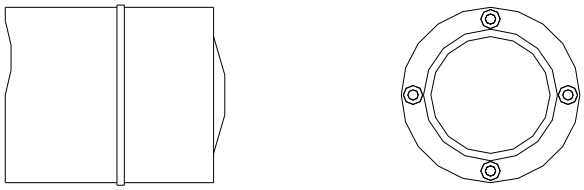


Figure 1: Push button assembly

C. Finish

Both housing and cover shall have an alodine conversion coating to provide a proper base for paint adhesion. The assembly shall be painted Federal Yellow and baked in a drying oven after painting.

D. Push Button Switch

The switch shall have terminal connection points on back to allow for an electrical spade connection to the back of the switch allowing user to connect twisted pair

directly to the back of the switch. Wire and Wire nut connections from the back of the switch shall not be acceptable.

The switch assembly shall be capable of operating in temperature ranges of 65°F through 180°F (18°C through 82°C) and have a mechanical life of up to 10,000,000 actuations. The switch assembly shall be electrically rated to carry 25 Amp at 125 volts AC, 250 volts maximum. The switch assembly must have the following recognized certifications and/or approval: UL, CSSA, Mil Spec # MIL-S-8805.

All pedestrian push buttons installed on a job shall be of the same manufacturer.

Upon request, the Contractor shall furnish a sample within (7) working days of the equipment they propose to furnish the City of Austin.

The Department of Transportation Planning and Sustainability or succeeding department may test a sample of the signal head under normal conditions. Failure of the equipment to meet these specifications or perform in a satisfactory manner during such testing shall be cause to reject push buttons.

E. Mounting Attachments

Mounting attachments shall be as indicated on the Drawings.

F. Hardware

All bolts, nuts, washers, lock washers, screws and other assembly hardware shall be galvanized steel, stainless steel or dichromate sealed aluminum in conformance with TxDoT Departmental Materials Specifications DMS-7120, "Sign Hardware". When dissimilar metals are used, the metals shall be so selected or insulated to prevent corrosion.

G. Pedestrian Instructional Sign

The instructional sign shall include the legend indicated on the Drawings and shall meet the requirements presented in sections 824S.3.E (Sign Blanks) and 824S.3.F (Sign Faces) of Standard Specification Item No. 824S, "Traffic Signs".

833S.4 Installation

The Contractor will be responsible for installing the pedestrian push-buttons and signs in the field. Drilling wire feed holes and mounting the pedestrian push-button on signal poles will be the Contractor's responsibility.

All wire feeding through the mast arm pole structure shall be wrapped once with plastic electrical tape and wrapped again with electrical friction tape extending 12 inches (300-mm) on each side of the pole opening for a total of 24 inches (600-mm). Pedestrian push-buttons shall have a common ground wire that is completely isolated and independent from all other ground wires.

833S.5 Measurement

This item will be measured by each pedestrian push button installed.

833S.6 Payment

Pedestrian push buttons shall be paid for at the unit bid price per each. The unit bid price shall include full compensation for: a) furnishing and installing all ancillary materials, b) drilling wire feed holes (as needed), c) mounting the push buttons on the signal poles and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

The cost of procuring, installing, and connecting mounting hardware, pedestrian signs, and cable from the push button to the controller is considered ancillary to various bid items and will not be paid for separately.

Payment will be made under:

Pay Item No. 833S-PPB: Pedestrian Push-button per Each.

END

SPECIFIC Cross Reference Materials
Standard Specification Item No. 833S, "Pedestrian Push Button Assembly"

City of Austin Standard Details

Designation	Description
No. 839S-1	Pedestrian and Vehicular Signal Installation Details
No. 839S-2	Wood Pole Span Wire Details
No. 839S-4	Traffic Signal Structures: Mast Arm Details
No. 839S-5	Traffic Signal Structures: Span Wire Details

City of Austin Standard Specifications

Designation	Description
Item No.824S	Traffic Signs
Section 824S.3.E	Sign Blanks
Section 824S.3.F	Sign Faces

TxDoT Departmental Materials Specifications

Designation	Description
DMS-7120	Sign Hardware

Item No. **834S**
Traffic Signal Pull Boxes

834S.1 Description

This item shall govern constructing, furnishing and installing traffic signal pull boxes as indicated on the Drawings; in conformity with this specification item; Standard Detail Nos. 834S-1 through 834S-8; the Drawings and/or written instructions from 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.

834S.2 Submittals

The submittal requirements of this specification item include:

A. Identification of the number and types (i.e. types A, B, C or D) of pull boxes proposed,
B. Mix design for 'Class A' Portland cement concrete,
C. Construction details (mortar, reinforcing steel, etc.) for the pull box and supporting foundation.

834S.3 Materials

Traffic signal pull box types of the size specified on the Drawings, shall be constructed as shown in the following Standard Details:

No. 834S-1 "Type A Traffic Bearing Pull Box",
No. 834S-2 "Frame and Lid for use with Type A Traffic Bearing Pull Box"
No. 834S-3 "Type B Pull Box",
No. 834S-4 "Ring and Lid for use with Type B Pull Boxes "
No. 834S-5 “Type C Pull Box with Light Weight Cover ",
No. 834S-6 "Ring and Lid for use with Type C Pull Box";
No. 834S-7 "Ring and Lid for Traffic Bearing Type C Pull Box ",
No. 834S-8 "Type D Communication Pull Box and Torsion Assisted Lid".

Ring and Lid for each type pull box shall be produced by a manufacturer approved by the Engineer or designated representative.

Brick for pull boxes shall be new common brick.

Portland cement concrete for the pull box base and encasement shall be Class A p.c. Concrete conforming to Standard Specification Item No. 403S, "Concrete for Structures".

834S.4 Construction Methods

Construction near any underground or overhead utilities shall be accomplished using established industry and utility safety practices. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and

application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.

Pull boxes shall be constructed in accordance with the lines, grades, details and dimensions indicated on the Drawings or established by the Engineer or designated representative. Pull boxes, which are exposed to view, as in sidewalks, shall be accurately set to the finished grade and anchored.

Masonry work for the lower portion of the pull boxes shall be accurately cut around the conduits and a smooth accurate bed shall be provided for the pre-cast concrete upper portion of the pull box. The pre-cast section shall be set in mortar upon the lower masonry course. The inside of pull boxes shall be left clean and the joints shall be wiped.

Any damage to utilities and/or structures, that occurs as a result of any construction activity performed by the Contractor, shall be repaired by the Contractor at the Contractor's sole expense. Pull boxes shall only be paid for once, regardless of extra work caused by obstructions and/or Contractor damage.

All loose material shall be removed from the bottom of an excavation before p.c. concrete is placed. Any water accumulated in the bottom of the excavated foundation shall be removed by pumping or bailing, prior to p.c. concrete placement.

The use of explosives will not be permitted.

The p.c. concrete shall be placed as soon as possible after excavation is completed, the reinforcing steel placed and other hardware (anchor bolts, conduits, ground rod, etc.) installed. The p.c. concrete shall not be placed when the atmospheric temperature (temperature reading taken in the shade away from artificial heat) drops below 35^0F (2^0C) unless permission is provided by the Engineer or designated representative.

A mechanical vibrator shall be used for consolidating the wet concrete. During consolidation of the p.c. concrete, the Contractor shall insure that there is minimal contact of the vibrator with the reinforcing steel.

Anchor bolts shall be held in place with templates during the placement of Portland cement concrete. Any pots, conduits or other hardware to be embedded in the foundation shall be held in place during p.c. concrete placement by templates or other suitable means approved by the Engineer or designated representative. Conduit, when used, shall be capped prior to placement of p.c. concrete. Conduit shall be reamed to remove burrs and sharp edges. Bell ends of bushings shall be installed on the conduit.

After the concrete has been placed and the top struck off, it shall be covered with wet cotton or burlap mats, for not less than 96 hours. Top templates may be removed after the p.c. concrete has achieved initial set. Forms and other bracing, when used, shall not be removed until the p.c. concrete has cured a minimum of 96 hours. When a Type III cement is used in the foundation, the p.c. concrete must cure a minimum of 48 hours. Anchor bolts and conduit shall not be subjected to any applied strain during the curing period.

Placement and compaction of backfill shall be performed in accordance with Standard Specifications Item Nos. 201S, "Subgrade Preparation" and 132S, "Embankment". Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. 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 leveled with suitable equipment to insure uniform compaction over the entire layer.

Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches (200 mm) or less in loose measure, for the full width of the individual cross section in a length that is best suited to the sprinkling and compaction methods utilized, while rock embankments shall be constructed in successive layers of 18 inches (450 mm) or less in thickness for the full width of the cross section.

Where excavation is undertaken in the roadway shoulder, the shoulder shall be replaced with material equal to the original composition. All backfilling shall be completed prior to erection of any structure on the foundation.

All excavated material, not required for backfill, shall be known as "Waste" and shall become the property of the Contractor. It shall be the Contractor responsibility to promptly remove and dispose of the material outside the limits of the project. The work site shall be kept clean and neat at all times. All backfilling shall be completed prior to the erection of any structure on the p.c. concrete foundation.

Unless permission is given by the Engineer or designated representative concrete shall not be placed when the atmospheric temperature drops below 35^0F (2^0C), where the temperature reading are taken in the shade away from artificial heat.

All parts of the p.c. concrete foundations extending above the natural or finished ground shall be given an ordinary finish in accordance with Standard Specification Item No. 410, "Concrete Structures".

Where existing surfacing is removed for placement of p.c. concrete foundations, repair shall be made by backfilling with material equals in composition and density to the surrounding area and by replacing any removed surfacing, such as asphalt pavement or p.c. concrete rip-rap, with like material to equivalent section and condition.

834S.5 Measurement

Pullboxes shall be measured as each type, complete in place.

834S.6 Payment

Pull boxes shall be paid for at the unit bid price per each. The unit bid price shall include full compensation for furnishing and constructing the pull-box as detailed on the Drawings and Standard Details, complete with all fittings, ring and lids covers, masonry work, excavation and backfill, for all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 834S-A:	Traffic Signal Pull Box, Type A	Per Each.
Pay Item No. 834S-B:	Traffic Signal Pull Box, Type B	Per Each.
Pay Item No. 834S-C:	Traffic Signal Pull Box, Type C	Per Each.
Pay Item No. 834S-CT:	Traffic Signal Pull Box, Traffic Bearing Type C	Per Each.
Pay Item No. 834S-D:	Traffic Signal Pull Box, Type D	Per Each.

End

SPECIFIC CROSS REFERENCE MATERIALS
Standard Specification Item No. 834S, “Traffic Signal Pull Boxes”

City of Austin Standard Details

Designation	Description
No. 834S-1	Type A Traffic Bearing Pull Box
No. 834S-2	Frame and Lid for use with Type A Traffic Bearing Pull Box
No. 834S-3	Type B Pull Box
No. 834S-4	Ring and Lid for use with Type B Pull Boxes
No. 834S-5	Type C Pull Box with Light Weight Cover
No. 834S-6	Ring and Lid for use with Type C Pull Box
No. 834S-7	Ring and Lid for Traffic Bearing Type C Pull Box.
No. 834S-8	Type D Communication Pull Box and Torsion Assisted Lid.

City of Austin Standard Specifications

Designation	Description
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 403S	Concrete for Structures
Item No. 410	Concrete Structures

RELATED CROSS REFERENCE MATERIALS
Standard Specification Item No. 834S, “Traffic Signal Pull Boxes"

City of Austin Standard Specifications

Designation	Description
Item No. 401	Structural Excavation and Backfill
Item No. 406	Reinforcing Steel
Item No. 410	Concrete Structures
Item No. 411	Surface Finishes for Concrete

Item No. 835S
Traffic Signal Conduit

835S.1 Description

This item shall govern furnishing and installation of all traffic signal conduit and/or materials in accordance with the specifications contained herein, Standard Detail No. 835S-1 "Trench Detail for Traffic Signal Conduit ", the Drawings and/or written instructions from the Engineer or designated representative. This item shall consist of all applicable work, including conduit and termination of conduit in pull boxes, etc., as prescribed under this item and in accordance with the City of Austin Standard Specifications, Standards (Details) and Utility Criteria Manual, Section 5, “Cuts in Public Rights-of-Way”.

Cutting, removal and restoration of pavement and base courses, driveways, curb and gutter, sidewalk and ramps, the furnishing and placement of select bedding, backfilling, the hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated on the Drawings shall be conducted and compensated in accordance with Standard Specification Item No. 844S, “Trench Excavation and Backfill for Traffic Signal Conduit”.

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.

835S.2 Submittals

The submittal requirements of this specification item may include:

A manufacturer’s certification that the PVC and other appropriate materials furnished under this Item were manufactured, sampled, tested, and inspected in accordance with the requirements of the pertinent ASTM specifications.

835S.3 Pipe/Conduit Materials

All conduit and materials furnished by the Contractor shall be new and UL-listed and shall meet NEMA and NEC requirements. Unless indicated otherwise on the Drawings, junction boxes, expansion joints and conduit fittings shall be fabricated from a material similar to the connecting conduit.

Any PVC pipe and fittings, that are to be encased in Portland cement concrete or buried, shall meet the requirements of ASTM D3034 type SDR-35 of the nominal size shown on the Drawings. All other conduit shall be electrical conduit, schedule 40 PVC. All bends shall be large radius [minimum of 18 inches (450 mm)] to facilitate pulling of cable.

Rigid metal conduit (RMC) shall be steel, hot dipped galvanized inside and outside. When tested in accordance with ASTM A 90, zinc coating of RMC shall be a minimum of 1.5 ounces per square foot (0.45 kilograms per square meter) inside and outside. Polyvinyl chloride (PVC) conduit shall meet the requirements of NEMA Standard TC-2, UL 651, and the NEC.

All 1” (50 mm) conduits including elbows and couplings shall be schedule 40 zinc-coated steel rigid threaded conduit (hot-dipped galvanized), conforming to Federal Specification WW-C-581d, ANSI C80 1, and Underwriters' Laboratories Specifications.

All 2”, 3”, and 4” (50mm, 75 mm and 100mm) conduits shall be PVC. All PVC conduits, including elbows and couplings shall be schedule 40 PVC conduit, conforming to Federal Specification W-C 1094 and Underwriter's Laboratories, Inc. Standard Ul-651.

835S.4 Construction Methods

Prior to commencement of work, all erosion control and tree protection measures required shall be in place and all utilities located and protected as set forth in Standard Contract Document Section 00700, “General Conditions”, the City of Austin “Utility Criteria Manual, Section 5, Cuts in Public Rights of Way”, and the City of Austin “Environmental Criteria Manual”. Adequate temporary supports and protection of surface and underground utilities shall be the responsibility of the contractor.

A street cut permit is required for excavation in an existing City street (City of Austin Utilities Criteria Manual Section 5.2.0, "Permit for Excavation in the Public Rights-of-Way" and Article 14-11-181, "Permit Required" of The Code of The City of Austin). Where traffic must cross open trenches, the Contractor shall provide suitable bridges. For trenches less than 2 feet (0.6 meter) in width, sheet steel plates having a minimum thickness of ½ inch (12.5 mm) shall be used. The plates shall overlay the top of the trench a minimum of 18 inches (450 mm) on both sides and secured by Cold-Mix asphalt that meets TxDoT Specification Item No. 334, "Hot Mix-Cold Laid Asphaltic Concrete Pavement".

Conduit shall be placed in accordance with the lines, grades, details and dimensions shown on the Drawings or as otherwise directed in writing by the Engineer or designated representative. Unless indicated otherwise on the Drawings, underground conduit shall be installed a minimum of 36 inches (914 mm) deep measured from the finished grade, or 18 inches (457 mm) deeper than the bottom of the sub-grade, whichever is greater. Installation of conduit shall be in accordance with the requirements of NEC. Conduit placed for Portland cement concrete (pcc) encasement shall be secured and supported in such a manner that the alignment will not be disturbed during placement of the p.c. concrete. No p.c. concrete shall be placed until all of the conduit ends are capped and all box openings closed. Field bends in rigid metal conduit shall have a minimum radius equal to 12 times the nominal diameter of the conduit.

Each length of rigid metal conduit shall be reamed and threaded on each end and couplings shall be made tight. PVC conduit shall be joined by the solvent-weld method in accordance with the conduit manufacturer's recommendations. No reducer couplings shall be used.

Construction near any underground or overhead utilities shall be accomplished using established industry and utility safety practices. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.

Any damage to utilities and/or structures, that occurs as a result of any construction activity performed by the Contractor, shall be repaired by the Contractor at the Contractor’s sole expense. Conduits shall be paid for once, regardless of extra work caused by obstructions and/or Contractor damage.

The Contractor shall comply with City of Austin's Standard Specifications, Standards (Details) and latest edition of the Street Cut and Excavation Repair Standards (City of Austin Utility Criteria Manual Section 5.0, “Cuts in Public Rights-of-Way”), when installing 2-inch (50 mm) conduit.

Unless otherwise noted by the Engineer, all traffic signal conduits shall be terminated in a new or existing pull box. The cost to make the termination is considered ancillary to the various bid items and no additional compensation will be made to the contractor for this work.

All conduit and fittings shall have burrs and rough places smoothed and shall be clean and free of obstructions before the cable is installed. Field cuts shall be made with a hacksaw only, and shall be square and true so that the ends will butt or come together for the full diameter thereof. In no case shall a cutting torch be used to cut or joint conduit. Slip joints or running threads will not be permitted for coupling conduit unless approved by the Engineer or designated representative. When a standard coupling cannot be used, an approved union coupling shall be used and shall provide a watertight coupling between the conduit. All couplings shall be properly installed to bring their ends of connected conduit together to produce a good rigid connection throughout the entire length of the conduit run. Where the coating on a metal conduit run has been damaged in handling or installation, such damaged parts shall be thoroughly painted with rust preventive paint. Ends of conduits shall be capped or plugged until installation of the wire is complete.

Upon request by the Engineer or designated representative, the Contractor shall draw a full-size metal wire brush, attached by swivel joint to a pull tape, through the metal conduit to ensure that the conduit is clean and free from obstructions. Any conduit not passing the wire brush shall be replaced at the contractor’s expense. Conduits shall be placed in an open trench to provide a minimum cover of 30 inches (750 mm) below the curb grade in the sidewalk areas, and 30 inches (750 mm) cover in the street areas.

Prior to final acceptance by the Owner of any conduit placed for future use, the contractor shall furnish and install a continuous nylon mule tape in each duct. The mule tape shall have a tensile strength of not less than 1800 pounds (8 kilonewtons). The mule tape shall be securely tied at each end of the conduit.

The Contractor shall provide adequately bent conduit and shall properly excavate so as to prevent damage to the conduit or conductor by a bend radius, which is too short.

Unless otherwise specified or directed by the Engineer or designated representative, all conduit runs shall be continuous and of the same material (metal only or PVC only). Where tying into existing conduit, the Contractor must continue with the same material (metal to metal or PVC to PVC). All conduits placed in trenches shall be laid side by side (no stacking.)

The size and number of conduits shall be as called out on the Drawings. The ends of all conduit placed for future use shall be fitted with caps.

835S.5 Trenching, Boring and Backfill

All trenching, excavation and backfill shall be to the lines and grades indicated on drawings and construction detail drawing and in accordance with Standard Detail No. 835S-1, “Trench Detail for Traffic Signal Conduit” and Standard Specification Item No. 401S, "Structural Excavation and Backfill", except for measurement and payment. Where existing surfacing is removed for placing conduit, the repair shall be made by backfilling with material equal in composition and density to the surrounding areas and by replacing any removed surfacing, such as asphalt pavement or concrete riprap, with like material to equivalent condition.

Jacking and Boring shall be as shown on the Drawings and in accordance with Standard Specification Item Nos. 501S, "Jacking or Boring Pipe" except for measurement and payment.

The work shall be executed in a safe and orderly fashion and in accordance with applicable Federal, State, and local laws, rules, and regulations. All work shall be performed in a competent manner consistent with the best modern practices, notwithstanding any omissions from the plans or these specifications.

All conduits shall be placed on a minimum 1” (25 mm) layer of bedding sand and covered with a minimum 4”(100 mm) layer of sand prior to backfill.

Trench safety and trench safety systems shall be the responsibility of the contractor and shall be prepared in accordance with Standard Item No. 509S, “Excavation Safety Systems” and all applicable Federal, State, and local laws, rules, and regulations.

Trenches shall be excavated to lines and grades as indicated by on construction plans or as directed by the engineer. Trenches shall be a minimum of 4”(100 mm) and a maximum of 8” (200 mm) wider than the outside dimension of the conduit configuration. Trench bottoms shall be graded smooth with a minimum 1” (25 mm) layer of sand or other fine grain materials and shall be free of any trash, debris, loose material, or water. Trenches shall be excavated to a depth that insures that the required 30” (750 mm) conduit cover is achieved. Blasting or use of explosives as an aid to digging is not permitted.

The Engineer or designated representative reserves the right to inspect and approve all trenching prior to conduit placement.

Placement and compaction of backfill shall be performed in accordance with Standard Specifications Item Nos. 201S, "Subgrade Preparation" and 132S, “Embankment”. Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. 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 leveled with suitable equipment to insure uniform compaction over the entire layer.

Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches (200 mm) or less in loose measure, for the full width of the individual cross section in a length that is best suited to the sprinkling and compaction methods utilized, while rock embankments shall be constructed in successive layers of 18 inches (450 mm) or less in thickness for the full width of the cross section.

Backfill under streets, driveways and all other pavement repairs shall conform to the City of Austin's Standard Specifications, Standards (Details) and Utility Criteria Manual, Section 5, “Cuts in Public Rights of Way”. Backfill material for use in backfiring trenches under streets and driveways shall be selected based on the material’s characteristic to maintain a

consistent compacted density. Emphasis is placed upon the need to obtain uniform density throughout the backfill. Backfill shall be compacted by mechanical tamping equipment.

If boring under a roadway or other structure is required, the contractor shall be responsible for all utility locations including any required pot holing. Such pot-holing and boring shall be completed at the sole expense of the contractor and shall be conducted in accordance with the requirements of the Utility Criteria Manual, Section 5, “Cuts in Public Rights of Way”.

835S.6 Measurement

The lineal foot will measure the Work prescribed by this item (lineal meter: 1 lineal meter equals 3.281 lineal feet) of conduit for actual quantities completed based on the dimensions indicated on the Drawings.

The cost for utility location (including pot holing), boring, trenching, and any other excavation shall be conducted and compensated in accordance with Standard Specification Item No. 844S, “Trench Excavation and Backfill for Traffic Signal Conduit”.

835S.7 Payment

The work performed as prescribed by this item will be paid for at the unit bid price per lineal foot for “Installing Traffic Signal Conduit”. The unit bid price shall include full compensation for cutting, removal and restoration of pavement surface and base courses, furnishing and installation of all conduit to the lines and grades indicated on the Drawings; for repair of entry of conduit through walls of existing pull boxes; the furnishing and placement of select bedding, backfilling, the hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated on the Drawings and for all labor, tools, equipment, manipulation, and incidentals necessary to complete the work.

The cost for utility location (including pot holing), boring, trenching and any other excavation shall be conducted and compensated in accordance with Standard Specification Item No. 844S, "Trench Excavation and Backfill for Traffic Signal Conduit".

The Work associated with construction of a new pull box will be paid for separately under a separate bid item identified with Standard Specification Item No 834S, "traffic Signal Pull Boxes".

Payment will be made under the following:

Pay item No. 835S-LT1: InstallingTraffic Signal Conduit with Conduit
1 inch in diameter Per Lineal Foot of conduit.

Pay item No. 835S-LT2: InstallingTraffic Signal Conduit with Conduit
2 inch in diameter Per Lineal Foot of conduit

Pay item No. 835S-LT3: InstallingTraffic Signal Conduit with Conduit
3 inch in diameter Per Lineal Foot of conduit

Pay item No. 835S-LT4: InstallingTraffic Signal Conduit with Conduit
4 inch in diameter Per Lineal Foot of conduit

Pay item No. 835S-LTM: Installing Traffic Signal Conduit with
____ Conduit ___ inches in diameter,
____ Conduit ___ inches in diameter and
____ Conduit ___ inches in diameter

Per Lineal Foot of conduit

END

SPECIFIC Cross Reference Materials
Standard Specification Item No. 835S, "Traffic Signal Conduit"

City of Austin Standard Specifications

Designation	Description
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 401S	Structural Excavation and Backfill
Item No. 501S	Jacking or Boring Pipe
Item No. 509S	Trench Safety Systems
Item No. 834S	Pull Boxes
Item No. 844S	Trench Excavation and Backfill for Traffic Signal Conduit

City of Austin Standard Details

Designation	Description
No. 835S-1	Trench Detail for Traffic Signal Conduit

City of Austin Standard Contract Documents

Designation	Description
Section 00700	General Conditions

City of Austin Utility Criteria Manual

Designation	Description
Section 5	Cuts in Public Right-of-Way
Article 5.2.0	Permit for Excavation in the Public Rights-of-Way

The Code of the City of Austin, Code of Ordinances, Volume 1

Designation	Description
Article 14-11-181	Permit Required

American Society for Testing and Materials (ASTM)

Designation	Description
ASTM D-3034	Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM A90/90M	Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings

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

Designation	Description
Item No. 334	Hot Mix-Cold Laid Asphaltic Concrete Pavement

Federal Specification WW-C-581d, ANSI C80 1,

Federal Specification W-C 1094

RELATED Cross Reference Materials
Standard Specification Item No. 835S, "Traffic Signal Conduits"

City of Austin Standard Specifications

Designation	Description
Item No. 104S	Removing Concrete
Item No. 111S	Excavation

Item No. 210S	Flexible Base
Item No. 401S	Structural Excavation Backfill
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures
Item No. 405	Concrete Admixtures
Item No. 406S	Reinforcing Steel

RELATED Cross Reference Materials (Continued)
Standard Specification Item No. 835S, "Traffic Signal Conduits"

City of Austin Standard Specifications (Continued)

Designation	Description
Item No. 410S	Concrete Structures
Item No. 420	Drilled Shaft Foundations
Item No. 836S	Traffic Signal Risers
Item No. 837S	Traffic Signal Loop Detectors
Item No. 838S	Pedestrian Signal Risers
Item No. 840S	Installation of Traffic Signals
Item No. 842S	Ducts

City of Austin Standard Details

Designation	Description
No. 510S-1	Concrete Trench Cap
No. 510S-3	Typical Trench with Paved Surface
No. 510S-5	Typical Trench with Unfinished Surface

City of Austin Utility Criteria Manual

Designation	Description
Article 5.5.0	Backfill of Excavated Area
Article 5.6.0	Restoration of Excavated Area
Article 5.7.0	Pavement Repairs
Article 5.8.0	Materials
Article 5.9.0	Miscellaneous Repairs

The Code of the City of Austin, Code of Ordinances, Volume 1

Designation	Description
Article 14-11-189	Conditions for Permit Issuance
Article 14-11-190	Excavation Sequence and Permit Term

Item No. 838S
Pedestrian Signal Installation

838S.1 Description

This item shall govern furnishing and installation of, pedestrian signal heads in accordance with the specifications contained herein, the Drawings, Standard Detail Nos. 839S-1, "Pedestrian and Vehicular Signals Installation Details", manufacturer recommendations and/or written instructions from the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

838S.2 Submittals

The submittal requirements of this specification item may include:

A. Wire size, characteristics and designation for each wire application (i.e. pedestrian signal and/or pedestrian push button),

B. Type, number of sections, lens configuration and manufacturer for each pedestrian signal item specified on the Drawings,

C. Type, number of sections and manufacturer for each pedestrian signal item specified on the Drawings,

D. Catalog cut and Manufacturer installation recommendations for signal heads and louvers

838S.3 Materials

A. General

All pedestrian signal heads installed on a job shall be by the same manufacturer. The pedestrian signal shall be designed to meet or exceed the requirements of the current State of California Standard Specifications for Type A pedestrian signals and shall be designed to fit the same mounting brackets as employed by State of CALIFORNIA Type B and C Neon Pedestrian Signals. The construction design shall be compatible with clamshell mounting hardware.

The general construction shall include a single-piece cast aluminum housing, a single-piece double parabolic reflector, a two symbol two color message lens, a single-piece cast aluminum swing down door frame, a blankout eggcrate type sun visor, two traffic signal lamps conforming to Section 831S.3 (F), “Lamps” of this specification item and appropriate sockets and other hardware. The design shall optimize performance per unit of energy consumed and shall accommodate 60, 67, 69, and 116 watt (J/s) lamps.

Optically, the pedestrian signal shall be capable of displaying, brightly and uniformly, the alternate messages “HAND” in Portland orange and “WALKING PERSON” in Lunar white while being subject to strong ambient light conditions. Under the same strong ambient light conditions, the messages shall “Blankout” when the signal is not energized.

The signal shall be furnished complete with two installed A21 traffic signal lamps. In order to facilitate installation and maintenance, the signal shall be designed so that all components are readily accessible from the front by merely opening the signal door.

B. Dimensions

The maximum overall dimension of the signal shall be 18 ½ inches (470 mm) wide, 18 ¾ inches (476 mm) high, and 9 inches (229 mm) deep including eggcrate type visor and hinges. The distance between the mounting surfaces of the upper (non-shurlock) and the lower (shurlock) openings shall be 15 ¾ inches (400 mm).

C. Optical System

The optical system shall consist of the following:

1. Two symbol two-color message lens,
2. Double parabolic reflector,
3. Lamps and lamp sockets and
4. Eggcrate type sun visor

The optical system shall be designed to minimize the return of the outside rays entering the unit from above horizontal (known as sun phantom). The optical unit shall be so designed and assembled that erroneous messages cannot be displayed by lamp burnout or by light spill over.

D. Two Symbol Message Lens

Messages shall be Lunar white and Portland orange as defined in the current version of Institute of Transportation Engineers standard “Adjustable Face Pedestrian Signal Head Standard”.

Two lens materials may be used, as follows:

1) STANDARD – 0.187 inch (4.75 mm) tempered glass with the outside surface textured to eliminate message “HOT SPOTS”.

2) OPTIONAL – 0.250-inch (6.35 mm) polycarbonate plastic with C-64 or C-66 pattern texture on the outside surface to eliminate message “HOT SPOTS”.

The lens shall be located at least 1.75 inches (44.5 mm) away from the closest glass envelope extremity of the ANSI Designation A21 traffic signal lamp.

The left side of the symbol lens when illuminated shall display the “HAND” symbol in Portland orange. The right side of the symbol lens when illuminated shall display the “WALKING PERSON” symbol in lunar white.

The inside face of each symbol section shall be painted in the message areas with an appropriate transparent color to produce a Portland orange “HAND” symbol and a lunar white “WALKING PERSON” symbol when illuminated by a traffic signal lamp operating at rated voltage. All other areas shall be painted black.

The inside of the lens shall be fitted with a one-piece sponge neoprene gasket fitted around the perimeter such that a weatherproof seal is afforded whenever the reflector, lens, doorframe, and case are properly mated.

E. Double Parabolic Reflector

A single piece double parabolic reflector shall be vacuum formed from 0.250-inch (6.35 mm) minimum thickness textured polycarbonate plastic sheet. The texture shall be on the lamp side of the reflector and shall conform to C-64 or C-66 pattern or equivalent for light uniformity.

The lamp side of the reflector shall be reflectorized by vacuum deposition of an aluminum coating, which shall in turn be protected by a hard wear resistant coating.

The two sections of the reflector shall be divided by a full depth 0.040 aluminum divider, that properly mates with the symbol lens, to effectively prevent light spillage from one section to the other.

F. Lamps

The pedestrian signal shall be completely equipped with traffic signal lamps and sockets (one set for each of the two sections of the double parabolic reflector). Each lamp shall conform to the following specification.

1. The light bulb shall be:

   68 watt (J/s), 120-125-volt At- or A-19 HI-BEAM TRAFFIC, KRYPTON, 15500-16500 User Hours.

2. All Traffic Signal Lamps shall be:

   Duro-Test Watt-Savers or equivalent, but must meet these standards:

   a) Lamps shall have projection-type Copperflex-tungsten filaments supported by two impurity- free high-tensile-strength Molybdenum supports and five extra hook support points to protect against vibration, voltage, and environmental shock. The filament shall be wound on a precision molybdenum mandrel. Bidder must be willing to have filament subjected to the filament stretch test.
   b) The filament shall be of the “V” shaped projection construction for greatest beam candlepower and to eliminate center dead spot.
   c) Life rating shall be guaranteed by the lamp manufacturer for two years from the date of installation. A confidential manufacturing code date shall be etched on the stem support of each lamp to justify user hour life rating.
   d) Each lamp shall be identified with information etched into the glass lamp with manufacturers name, wattage, voltage, average rated user hour life, lot identification, rated lumens, and date of manufacture.
   e) The lamp filament support shall be a solid glass stem and shall be equipped with a polished aluminum deflector disc for greater candlepower concentration and to help protect the socket and wiring from bulb heat.
   f) Lamps shall have built-in fuse wire in base of lamp to prevent damage to socket and electrical controls.
   g) Lamps shall have a corrosion proof brass medium base adhered to glass envelope with dual use silicone adhesive. Bulb glass shall be grooved to give added mechanical grip, prevent vibration shake out, breakage, and socket weld.
   h) Lamps shall meet or exceed rated initial lumens and minimum initial lumens requirements as specified in the Institute of Transportation Engineers standard “Traffic Signal Lamps”, latest edition.

i) Beam Candlepower specifications shall be supported by a report from a nationally recognized independent testing laboratory and certified by such laboratory personnel.

j). Lamp fill gas shall be no less than 90% krypton gas concentration ("volume per volume" of total fill gas in the lamp) for increased lumen output at stated wattage.

k). Gas analysis for krypton fill shall be supported by a report from a nationally recognized independent testing laboratory.

l). Lamps shall have the ATC shape to allow for extra room for heat dissipation away from the filament. Super life A and ATC shape shall have user rated hours etched onto the bulb at a position below the etched name of the manufacturer.

3. The Contractor shall provide traffic signal lamps that conform to all of the criteria of this specification. Any traffic signal lamps that are delivered but do not meet the above requirements will be returned at contractor's own expense.

G. Lamp Sockets

Each lamp socket shall be accurately positioned in the center and pre-focused in its respective section of the reflector when the above-described lamps are installed.

The mounting shall be made to a die cast aluminum case in order to efficiently conduct heat away from the respective socket.

The lamp socket may be made of molded Bakelite, molded phenolic, or ceramic and shall be provided with a brass screw shell with lamp grip. An optional socket rotating mechanism with a minimum of 8 spring-loaded detents shall be available to allow positioning of the opening of the lamp filament upwards.

Each lamp socket shall be provided with one colored lead (non-white and non-green) from the socket and one white lead from the shell. Leads shall be 18 AWG and shall be wired to respective terminals of a three terminal pair screw type terminal block. The two white wires shall be connected to a common terminal. The terminal block shall be located inside the pedestrian signal housing.

H. Eggcrate Visor

Each signal shall be provided with an eggcrate type visor designed to eliminate sun phantom. The eggcrate type sun shield shall be installed parallel to the face of the "HAND/WALKING PERSON" message. The eggcrate visor assembly shall be held in place by the use of stainless steel screws.

The eggcrate assembly shall consist of a minimum of 20 straight horizontal louvers and 21 zigzag pattern louvers.

Each alternate formed louver shall be reversed in order to form cells 1 inch (25 mm) square but rotated 45 degrees from the horizontal to provide diamond shaped cells when assembled. Each diamond shall be bisected by a straight louver inserted between each pair of formed zig-zag louvers. Where the apex of each formed louver comes in contact with the interspersed straight louver, the entire length of the joint shall be chemically welded.

The basic material used in construction of the eggcrate shall be nominally 0.030 inch (0.762 mm) thick and shall be 100% impregnated black polycarbonate plastic processed with a flat finish on both sides. Additional members may be employed outside the two

legend areas but are not required unless dictated by structural strength of the particular assembly technique employed.

The assembly shall be enclosed in a mounting frame constructed of 0.040-inch (1.02 mm) minimum thickness of aluminum. This frame shall be 1 ½ inches (38 mm) deep and shall contain mounting holes for installation directly in the pedestrian signal doorframe.

I. Case

The case shall be a one-piece corrosion resistant aluminum alloy die casting complete with integrally cast top, bottom, sides, and back. Four integrally cast hinge lug pairs, two at the top and two at the bottom of each case, shall be provided for operation of a swing down door.

The case, when properly mated to other pedestrian signal components and mounting hardware, shall provide a dustproof and weatherproof enclosure with easy access to and replacement of all components.

Three versions of the case may be used dependent upon the specific job application. The first version shall be supplied with clamshell mounting hardware installed (ordered concurrently) for installation of “pole left of message”. The second version shall be the same except intended installation shall be “pole right of message”. The third version shall contain upper and lower openings as described below suitable for either post top or bracket mounting. The first and second versions need not include upper and lower openings but when provided shall be adequately plugged.

The openings included in the third version at the top and bottom of the case shall accommodate standard 1 ½ inch (38 mm) pipe brackets. The bottom opening of the signal case shall have a shurlock boss integrally cast into the case. The dimensions of the shurlock boss shall be as follows: Outside diameter 2.625 inches (66.7 mm); inside diameter 1.969 inches (50mm); number of teeth 72; angle of teeth 90 degrees; and depth of teeth 5/64 inch (2 mm). The teeth shall be clean and sharp and provide full engagement. The radial angular grooves of the shurlock boss, when used with shurlock fittings, shall provide positive positioning of the entire signal to eliminate rotation or misalignment of the signal.

J. Door Frame

The door frame shall be a one-piece corrosion resistant aluminum alloy die casting, complete with two hinge lugs cast at the bottom and two latch slots cast at the top of each door. The door shall be attached to the case by means of two Type 304 stainless steel spring pins. Two stainless steel hinged bolts with captive stainless steel wing nuts and washers shall be attached to the case with the use of stainless steel spring pins. Hence, latching or unlatching of the door shall require no tools.

K. Paint

Prior to final assembly; the case, doorframe and eggcrate visor (aluminum portion only) shall be thoroughly cleaned and a chromate conversion coating applied inside and out per Military Specification Mil-C-5541. A synthetic enamel conforming to Military Specification TTE-529 shall then be electrostatically applied. The color and gloss of the case and doorframe shall be selected by the purchaser. The color of the eggcrate visor shall be flat black. The finish shall be oven cured for a minimum of 20 minutes at 350°F (177°C).

L. Warranty

The entire pedestrian signal including eggcrate visor, message lens, single piece double parabolic reflector, lamp sockets, case, and door shall be warranted against defects in work performed and/or materials for two (2) years from the date of original shipment.

838S.4 Installation

The Contractor shall be responsible for the installation of the pedestrian signal heads in the field as shown on the drawings. This work shall include providing and installing the pedestrian heads, wiring, and mounting the hardware at the job site. Drilling wire feed holes and mounting the pedestrian signal head will also be the Contractor's responsibility.

All wire feeding through the pole structure shall be wrapped once with plastic electrical tape and wrapped again with electrical friction tape extending 12 inches (300 mm) on each side of the pole opening for a total of 24 inches (600 mm). The contractor shall adhere to the City of Austin's color code when splicing all conductors. Cabling for each signal (number of conductors, wire gauge, etc) shall be in accordance with the Drawings.

All pedestrian signal heads not yet in operation shall be covered with burlap until placed into service.

838S.5 Measurement

This item will be measured by each pedestrian signal installed in place.

Procuring, installing and connecting mounting hardware and cable from the pedestrian heads to the controller are considered ancillary to this item and will not be measured or paid for separately.

838S.6 Payment

The work performed and material furnished in accordance with this item and measured as provided under "Measurement" will be paid for at the unit bid price for "Pedestrian Signals" per each. The unit bid price shall include full compensation for: a) furnishing and installing all materials, b) drilling wire feed holes (as needed), c) mounting the pedestrian signal heads on the mast arms and signal poles, d) covering the pedestrian signal heads with Contractor-supplied burlap (if required), e) correctly cabling the signal head per the drawings and f) adjusting the pedestrian signal head for proper visibility, as indicated on the Drawings and for furnishing all labor, tools, equipment and incidentals necessary to complete the Work.

Payment will be made under:

Pay Item No. 838S-PSM	Pedestrian Signal Installation, Complete in Place	per Each

END

SPECIFIC Cross Reference Materials
Standard Specification Item No. 838S, "Pedestrian Signal Installation"

City of Austin Standard (Details)

Designation	Description
Number 839S-1	Pedestrian and Vehicular Signal Details

U.S. Corps of Engineers
Military Specification Mil-C-5541

Military Specification TTE-529

RELATED Cross Reference Materials
Standard Specification Item No. 838S, "Pedestrian Signal Installation"

City of Austin Standard Specifications

Designation	Description
Item No. 104S	Removing Concrete
Item No. 111S	Excavation
Item No. 401S	Structural Excavation Backfill
Item No. 403S	Concrete for Structures
Item No. 405	Concrete Admixtures
Item No. 406S	Reinforcing Steel
Item No. 410S	Concrete Structures
Item No. 420	Drilled Shaft Foundations

City of Austin Standard (Details)

Designation	Description
Detail 831S-1	Traffic Signal Drilled Shaft Foundation Details

Item No. **839S**
Traffic Signal Poles

839S.1 Description

This item shall govern furnishing and installation of traffic signal poles in accordance with the specifications contained herein, the Drawings, Standard Detail No. 839S-1, "Pedestrian and Vehicular Signal Installation Details", Standard Detail No. 839S-2, "Wood Pole Span Wire Details", Standard Detail No. 839S-3, "Wood Pole Span Wire Installation Details", Standard Detail No. 839S-4, “Traffic Signal Structures Mast Arm Details", Standard Detail No. 839S-5, "Traffic Signal Structures Span Wire Details", the manufacturer’s recommendations and/or written instructions from the Engineer or designated representative.

Traffic signal poles shall be of the size and type shown on the project drawings and referenced details.

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.

839S.2 Design Requirements

All design drawings and calculations for traffic signal poles shall be signed, dated and sealed by a Licensed Professional Engineer registered in the State of Texas, who shall be wholly responsible for the design of all poles, arms and davit extensions. Acceptance of traffic signal pole designs by the City of Austin shall not relieve the designer of this responsibility.

839S.3 Submittals

The Contractor shall submit to the City of Austin, with the submittal data, the design drawings showing design details and copies of the design strength and deflection calculations for each completed pole/arm/ davit extension structure for review and acceptance prior to fabrication. The ASTM specifications numbers for the materials to be used shall be included as part of the design strength calculations.

839S.4 Materials

A. General Requirements

This section of the Specifications describes steel poles, mast arms and davit extensions for traffic signal and street light support. The Specifications cover monotube steel strain and mast arm poles, monotube steel cantilevered mast arms and davit type steel luminaire poles and extensions for steel strain and mast arm poles. The general design of the poles, arms and extensions shall conform to the requirements of the plans and the typical drawings with no guys, struts, rods, stay braces, or clamps of U-bolts, except where noted otherwise.

B. AASHTO Specifications

The design of the completed assembly of poles, davit extensions, mast arms and hardware shall equal or exceed the most current version of AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, and addenda thereto, assuming ice and 80 mph. (128 kmph) winds with 104 mph (167kmph) gusts when loaded in accordance with the typical drawings and these Specifications.

C. Dimension Limits

Each complete pole/arm/extension assembly shall be within the dimension limits shown on the drawings.

D. Structural Cross-Sections

All poles, arms and davit extensions shall have a round cross-sectional design with a uniform taper between 0.1 and 0.2 inches of diameter change per foot of length (between 8.0 and 16.0 mm of diameter change per meter of length).

E. Mounting Points

Suitable mounting points with 1.5-inch (38-mm) internally threaded half-couplings shall be provided for mounting the signals and pedestrian pushbuttons to poles and mast arms as indicated on the typical drawings. The couplings shall be internally threaded according to the National Pipe Thread (N.P.T.) and shall be mounted within the poles and arms. All couplings shall be essentially flush with the outside surfaces of the poles and arms. The couplings shall be installed before galvanizing. All mounting points shall have sufficient strength to support the signal and pedestrian pushbutton loads described below when mounted in accordance with the typical drawings. A threaded plug shall be furnished and installed (after galvanization to ensure a good threaded fit) in each mounting point including the end of the mast arm. The surface of the plug shall be essentially flush with the outer end of the mounting point when installed and shall have a recessed hole to accommodate a standard wrench.

F. Cable Outlets

The design shall permit all cables to be installed inside poles, mast arms and davit extensions. Cable passages from the signal heads to the insides of the poles and mast arms shall be inside the 1.5-inch (38-mm) internally threaded couplings.

G. Galvanizing

The complete pole and arms, including all parts used in the assembly shall be completely hot-dip galvanized after fabrication. All threaded material shall be brushed and re-tapped as necessary after galvanizing. Threaded plugs shall be separately galvanized and installed after the mast arms and poles have been galvanized. Hot-dipped galvanizing on the structure shall be in accordance with ASTM Standard A-123, and galvanizing on the hardware shall be in accordance with ASTM Standard A-153.

H. Weights and Areas of Signal Heads, Luminaires and Signs to be Supported

In the design of the pole/arm/extension structures, the following weights and areas shall be assumed:

1) Signal head at end of mast arm:

2-way, 5-section, 12 inch (300 mm) with backplate
Weight: 145 pounds (66 kilograms)

Projected area: 15 square feet (1.39 square meters)

2) Each inboard signal head on mast arm:

1-way, 3-section, 12-inch (300 mm) with backplate
Weight: 50 pounds (22.7 kilograms)
Projected area: 9.75 square feet (0.9 square meters)

3) Signal heads attached to span wire, including backplate, disconnect hanger, brackets and adjustable drop bracket

a) 2-way, 5-section, 12-inch (300 mm)
Weight: 145 pounds (66 kilograms)
Projected area: 15 square feet (1.39 square meters)

b) 1-way, 5-section, 12-inch (300 mm)
Weight: 75 pounds (34 kilograms)
Projected area: 15 square feet (1.39 square meters)

c) 1-way, 3-section, 12-inch (300 mm), 4-section
Weight: 50 pounds (22.7 kilograms)
Projected area: 9.75 square feet (0.9 square meters)

4) All signal heads attached to pole shaft, worst case, common mounting:

Weight: 135 pounds (59 kilograms)
Projected area: 15 square feet (1.39 square meters)

5) Each luminaire:

Weight: 75 pounds (34 kilograms)
Projected area: 3.3 square feet (0.31 square meters)

6) Signs on mast arm:

a) One mounted with its center 5.5 feet (1.68 meters) from the end of the arm:

Weight: 27 pounds (11.8 kilograms)
Projected area: 9 square feet (0.84 square meters)

b) One mounted with its center 7.0 feet (2.13 meters) from the center of the pole:

Weight: 36 pounds (15.7 kilograms)
Projected area: 18 square feet each (1.67 square meters each)

I. POLES

1) General

a) Worst-Case Loads. The poles and hardware shall be designed to support the worst-case loads, including twin davit extensions, shown in the typical drawings.

b) Pole Deflection. The allowable pole deflection, when loaded with a twin davit extension and the worst-case signal and sign dead loads specified above and in the typical drawings, shall not exceed an angular rotation of one degree forty minutes, as measured between the intersection of the vertical centerline through the base and the projection of the centerline through the top. The deflection of the pole when loaded in this manner shall not exceed 0.35 inch/foot (29 mm/m).

2) Base Plate

Each pole shall have a base plate as shown in the typical drawings. The anchor boltholes in the pole base plate shall be 1/4-inch (6.35 mm) larger than the anchor bolts diameters. Anchor bolt holes in the base plates shall be elongated as shown on the typical drawings to provide adequate adjustment of the pole's orientation.

3) Handholes

Each pole shall have a 4" x 6.5" (102 mm by 165 mm) handhole with a reinforced frame located as shown on the typical drawings. The hand hole shall be furnished with a cover and screws. In addition, 20 percent spare handhole covers shall be furnished with each order. For small orders, at least one spare cover shall be furnished with each order.

4) Pole Types

Each kind of pole (mast arm or strain) shall be classified by type. Type 0 applies only to strain poles and indicates that the pole does not support a mast arm. Types 1,2 and 3 apply to mast arm poles. The types indicate the lengths of mast arms, which the pole shall be designed to support as follows:

a) Type 1 - 15 to 30-foot (4.57 to 9.14 meter) arm;
b) Type 2 - 35 to 45-foot (10.67 to 13.724 meter) arm; and
c) Type 3 - 50 to 60-foot (15.24 to 18.29) arm.

The poles shall be permanently stamped above the hand holes with their type numbers, the manufacturer's name and logo, and the date of manufacture.

5) Davit Extension Provisions

Each pole shall be furnished with a steel plate in the top to accommodate the mounting of a davit extension as shown in the typical drawings. The plate shall have eight (8) threaded holes arranged at 45-degree intervals to accommodate the extension attachment bolts. Four (4) bolts shall be used to attach the extension and the eight holes in the plate shall allow the extension to be oriented at any 45-degree increment with respect to the pole. Six (6) (2 spare) bolts shall be provided with each pole.

6) Pole Cap and Base Cover

Each pole shall be furnished with a removable pole cap for the top, to be used in the absence of a davit extension, and with a base cover. Suitable attachment screws shall also be furnished.

7) Mountings for Signals and Pushbuttons

Four (4) couplings shall be provided on the pole for the mounting of pedestrian pushbuttons at a height of 42-inches (1 meter) above the base, as shown on the typical drawings.

Four (4) couplings shall be provided on the pole for the mountings of signals and pedestrian signals. These mountings points shall be at a height of 9 feet (2.75 meters) above the base, as shown on the typical drawings.

8) Grounding Lugs

Each pole shall be equipped with a grounding lug, which will accommodate an A.W.G. #6 ground wire. The lug shall be electrically bonded to the pole and shall be located inside the pole opposite the handhole.

9) Mast Arm Poles

a) Davit Extension. Mast arm poles shall accommodate Type 1 davit extension, both single and twin. For the purpose of pole design, the pole shall be assumed to have a twin davit oriented to be in the same vertical plan as the mast arm.

b) Mast Arm Attachment. Each mast arm pole shall be furnished with a pole plate and associated gussets and fittings as shown in the typical drawings for the attachment of the appropriate type of mast arm. Type 1 poles shall include six (6) (2 spare) bolts, which mate with the threaded holes in the pole plate.

J. STRAIN POLES

1) Sign Loading on Span Wire Suspension

Traffic signs, which are supported by the span wire suspension, shall be mounted on the leveling cable instead of on the support cable unless otherwise noted.

2) Davit Extension

Strain poles shall accommodate Type 2 davit extensions, both single and twin. For the purpose of pole design, the pole shall be assumed to have a twin davit extension oriented to provide a worst-case loading.

3) Mast Arm Attachment

a) Type 0 strain poles shall not accommodate a mast arm. Each Type 1,2, and 3 mast arm pole shall be furnished with a pole plate and associated gussets and fittings as shown in the typical drawings for the attachment of the appropriate type of mast arm. Type 1 poles shall include six (6) (2 spare) bolts, which mate with the threaded holes in the pole plate.

b) The mast arm attachment shall be located on the pole to provide the orientation with respect to the span wire load that is shown on the plan and the typical drawings. The orientation angle, in degrees, shall be stamped on the pole above the handhole and adjacent to the type stamp.

c) As part of the mast arm attachment, a cable passage hole shall be provided in the pole to allow passage of the signal cables from the pole to the arm.

4) Messenger Cable Attachment Provisions

a) Each strain pole shall be equipped with a 0.625-inch (15.9 mm) diameter thimbleye bolt for connection to the leveling cable. The bolt shall be at a height of 22’ 6” (6.86 meters) above the base of the pole and the thimbleye shall be on the side of the pole where the span wires are to be attached.

b) Each strain pole shall include a span wire clamp and associated hardware for the attachment of the support cable of the span wire suspension. The diameter of the clamp shall be appropriate to its location on the pole. The clamp shall conform to the requirements of the typical drawings.

5) Grommeted Cable Outlet

A 2-inch (50-mm) hole equipped with a grommet shall be provided on the span wire load side of the pole at a height of 22'3" (6.78 meters) above the base of the pole to accommodate passage of the signal cables from inside the pole to the leveling cable.

K. MAST ARMS

1. Arm Fabrication

All mast arms up to and including 40-foot (12.2-meter) arms shall be one piece. 45-foot, 50-foot, 55-foot and 60-foot (13.72, 15.24, 16.76 and 18.29 meter) arms may be fabricated in two pieces which overlap each other by at least 1.5 times the inside diameter of the outside section. Each of the two pieces of 45, 50, 55, and 60 foot (13.72, 15.24, 16.76 and 18.29 meter) arms shall be fabricated of one piece monotube steel. Mast arms shall not have any transverse butt welds.

2. Mast Arm and Pole Types

All mast arms up to and including 30-foot (9.14-meter) arms shall be interchangeable on any Type 1 pole. All 35-foot through 45-foot (10.67-meter through 13.72-meter) arms shall be interchangeable on any Type 2 pole. All 50-foot through 60-foot (15.24-meters through 18.29-meters) arms shall be interchangeable on any Type 3 pole.

3. Variance From Horizontal

Each mast arm shall have a variance within the range of -0 degrees and +1.5 degrees from the horizontal plane when loaded as discussed above and as shown in the typical drawings and with the pole exactly vertical. This may be achieved with or without shims or other similar devices. If shims are required, then the manufacturer shall include these shims with the material delivery. All mast arms and mast arm fastening plates shall be manufactured to maintain a vertical clearance between the bottom of the mounted signal heads to the top of the pole base plate between 17.5' to 19.0' (5.33 to 5.79 meters).

4. Mast Arm Attachment

The mast arm shall be fastened to the pole as shown on the typical drawings. The arm plate and all necessary attachment hardware, including bolts, nuts, washers and brackets, which is not included, as part of the pole shall be furnished as part of the arm.

5. Signal Clamps Required

A signal clamp corresponding to each mounting point on the arm shall be furnished as part of the arm. The number of clamps shall equal the number of mounting points. The diameter of each clamp shall correspond to the diameter of the arm at its intended location. The clamps shall conform to the requirements of the typical drawings.

6. Mounting for Signals

Couplings shall be provided on the mast arm for the mounting of signals as shown on the typical drawings.

839S.5 Installation

The Contractor shall be responsible for installing the pole assemblies in the field on the pole foundations. The contractor will not be allowed to store signal poles at the job sites except as approved by the Engineer or designated representative on a case-by-case basis.

839S.6 Measurement

This item will be measured by each type and/or length of signal pole item (strain poles, mast arm pole, mast arm, single davit extension, twin davit extension) installed in place.

839S.7 Payment

Traffic signal pole items shall be paid for at the unit bid price per each. The unit bid price shall include full compensation for furnishing and installing all materials, and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 839S-STRP	Type O Strain pole	per Each
Pay Item No. 839S-MAP1	Type 1 Mast Arm Pole	per Each
Pay Item No. 839S-MAP2	Type 2 Mast Arm Pole	per Each
Pay Item No. 839S-MAP3	Type 3 Mast Arm Pole	per Each
Pay Item No. 839S-MA15	15-foot Mast Arm	per Each
Pay Item No. 839S-MA18	18-foot Mast Arm	per Each
Pay Item No. 839S-MA20	20-foot Mast Arm	per Each
Pay Item No. 839S-MA25	25-foot Mast Arm	per Each
Pay Item No. 839S-MA30	30-foot Mast Arm	per Each
Pay Item No. 839S-MA35	35-foot Mast Arm	per Each
Pay Item No. 839S-MA40	40-foot Mast Arm	per Each
Pay Item No. 839S-MA45	45-foot Mast Arm	per Each
Pay Item No. 839S-MA50	50-foot Mast Arm	per Each
Pay Item No. 839S-MA55	55-foot Mast Arm	per Each
Pay Item No. 839S-MA60	60-foot Mast Arm	per Each
Pay Item No. 839S-SDX1	Type 1 Single Davit Extension	per Each
Pay Item No. 839S-SDX2	Type 2 Single Davit Extension	per Each
Pay Item No. 839S-TDX1	Type 1 Twin Davit Extension	per Each
Pay Item No. 839S-TDX2	Type 2 Twin Davit Extension	per Each

END

Specific Cross Reference Materials
Standard Specification Item No. 839S, "Traffic Signal Poles"

City of Austin Standard Details

Designation	Description
No. 839S-1	Pedestrian and Vehicular Signal Installation Details
No. 839S-2	Wood Pole Span Wire Details
No. 839S-3	Wood Pole Span Wire Installation Details
No. 839S-4	Traffic Signal Structures Mast Arm Details
No. 839S-5	Traffic Signal Structures Span Wire Details

American Society for Testing and Materials

Designation	Description
A-123/123M	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A-153/153M	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware

Item No. 844S
Trench Excavation and Backfill
For Traffic Signal Conduit

844S.1 Description

This item shall govern trench excavation and backfill for installation of traffic signal conduit constructed in accordance with the lines and grades indicated on the Drawings, construction detail drawings, Standard Detail No. 835S-1 "Trench Detail for Traffic Signal Conduit ", and/or written instructions from the Engineer or designated representative. This item shall include all applicable work, including trench excavation, bedding material, backfill for the traffic signal conduit and Portland cement concrete trench cap and encasement; as specified under this item and in accordance with City of Austin Standard Specifications, Standards and the Utility Criteria Manual, Section 5, “Cuts in Public Rights-of-Way”.

Unless indicated otherwise on the Drawings, this item shall include cutting, removal, disposal and restoration of existing pavement surface and base courses, driveways, curb and gutter, sidewalk and ramps, furnishing and placement of select bedding, backfilling, hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or roadway access as indicated on the Drawings.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

844S.2 Submittals

The submittal requirements of this specification item may include:

A. Portland cement concrete mix design and characteristics of various mix ingredients,
B. Source, characteristics and test results for proposed flexible base material,
C. Source, gradation, decantation results and resistivity of the bedding sand,
D. Source, characteristics and test results for proposed controlled low strength material
E. Trench Safety System for trench excavation.

844S.3 Materials

A. Portland Cement Concrete

Portland cement concrete shall conform to Standard Specification Item No. 403S, “Concrete for Structures”.

B. Flexible Base

Flexible base shall conform to Standard Specification Item No. 210S, “Flexible Base”.

C. Bedding Sand

Bedding material shall consist of clean, hard, durable, and uncoated particles of natural or manufactured sand or combination thereof, with or without mineral filler. It shall be free of frozen material or injurious amount of salt, alkali, vegetable matter, or other objectionable material and shall not contain more than 0.5 percent by weight of clay or other binding agents.

It shall be a homogeneous material composed mainly of granular mineral matter and shall be clean and free of mud, silt, clay lumps or clods, vegetation or debris. The quantity of 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 average electrical resistance when water-saturated (TxDoT Test Method TEX-129-E shall be at least 1,800 ohm/cm by the single probe method, with no single test reading lower than 1,500 ohm/cm. The gradation of bedding sand shall be as follows:

Gradation Table		
Sieve Size		% Retained by Weight (Mass)
US	SI	
¼ inch	6.35 mm	0
No. 6	3.36 mm	75 to 100
No. 100	150 µm	95 to 100

D. Controlled Low Strength Material

The backfill material shall conform to Standard Specification Item No. 402S, “Controlled Low Strength Material”.

844S.4 Construction Methods

The work shall be executed in a safe and orderly fashion and in accordance with applicable Federal, State, and local laws, rules, and regulations. All work shall be performed in a manner consistent with the best modern practices, notwithstanding any omissions from the Drawings or these specifications

Trenching for traffic signal conduit shall be divided into the following categories, or “classes”, of trench.

Class 1: trenches of nominal 6” (150 mm) width that accommodate one 2” (50 mm) conduit or one 3” (75 mm) conduit.

Class 2: trenches of nominal 12” (300 mm) width that accommodate two 2” (50 mm) conduits, three 2” (50 mm) conduits, two 3” (75 mm) conduits, or one 4” (100 mm) conduit.

Class 3: trenches of nominal 18” (450 mm) width that accommodate three 3” (75 mm) conduits or two 4” (100 mm) conduits.

Prior to commencement of work, all erosion control and tree protection measures required shall be in place and all utilities located and protected as set forth in Standard Contract Document Section 00700, “General Conditions”, the City of Austin “Utility Criteria Manual, Section 5, Cuts in Public Rights of Way”, and the City of Austin “Environmental Criteria Manual”. Adequate temporary supports and protection of surface and underground utilities shall be the responsibility of the contractor.

A street cut permit is required for excavation in an existing City street (City of Austin Utilities Criteria Manual Section 5.2.0, "Permit for Excavation in the Public Rights-of-Way" and article 14-11-181, "Permit Required" of The Code of The City of Austin). Where traffic must cross open trenches, the Contractor shall provide suitable bridges. For trenches less than 2 feet

(0.6 meter) in width, sheet steel plates having a minimum thickness of ½ inch (12.5 mm) shall be used. The plates shall overlay the top of the trench a minimum of 18 inches (450 mm) on both sides and secured by Cold-Mix asphalt that meets TxDoT Specification Item No. 334, "Hot Mix-Cold Laid Asphaltic Concrete Pavement".

Construction near any underground or overhead utilities shall be accomplished using established industry and utility safety practices. The Contractor shall verify existing underground utilities through review of record data, use of one-call utility locates, collection/observation of visible surface evidence, consultation with utility facility owners and application of subsurface utility engineering techniques (e.g., potholing, ground penetrating radar, etc.) to determine the location of existing utilities and structures.

Any damage to utilities and/or structures, that occurs as a result of any construction activity performed by the Contractor, shall be repaired by the Contractor at the Contractor's sole expense. Conduit shall be paid for only one time, regardless of any extra work caused by obstructions and/or Contractor damage.

The Contractor shall comply with City of Austin Standard Specifications, Standards (Details) and the Street Cut and Excavation Repair Standards (City of Austin Utility Criteria Manual Section 5.0, "Cuts in Public Rights-of-Way"), when installing 2-inch (50 mm) conduit.

The Contractor shall provide adequately bent conduit and shall properly excavate so as to prevent damage to the conduit or conductor by a bend radius, which is too short.

All trenching, excavation and backfill shall be completed to the lines and grades indicated on design drawings, construction detail drawings and in accordance with Standard Specification Item No. 401, "Structural Excavation and Backfill", except for measurement and payment.

Where existing pavement structure is removed for trenching and/or conduit placement, the repair shall be made by backfilling with material equal in composition and density to the surrounding areas and by replacement of any removed surfacing, such as asphalt pavement or Portland cement concrete, with approved like material to equivalent condition.

Jacking and Boring shall be as shown on the Drawings and in accordance with Standard Specification Item Nos. 501S, "Jacking or Boring Pipe" except for measurement and payment.

All conduits shall be placed on a minimum 1" (25 mm) layer of bedding sand and covered with a minimum 4"(100 mm) layer of sand prior to backfill.

Trench safety and trench safety systems shall be the responsibility of the contractor and shall be prepared in accordance with Standard Item No. 509S, "Excavation Safety Systems" and all applicable Federal, State, and local laws, rules, and regulations.

Trenches shall be excavated to lines and grades as indicated by on construction drawings or as directed by the Engineer or designated representative. Trenches shall be constructed between a minimum of 4" (100 mm) and a maximum of 8" (200 mm) wider than the outside dimension of the conduit configuration. Trench bottoms shall be graded smooth with a minimum 1" (25 mm) layer of sand or other fine grain materials placed in the bottom and shall be free of any trash, debris, loose material, or water. Trenches shall be excavated to a depth that insures that the required 30" (750 mm) conduit cover is achieved. Blasting or use of explosives as an aid to digging is not permitted.

The Engineer or designated representative reserves the right to inspect and approve all trenching prior to conduit placement.

Placement and compaction of backfill shall be performed in accordance with Standard Specifications Item Nos. 201S, "Subgrade Preparation" and 132S, “Embankment”. Each layer shall be compacted to the required density by any method, and/or type and size of equipment, which will produce the required compaction. Prior to and in conjunction with the rolling operation, each layer shall be brought to the moisture content necessary to obtain the required density and shall be kept leveled with suitable equipment to insure uniform compaction over the entire layer.

Unless directed otherwise, earth embankments shall be constructed in successive layers, with a thickness of 8 inches (200 mm) or less in loose measure, for the full width of the individual cross section and in a length that is best suited to the sprinkling and compaction methods utilized, while rock embankments shall be constructed in successive layers of 18 inches (450 mm) or less in thickness for the full width of the cross section.

Backfill under streets, driveways and all other pavement repairs shall conform to the City of Austin Standard Specifications, Standards (Details) and Utility Criteria Manual, Section 5, “Cuts in Public Rights of Way”. Backfill material for use in backfilling trenches under streets and driveways shall be selected based on the material’s characteristic to maintain a consistent compacted density. Emphasis shall be placed upon the need to obtain uniform density throughout the backfill. Backfill shall be compacted by mechanical tamping equipment.

If boring under a roadway or other structure is required, the contractor shall be responsible for all utility locations including any required pot holing. Such pot-holing and boring shall be completed at the sole expense of the contractor and shall be conducted in accordance with the requirements of the Utility Criteria Manual, Section 5, “Cuts in Public Rights of Way”.

844S.5 Measurement

The Work prescribed by this item will be measured by the lineal foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) of completed trenching of the various classes (including sand bedding for conduit, backfill and compaction, and pavement repair for streets, driveways, curb and gutter, ramps and sidewalks).

The utility location (including pot-holing) shall be considered ancillary to this item.

844S.6 Payment

The work performed as prescribed by this item will be paid for at the unit bid price per lineal foot for “Trenching for Traffic Signal Conduit”. The unit bid price shall include full compensation for removal of all materials to the depth shown on the Drawings; for hauling, placement and preparation of bedding materials; for hauling, moving, placement and compaction of backfill materials; for repair of streets, driveways, sidewalks, ramps, curbs, gutters, medians and other structures damaged or removed as a result of trenching; for repair of conduit entry through walls of existing pull boxes; and for all labor, tools, equipment, manipulation, and incidentals necessary to complete the work.

The Work associated with construction of a new pull box will be paid for separately under a separate bid item identified with Standard Specification Item No 834S, "Traffic Signal Pull Boxes".

The cost of location of the existing utility (including pot-holing) shall be included in the unit price bid items below and will not be paid for separately.

Payment will be made under the following:

Pay item No. 844S-1: Class 1 Trenching for Traffic Signal Conduit
Per Lineal Foot of trench.

Pay item No. 844S-2: Class 2 Trenching for Traffic Signal Conduit
Per Lineal Foot of trench.

Pay item No. 844S-3: Class 3 Trenching for Traffic Signal Conduit
Per Lineal Foot of trench.

END

SPECIFIC Cross Reference Materials
Standard Specification Item 844S, " Trench Excavation and Backfill for Traffic Signal Conduit"

City of Austin Standard Specifications

Designation	Description
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 210S	Flexible Base
Item No. 401S	Structural Excavation and Backfill
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures
Item No. 501S	Jacking or Boring Pipe
Item No. 509S	Trench Safety Systems
Item No. 834S	Pull Boxes

City of Austin Standard Details

Designation	Description
No. 835S-1	Trench Detail for Traffic Signal Conduit

City of Austin Standard Contract Documents

Designation	Description
Section 00700	General Conditions

City of Austin Utility Criteria Manual

Designation	Description
Section 5	Cuts in Public Right-of-Way
Article 5.2.0	Permit for Excavation in the Public Right-of-Way

SPECIFIC Cross Reference Materials (Continued)
Standard Specification Item 844S, " Trench Excavation and Backfill for Traffic Signal Conduit"

The Code of the City of Austin, Code of Ordinances, Volume 1

Designation	Description
Article 14-11-181	Permit Required

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

Designation	Description
Item No. 334	Hot Mix-Cold Laid Asphaltic Concrete Pavement

Texas Department of Transportation and Development Manual of Testing Procedures

Designation	Description
TEX-129-E	Method for Test For The Resistivity Of Soils Material

TEX-406-A	Material Finer Than 75 µm (No. 200) Sieve in Mineral Aggregates (Decantation Test For Concrete Aggregates)

Federal Specification WW-C-581d, ANSI C80 1,

Federal Specification W-C 1094

RELATED Cross Reference Materials
Standard Specification Item No. 844S, " Trench Excavation and Backfill for Traffic Signal Conduit"

City of Austin Standard Specifications

Designation	Description
Item No. 104S	Removing Concrete
Item No. 111S	Excavation
Item No. 401S	Structural Excavation Backfill
Item No. 403S	Concrete for Structures
Item No. 405	Concrete Admixtures
Item No. 406S	Reinforcing Steel
Item No. 410S	Concrete Structures
Item No. 420	Drilled Shaft Foundations

Designation	Description
Detail No. 505S-1	Concrete Encasement
Detail No. 510S-1	Concrete Trench Cap
Detail No. 510S-3	Typical Trench with Paved Surface
Detail No. 510S-5	Typical Trench with Unfinished Surface
Detail No. 831S-1	Traffic Signal Drilled Shaft Foundation Details
Detail No. 835S-1	Trench Detail for Traffic Signal Conduit

City of Austin Utility Criteria Manual

Designation	Description
Article 5.5.0	Backfill of Excavated Area
Article 5.6.0	Restoration of Excavated Area
Article 5.7.0	Pavement Repairs
Article 5.8.0	Materials
Article 5.9.0	Miscellaneous Repairs

The Code of the City of Austin, Code of Ordinances, Volume 1

Designation	Description
Article 14-11-189	Conditions for Permit Issuance
Article 14-11-190	Excavation Sequence And Permit Term

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 50^0F (10^0C). 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 50^0F (10^0C).

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. 1301S
Granite Gravel Hike and Bike Trail

1301.01 - Description

This standard specification item shall govern furnishing and placing red granite gravel surfacing for hike and bike trails. The granite gravel surface shall be constructed in a single layer on an approved and properly prepared base course, conforming to typical sections and to the lines and grades indicated on the drawings or established by the engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

1301S.2 - Submittals

The submittal requirements of this specification item may include:

(1) Sample of decomposed red granite gravel surface material along with source identification and gradation and plasticity test results for approval, quality assurance and color;

(2) Sample of red road base material or approved equivalent along with source identification and gradation and plasticity test results for approval, quality assurance and color;

(3) Optimum moisture-density characteristics for decomposed red granite gravel and red road base sources;

(4) Proposed trail/path construction sequence and equipment; and

(5) Field density test results for in-place compacted red granite gravel and red road base.

1301S.3 - Materials

The surface and base layer materials shall be tested by the city's designated laboratory and approved by the engineer or designated representative prior to being hauled to the project.

The decomposed red granite gravel and red road base materials or approved equivalent shall be tested according to the following TxDoT standard test methods:

1. Preparation for Soil Constants and Sieve Analysis	Tex-101-E
2. Moisture Content	Tex-103-E
3. Liquid Limit	Tex-104-E
4. Plastic Limit	Tex-105-E

5. Plasticity Index	Tex-106-E
6. Sieve Analysis	Tex-110-E
7. Laboratory Compaction	Tex-113-E
8. Field Density	Tex-115-E

The surface layer material shall be from a source approved by the city and shall be composed of a mixture of Texas decomposed unwashed granite aggregate and red clay fines that meets the following requirements:

Sieve Designation		% Passing	
US	SI		
5/8 ″	19 mm	100	
#40	425µm	40 to 45	
# 200	75µm	15 to 25	
Plasticity Index			12 to 18

The red road base material or approved equivalent shall be from a source approved by the city and shall consist of a hematite, hydrated hematite or limonite "iron" ore, occurring with or without sand, as found at or near the ground surface, which, when loaded at from the material pit, shall not contain an excess of free clay. Material containing gravel or hard pieces of ore exceeding the maximum specified size in their largest dimension shall be broken up and uniformly mixed with the remainder of the material/.

When properly slaked and tested by TxDoT methods the red road base material or approved equivalent shall meet the following requirements.

Sieve Designation		% Passing	
US	SI		

1¾″	45 mm	100	
7/8 ″	22.5 mm	65 to 90	
#40	425 µm	15 to 50	
Liquid Limit			35 maximum
Plasticity Index			12 maximum

1301S.4 - Construction

(1) General

Prior to commencement of this work, all required erosion controls and tree protection measures indicated on the Drawings shall be in place. All 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.

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 by the engineer or designated representative and shall be protected from scarring, barking or other injuries during construction operations in accordance with Standard Specification 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.

(2) Subgrade Preparation

The subgrade shall be excavated and shaped in conformity with the typical sections shown on the drawings and to the lines and grades as established by the Engineer or designated representative. The subgrade shall be tested by "proof rolling" and shall conform to Standard Specification Item No. 236S, except that a 10-ton roller will be used prior to placement of the red road base material. Any unstable or spongy subgrade areas identified by proof rolling shall be corrected either by additional re-working, drying and compaction, or by removal and replacement of unsuitable materials.

If required the subgrade shall be wetted, reshaped and rolled to the extent directed in order to place the subgrade in an acceptable condition to receive the red road base

material. The surface of the subgrade shall be finished true to line and grade as established by the Engineer or designated representative in conformity with the typical section shown on the drawings. Material excavated in the preparation of the subgrade shall be utilized in the construction of adjacent shoulders and slopes or otherwise disposed of as directed by the Engineer or designated representative. Additional material required for completion of the shoulders and slopes shall be secured from sources approved by the City of Austin.

(3) Red Road Base

The Contractor shall not place red road base or approved equivalent until the subgrade has cured to the satisfaction of the Engineer or designated representative, regardless of whether or not the subgrade has been successfully proof rolled. As a minimum, this will be when the surface displays no damp spots and there is no evidence of "sponginess" in the subgrade.

The base material shall be delivered in approved vehicles of uniform capacity and it shall be the responsibility of the Contractor to deliver at each 100-foot (30-meter) station the required amount of specified material to yield the compacted thickness shown on the drawings. Material deposited upon the subgrade shall be spread and shaped the same day unless directed otherwise by the Engineer in writing. All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well-graded material.

In the event inclement weather or other unforeseen circumstances render impractical the spreading of the base material during the first 24-hour period, it shall be scarified and spread as early as possible as directed by the Engineer or designated representative. If it becomes evident that insufficient material was placed, additional material as necessary shall be delivered and the entire course scarified, mixed and compacted.

The base layer shall be sprinkled as required to bring the material to optimum moisture content, then compacted in accordance with Standard Specification Item No. 210S, "Flexible Base" to the extent necessary to provide not less than 90% of the optimum density. In no case shall the material be worked at more than 2 percent above or below optimum moisture as determined by TxDoT Test Method Tex-113-E. Field density determinations shall be made in accordance with TxDoT Test Method Tex-115-E. In addition to the requirements specified for density, the full depth of base material shall be compacted to the extent necessary to remain firm and stable under construction equipment.

After each section of flexible base material is completed, tests, as necessary, will be made by the Engineer or designated representative. As a minimum, three in-place density tests per section. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. All initial testing will be paid for by the city. All retesting shall be paid for by the Contractor. Throughout the entire operation, the surface of the material shall be maintained by blading and, upon completion, shall be smooth and shall conform to the typical section indicated on the Drawings and to the established lines and grades.

If the base material, due to any reason or cause, loses the required stability, density or finish before placement of the red granite gravel surface layer, it shall be recompacted and refinished at the Contractor's expense.

(4) Red Granite Gravel Surface

Construction methods for the succeeding red granite gravel layer shall be the same as prescribed for the red road base layer with the exception of the compaction requirements. The surface layer shall be sprinkled as required to bring the material to optimum moisture content, then compacted in accordance with Standard Specification Item No. 210S, "Flexible Base" to the extent necessary to provide not less than 92% of the optimum density. In no case shall the material be worked at more than 2% above or below optimum moisture.

When the thickness of a particular lift of the flexible base is in question, the Contractor shall check the surface of for conformity to the lines and grades by setting "blue tops" at intervals not exceeding 50 feet (15 meters) on the centerline, the edge of the trail/path, and at other points that may be indicated on the Drawings

If the base material and/or surface layer due to any reason or cause, loses the required stability, density or finish prior to acceptance of the project, the base layer and/or surface layer shall be recompacted and refinished at the Contractor's expense.

1301S.5 - Measurement

"Granite Gravel Hike and Bike Trail" will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.196 cubic yards), complete in place, as indicated in the Contract Documents.

1301S.6 - Payment

This item will be paid for at the contract unit bid price for "Granite Gravel Hike and Bike Trail." The unit bid price shall include full compensation for all work specified herein, including the protection of existing trees, property and public right-of-way, traffic control measures, the furnishing, hauling, placing and compacting of all materials; for rolling, proof rolling, recompacting and refinishing; for all water required; for retesting as necessary; and for all equipment, tools, labor and incidentals necessary to complete the Work.

Payment will be made under the following:

Pay Item No. 1301S-A:	Granite Gravel Hike and Bike Trail	Per Cubic Yard.
Pay Item No. 1301S-B:	Granite Gravel Hike and Bike Trail	Per Square Yard.

End

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item No. 1301S, "Granite Gravel Hike and Bike Trail"	

City of Austin Standard Contract Documents	
Designation	Description
Section 00700	General Conditions

City of Austin Standard Specifications	
Designation	Description
Item No. 201S	Subgrade Preparation
Item No. 210S	Flexible Base
Item No. 236S	Proof Rolling
Item No. 610S	Preservation of Trees and Other Vegetation

Texas Department of Transportation: Manual of Testing Procedures	
Designation	Description
Tex-101-E	Preparation of Soil and Flexible Base Materials for Testing
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-110-E	Determination of Particle Size Analysis of Soils
Tex-113-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials and Cohesionless Sands
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

City of Austin Standard Details

Designation	Description
1301S-1	Granite Gravel Trail

Item No. 16120S

Wiring

16120S.1 - Description

This item shall govern furnishing and installation of wiring of all types of wiring in accordance with the code, the manufacturer recommendations, the Drawings and as approved by the Engineer or designated representative.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text and accompanying tables, the inch-pound units are given preference followed by SI units shown within parentheses.

16120S.2 - Submittals

The submittal requirements of this specification item include the wire size, characteristics and designation for each wire application, the size and types of conduit, terminal posts and fasteners proposed for the application and manufacturer installation recommendations.

16120S.3 - Materials and Construction

All materials shall be new and shall meet all requirements shown in the Standard Specifications for Electrical Construction of Austin Energy or succeeding agency and shall conform to the National Electrical Code (NEC) and all pertinent codes relating to this type work.

16120S.4 - Measurement

Wiring shall be measured on a Lump Sum basis complete in place.

16120S.5 - Payment

Wiring shall be paid for at the unit bid price for wiring. The unit bid price shall include full compensation for furnishing and installing all wiring, fittings, and related appurtenances as indicated on the Drawings and for furnishing all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 16120S:	Wiring	Lump Sum

End

RELATED CROSS REFERENCE MATERIALS	
City of Austin Standard Specifications	

Designation	Description
Item No. 16550S	Street Light Standard Foundations

SPECIAL PROVISION
To Standard Specification Item No. 608S (Version 09/26/2012)
Planting

For this project, Item No. 608S, Planting, 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. **608S.4 Materials**

Add the following paragraphs to the end of Section 608S.4.E:

E. Mulch

Hardwood Mulch (no cypress or cedar mulch) shall be used as shown on the Drawings.

Add the following paragraph to the end of Section 608S.4.I:

I. Fertilizer

All proposed fertilization shall be submitted for approval to the Landscape Architect or Project Landscape Representative along with proof of the need for fertilizing per the results of a site soil test.

Delete the Section 608S.4.K in its entirety.

Replace with the following:

K. Stakes

Stakes shall be metal “T” fence posts driven outside the rootball and connected to the tree with a web fabric tape (e.g. Arbor Tie) as shown in the Special Detail “SD-L-P01” and “SD-L-P02.” The web fabric tape should be tied to form a figure eight (8) twist that is not tied to the trunk, just attached to the posts. The point of contact should be only about halfway up the trunk. All stakes and web fabric tape shall be removed after one year.

Delete the Section 608S.4.L in its entirety.

Add the following paragraphs after the last paragraph to the section 608S.4 Materials

Steel Landscape Edging shall be hot-rolled, standard flexible carbon steel, measuring 1/8” x 6” x 10’, fabricated in sections with stake pockets stamped, punched, or welded to face of sections approximately thirty inches (30”) apart to receive steel stakes. Steel Landscape Edging shall be double staked at overlap joints and designed to receive tapered steel stakes.

Steel Landscape Edging Stakes shall be 10-gauge steel, tapered, and 16” minimum length.

Steel Landscape Edging and Stakes shall be painted BROWN in color. Painted finished shall be powder coat paint electrostatically applied and oven baked to withstand outdoor exposure.

2. 608S.5 Construction Methods

Add the following to the end of Section 608S.5.E:

and circling or girdling roots.

Delete the Section 608S.5.K in its entirety.

Replace with the following:

K. Plant Supports and Staking Trees

Plant supports such as staking shall be as shown on the Drawings or as required by the Landscape Architect or Project Landscape Representative.

All new trees shall be staked for support during the same day as planted. Unless shown otherwise on the Drawings, the trees shall stand approximately vertical after staking. The Contractor shall be responsible for material remaining approximately vertical and straight for all given conditions and shall repair tree supports as often as required until final acceptance of the work.

All new trees shall be staked per Special Detail “SD-L-P01” and “SD-L-P02.” Staking shall include metal “T” fence posts driven outside the rootball and connected to the tree with a web fabric tape (e.g. Arbor Tie). The web fabric tape should be tied to form a figure eight (8) twist that is not tied to the trunk, just attached to the posts. The point of contact should be only about halfway up the trunk. All stakes and web fabric tape shall be removed after one year.

No wires will be considered an acceptable means of connecting the posts to the tree.

Add the following sections after Section 608S.5.P

Q. Planting

Planting shall be installed complete in place and as indicated on the Drawings and Special Details “SD-L-P01, SD-L-P02, SD-L-P03, SD-L-P04, and SD-L-H01.”

R. Hardwood Mulch

Hardwood Mulch shall be installed as indicated on the Drawings.

S. Steel Landscape Edging

Steel Landscape Edging shall be installed as indicated in the Drawings and Special Detail "SD-L-H01."

3. 608S.6 Plant Establishment

Delete the second sentence in the first paragraph in its entirety.

Replace with the following:

In those instances where planting 'out of season' is allowed in writing by the Landscape Architect or Project Landscape Representative, "Plant Establishment" shall commence with notice of substantial completion and shall extend for a minimum of twelve (12) months.

Delete the Sections 608S.6.A – I in its entirety.

Replace with the following:

A. Landscape Maintenance Checklist

1. Remove any broken or fallen branches from trees. Remove sucker growth from tree trunks. Prune any branches that interfere with public safety. Shrubs and ornamental grasses to not require pruning. DO NOT SHEAR. Do not cut ornamental grasses in fall or winter. No pruning of ornamental grasses is required or allowed. Improperly cut or pruned plant materials may require replacement, at the discretion of the Owner and the expense of the Contractor.

2. Inspect stakes and web fabric tape for damage. Any damaged or destroyed stakes, or web fabric tape shall be removed and replaced by the Contractor in accordance with the Special Details shown on the Drawings. This shall include any adjustment to the stakes or web fabric tape to prevent girdling of trees.

3. Remove any weeds listed on the weed list in Standard Specification 609S larger than 2 inches high or wide from the median, planting areas, rain gardens, and biofiltration ponds. Weeds 2 inches and larger must be removed, not just killed.

4. Replace Hardwood Mulch which has been knocked or washed out of planting beds. Smooth Hardwood Mulch layer if it has been disturbed. Add new Hardwood Mulch if less than 2 inches deep.

5. Replace Decomposed Granite which has been knocked or washed out of designated Decomposed Granite areas along street and in planting beds. Sweep Decomposed Granite from sidewalk and gutter back into designated areas. Smooth Decomposed Granite layer if it has been disturbed.

6. Check plants in beds and planters for signs of stress or disease. Replace any plants that meet conditions for replacement at the Contractor's expense. Request authorization to replace other dead or missing plants. Note: Contractor must request authorization to make replacements within one week of the damage becoming evident.

7. Treat for any signs of disease or pest infestation.

8. All plants in beds and planters shall be watered as frequently as necessary to ensure healthy establishment during plant establishment period. Additional watering may be required for plants that are dry and stressed.

9. Clean up and haul off all debris resulting from the maintenance operation plus any debris which may have accumulated in the planting beds and planters.

The Contractor shall perform “Plant Establishment” as prescribed by the Landscape Maintenance Checklist and submit to the Landscape Architect or Project Landscape Representative for review and approval on a monthly basis.

4. 608S.8 Measurement

Delete the paragraph in its entirety.

Replace with the following:

Planting will be measured as each plant for the indicated type and size, and installed per Special Details “SD-L-P01, SD-L-P02, SD-L-P03, and SD-L-P04,” complete in place.

Hardwood Mulch will be measured per cubic yard complete in place as indicated on the Drawings.

Plant Establishment for the whole project will be measured by the number of months of actual service performed as prescribed in the Section 608S.6 of this Special Provision SP608S.

Steel Landscape Edging will be measured per linear foot, including Steel Landscape Edging Stakes, complete in place.

5. 608S.9 Payment

Add the following paragraphs after the last paragraph to the Section 608S.9 Payment

Payment for Planting, measured as prescribed above, will be paid for at the unit price bid for the indicated type and size. The unit price bid shall include full compensation for planting, materials, time, labor, tools, equipment, and other incidentals necessary to complete the planting, as indicated on the Drawings, complete in place.

Payment for Hardwood Mulch, measured as prescribed above, will be paid for at the unit price bid. The unit price bid shall include full compensation for furnishing, hauling, and installing Hardwood Mulch, time, labor, tools, equipment, and other incidentals necessary to complete the installation, as indicated on the Drawings, complete in place.

Payment for Plant Establishment, measured as prescribed above, will be paid for at the unit price bid. The unit price bid shall include full compensation for furnishing, hauling, installing, planting, materials, time, labor, tools, equipment, and other incidentals necessary to complete the Work, complete in place.

Payment for “Steel Landscape Edging,” measured as prescribed above, will be paid for at the unit price bid for the indicated type, size, and color, complete in place. The unit price bid shall include full compensation for installing of Steel Landscape Edging, and for time, labor, tools, equipment, and other incidentals necessary to complete the installation, as indicated in the Drawings, complete in place.

Add the following pay items:

Payment will be made under:

Pay Item No.	**Item Description**	**Unit**
SP608S-AG	Planting Type, Parry Agave, Size 5 Gallon	Per Each
SP608S-BI	Planting Type, Big Muhly, Size 5 Gallon	Per Each
SP608S-BP	Planting Type, Pride of Barbados Red, Size 5 Gallon	Per Each
SP608S-CE	Planting Type Cedar Elm, Size in inches 3"	Per Each
SP608S-DA	Planting Type Damianita, Size 1 Gallon	Per Each
SP608S-FE	Planting Type Mexican Feather Grass, Size 1 Gallon	Per Each
SP608S-FI	Planting Type Fire Cracker Fern, Size 1 Gallon	Per Each
SP608S-IP	Planting Type Ice Plant, Size 1 Gallon	Per Each
SP608S-LO	Planting Type Live Oak, Size in inches 3"	Per Each
SP608S-OP	Planting Type, Spineless Prickly Pear, Size 5 Gallon	Per Each
SP608S-RB	Planting Type Redbud, Size in inches 2"	Per Each
SP608S-TL	Planting Type, Purple Trailing Lantana, Size 1 Gallon	Per Each

Pay Item No.	Item Description	Unit
SP608S-TY	Planting Type, Twist Leaf Yucca, Size 1 Gallon	Per Each
SP608S-HM	Hardwood Mulch, Plan Quantity	Per Cubic Yard
SP608S-LE	1/8” x 6” x 10’ Steel Landscape Edging **(Brown in color)**	Per Linear Foot
SP608S-PE	Plant Establishment	Per Month

END

Special Specification 612
Imported Topsoil Mix

612.1 Description

This item shall govern the furnishing and placing of imported topsoil mix to depths and areas shown on the Drawings or as directed by the Engineer or designated representative.

612.2 Submittals

The submittal requirements of this specification item shall include the test results and soil classification necessary for approval of material as suitable growing medium.

A. Submittals Required Before Construction

1. Current (no more than 90 calendar days before date of submittal) lab analysis report from a State of Texas qualified soil analytical laboratory that clearly demonstrates the proposed material is suitable topsoil mix for plant growth as described below. The tests shall include a particle-size analysis (soil texture), percentage of organic matter, pH, nutrient and micronutrient content, as well as indication of deleterious material, and recommendations on amendments.
2. A notarized statement from the producer of the soil attesting that the mix conforms to this specification.
3. A sample (2-gallon) of proposed planting mix shall be submitted to the Owner or their representative 30 calendar days before installation and be approved before installation. Sample should be labeled including type of material, specification number; name, address, and telephone number of manufacturer or supplier; and address of the location of the source or material stockpile.
4. A description of the location, equipment, and method proposed to mix the material.
5. The samples and analysis reports shall be submitted at the same time.

B. Submittals Required During Construction

1. Delivery tickets indicating type/product name, source and quantities of imported topsoil mix.

612.3 Materials

A. Imported topsoil mix shall consist of material that is clean and friable soil capable of supporting plant life, and is free of stones, roots, and any other deleterious materials.
B. Imported topsoil mix shall be a dark brown to black mix at a proportion of approximately 1 part clay-rich mineral soil to 1 part composted soil with moderate moisture content (30-50% of total weight).
C. The clay-rich mineral soil component of the topsoil mix shall be an acceptable agricultural, homogeneous material meeting the USDA texture of a silty clay

loam, silty clay, or clay, with no particles greater than 1/8 inch. High clay content subsoils or soils with redoximorphic features (mottled) are not acceptable.

D. The composted soil component of the topsoil mix shall be a composted mix of approximately equal proportions of clay-rich mineral soil and composted yard waste and inoculated with leaf mold. The composted soil shall have been composted together for at least 12 months, reaching a temperature of at least 150 degrees Fahrenheit for at least 15 days. After composting, the composted soil shall have been passed through a 3/8-inch screen to remove larger particles.

E. The compost component shall be well decomposed, stable to very stable organic matter source derived from yard trimmings or City approved alternate source. The Carbon/Nitrogen (C/N) ratio shall be less than 25:1 and trace metals test results should "pass". It shall not contain substances toxic to plants and shall not have objectionable odors. It shall not resemble the raw material from which it was derived and shall be reasonably free of man-made foreign matter.

F. Mix Parameters:

Parameters	Optimal Range	Reported Units
pH	6.1 – 7.9	pH units
% O.M. Humus	4.5 – 7.0	%, dry weight basis
EC Salts	< 6.00*	mmhos/cm
Nitrate (NO_3)	50 - 200	ppm
Phosphate (P_2O_5)	20 - 70	ppm
Potassium (K - H_2O) (K - CO_2)	100 - 250 175 - 500	ppm
Sodium (Na - H_2O) (Na - CO_2)	< 349 < 499	ppm
Calcium (Ca - H_2O) (Ca - CO_2)	76 - 224 300 - 899	ppm
Magnesium(Mg - H_2O) (Mg - CO_2)	25 - 99 75 - 199	ppm
Ratio: Na/Ca	<5	ppm
Ratio: Na/Mg	<10	ppm
Solvita (C- CO_2 burst)	>60	ppm

* Compost-rich soil mixes should have EC Salts <3.00 mmhos/cm when used as topsoil substitute.

612.4 Construction Methods

A. The imported topsoil mix shall be protected from all sources of contamination from the supplier's yard to the project site.

B. Areas to receive imported topsoil mix shall be free of construction debris, refuse, and rocks and earth clods over three inches.

C. The material shall be placed in loose lifts, not to exceed eight inches each lift, and shall be compacted with a water-filled landscape roller. During installation the material shall be protected from other forms of compaction, including equipment and pedestrian traffic, to the extent possible. Storage of construction materials on top of the topsoil mix is prohibited.

D. Where the proposed planting area is compacted, the existing soil shall be tilled to a minimum depth of four inches before installation of the topsoil mix. For compacted areas in the critical root zone of trees, scarify to one inch maximum.
E. The imported topsoil mix should not be placed if the ground is muddy, saturated, or frozen.
F. For work in critical root zones of trees, all work must be done with hand tools (e.g., shovels, rakes).
G. After placing and grading the topsoil mix, planting should commence as soon as possible to minimize possibility of erosion or further compaction. Erosion and sedimentation control devices following City of Austin guidelines are required until permanent stabilization is achieved.
H. To prevent the compaction of imported topsoil mix, the Contractor shall properly sequence all construction activities, including landscape and irrigation installation, before soil placement. Trenching and installation of subsurface irrigation components shall occur before placing imported topsoil mix. Avoid travel across areas of placed topsoil or minimize the number of travel routes, to the extent possible. Heavy vehicles shall not be permitted in these areas.

612.5 Measurement

For applicable Pay Items as noted in 612.6 below, “Imported Topsoil Mix” will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.196 cubic yards), complete in place, as indicated in the Contract Documents.

612.6 Payment

This item will be paid for at the contract unit bid price for “Imported Topsoil Mix.” The unit bid price shall include full compensation for all work specified herein, including the furnishing, hauling, placing of all materials; and for all equipment, tools, labor and incidentals necessary to complete the Work.

Pay Item SS 612-A:	Imported Topsoil Mix	Per Cubic Yard

End

Special Specification 650
Imported Flower and Garden Planting Soil Mix

650S.1 Description

This item shall govern the furnishing and placing of imported flower and garden planting soil mix to depths and areas shown on the Drawings or as directed by the Engineer or designated representative.

650S.2 Submittals

The submittal requirements of this specification item shall include the test results and soil classification necessary for approval of material as suitable growing medium.

A. Submittals Required Before Construction

1. Current (no more than 90 calendar days before date of submittal) lab analysis report from a State of Texas qualified soil analytical laboratory that clearly demonstrates the proposed material is suitable flower and garden soil mix for plant growth as described below. The tests shall include a particle-size analysis (soil texture), percentage of organic matter, pH, nutrient and micronutrient content, as well as indication of deleterious material, and recommendations on amendments.
2. A notarized statement from the producer of the soil attesting that the mix conforms to this specification.
3. A sample (2-gallon) of proposed planting mix shall be submitted to the Owner or their representative 30 calendar days before installation and be approved before installation. Sample should be labeled including type of material, specification number; name, address, and telephone number of manufacturer or supplier; and address of the location of the source or material stockpile.
4. A description of the location, equipment, and method proposed to mix the material.
5. The samples and analysis reports shall be submitted at the same time.

B. Submittals Required During Construction

1. Delivery tickets indicating type/product name, source and quantities of imported topsoil mix.

650S.3 Materials

A. Imported flower and garden planting soil mix shall be a locally available native planting soil and consist of material that is clean and friable soil capable of supporting plant life, and is free of stones, roots, and any other deleterious materials.
B. Imported flower and garden planting soil mix shall be a dark brown to black mix at a proportion of approximately 2 parts sand-rich mineral soil to 1 part

composted soil with moderate moisture content (30-50% of total weight), by volume.

C. The sand-rich mineral soil component of the flower and garden planting soil mix shall be an acceptable agricultural, homogeneous material meeting the USDA texture of a sandy loam, with no particles greater than 1/8 inch. High clay content subsoils or soils with redoximorphic features (mottled) are not acceptable.

D. The composted soil component of the flower and garden planting soil mix shall be a composted mix of approximately equal proportions of clay-rich mineral soil and composted yard waste, and inoculated with leaf mold. The composted soil shall have been composted together for at least 12 months, reaching a temperature of at least 150 degrees Fahrenheit for at least 15 days. After composting, the composted soil shall have been passed through a 3/8-inch screen to remove larger particles.

E. The compost component shall be well decomposed, stable to very stable organic matter source derived from yard trimmings or City approved alternate source. The Carbon/Nitrogen (C/N) ratio shall be less than 25:1 and trace metals test results should "pass". It shall not contain substances toxic to plants and shall not have objectionable odors. It shall not resemble the raw material from which it was derived, and shall be reasonably free of man-made foreign matter.

F. Mix Parameters:

Parameters	Optimal Range	Reported Units
pH	6.1 – 7.9	pH units
% O.M. Humus	4.5 – 7.0	%, dry weight basis
EC Salts	< 10.00*	mmhos/cm
Nitrate (NO_3)	50-199	ppm
Phosphate (P_2O_5)	20-69	ppm
Potassium (K - H_2O) (K - CO_2)	100 - 249 175 - 499	ppm
Sodium (Na - H_2O) (Na - CO_2)	< 349 < 499	ppm
Calcium (Ca - H_2O) (Ca - CO_2)	75 - 224 300 - 899	ppm
Magnesium(Mg - H_2O) (Mg - CO_2)	25 - 99 75 - 199	ppm
Ratio: Na/Ca	<5	ppm
Ratio: Na/Mg	<10	ppm
Solvita (C- CO_2 burst)	>60	ppm

* Compost-rich soil mixes should have EC Salts <3.00 mmhos/cm when used as topsoil substitute.

650S.4 Construction Methods

A. The imported flower and garden planting soil mix shall be protected from all sources of contamination from the supplier's yard to the project site.

B. Imported flower and garden planting soil mix shall be free of construction debris, refuse, and rocks and earth clods.

C. The planting material shall be placed in above-ground planters located along the project. Bottom ½ of planters to be filled with loose rocks. Top ½ of planters to be filled with planting material. During installation the planting material shall be protected from all forms of compaction, including equipment and pedestrian traffic, to the extent possible.
D. After placing the flower and garden planting soil mix in the planters, planting should commence as soon as possible to minimize possibility of planting material drying out.

650S.5 Measurement

For applicable Pay Items as noted in 600.6 below, “Imported Flower and Garden Planting Soil Mix ” will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.196 cubic yards), complete in place, as indicated in the Contract Documents.

650S.6 Payment

Payment for Imported Flower and Garden Planting Soil Mix, measured as prescribed above, will be paid for at the unit price bid. The unit price bid shall include full compensation for furnishing, hauling, and installing Imported Flower and Garden Planting Soil Mix, time, labor, tools, equipment, and other incidentals necessary to complete the installation, as indicated on the Drawings, complete in place.

Payment will be made under:

Pay Item No. SS650S-A:	Imported Flower and Garden Planting Soil Mix	Per CY

End

Item No. SS750
Steel Planters

750.1 Description

This item shall consist of furnishing, fabricating, painting, and installation of steel planters with a drainage layer, filter fabric, and planting mix. Steel planters shall be constructed with materials and work quality as indicated or approved by the Landscape Architect and/or Engineer.

750.2 Materials

(1) Steel Planter Boxes
The steel planters shall be constructed of ¼ inch, hot rolled, mild, weldable, steel plate conforming with standard specification 720S Metal for Structures.

(2) Drainage Material
The drainage material for the steel planters shall consist of an eighteen (18) inch layer of Grade 3 coarse aggregate per standard specification 403S.3C Table 2: Coarse Aggregate Gradation Chart (Percent Passing) installed on the bottom of the planter.

(3) Filter Fabric
The filter fabric for the steel planters shall consist of nonwoven High Flow Filter Fabric per standard specification 620S.4 Table 2: HIGH FLOW FILTER FABRIC REQUIREMENTS. The fabric shall be cut an additional 6 inches in length and width to ensure contact with all four sides of the steel planters.

(4) Planting Mix
The planting soil mix shall consist of an eighteen (18) inch layer of soil conforming to the planting mix detailed in special specification 650 Imported Flower and Garden Planting Soil Mix.

(5) Decorative Metal Edging
The decorative metal edging shall be constructed of ¼ inch, hot rolled, mild, weldable, steel plate conforming with standard specification 720S Metal for Structures.

704.3 Sampling and Testing

A sample of the planter box, drainage material, filter fabric, and planting mix may be taken for each project or for each shipment to a project. All samples shall be furnished to the City free of charge.

- The steel plate for planters and decorative edging shall be sampled and tested in accordance with the requirements of standard specification 720S Metal For Structures.
- The drainage material shall be tested per standard specification 403S Concrete for Structures.
- The filter fabric shall be tested per standard specification 620S Filter Fabric.
- The Planting mix shall be tested per special specification 650 Imported Flower and Garden Planting Soil Mix

704.4 Construction Methods

The steel planter boxes shall be constructed with welded corners and internal bracing and stiffeners to prevent deformation under regular loading conditions. The interior bracings shall be welded and spaced no more than 18 inches apart. The stiffeners shall be welded 1.5 inches below top of planter and on all four sides. Apart. The Bracing and Stiffeners shall consist of 2x2x1/4" angle. All planters shall be sealed with silicone on the interior of all welded corners. The steel plate shall be waterproofed with roll on or spay waterproofing on interior of the planters.

The decorative metal edging shall be 10” tall with 2” below planting bed soil line. Edging shall be constructed with welded corners and internal bracing to prevent deformation under regular loading conditions. The interior bracings shall be welded and spaced approximately 10.75” apart. The internal bracing shall consist of 2x2x1/4” angle. Twenty-four (24) inch stakes shall be 10-gauge steel, tapered, and welded to inner face at corners and bracings. All sides of the decorative metal edging shall be sealed with silicone on the interior of all welded corners. The steel plate shall be waterproofed with roll on or spray waterproofing on interior of the edging.

750.5 Measurement

A. Steel Planter Boxes
This item shall be measured “per each” complete in place and shall include furnishings, fabricating, transporting, erecting and installing each steel planter, including all material, labor, tools, equipment, barricading and incidentals necessary to complete the work.

B. Drainage Material
This item shall be measured per cubic yard Plan Quantity. For those items measured for plan quantity payment, adequate calculations have been made.

C. Filter Fabric
Work and acceptable material for "Filter Fabric" will be measured by the square foot, complete in place.

D. Planting Mix
“Planting Mix” will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.196 cubic yards), complete in place, as indicated in the Contract Documents.

E. Decorative Metal Edging
This item shall be measured per linear foot, complete in place, and shall include furnishings, fabricating, transporting, erecting, and installing decorative metal edging, including all material, labor, tools, equipment, barricading and incidentals necessary to complete the work.

750.6 Payment

The work performed and material furnished as prescribed by this item, measured as provided under "Measurement" will be paid for at the unit price bid for " Steel Planter Boxes", “Drainage Material,” or " Filter Fabric,” or “Planting Mix," or “Decorative Metal Edging,” which price shall be full compensation for furnishing all materials, including necessary preparation, hauling and erection and waterproofing, and for all labor, tools, equipment and incidentals necessary to complete the work. Payment will be made under one of the following:

Pay Item No. SS750S-A1:	Steel Planter 8’ x 3’ x 3’	Per Each.
Pay Item No. SS750S-A2:	Steel Planter 8’ x 1’ x 3’	Per Each.
Pay Item No. SS750S-B1:	Drainage Material	Per YD3
Pay Item No. SS750S-C1:	Filter Fabric	Per SQFT
Pay Item No. SS750S-D1:	Planting Mix	Per YD3
Pay Item No. SS750S-E1:	Decorative Metal Edging	Per LF

End

Item No. SS16650
Solar Lamp Posts

16650.1 Description

This item shall consist of furnishing, fabricating, and installation of solar lamp posts with internal battery banks. Solar lamp posts shall be constructed with materials and work quality as indicated or approved by the Landscape Architect and/or Engineer.

16650.2 Materials

Solar Panel/Array - 260W (9'1" in length) cylindrical array (RW260 Roadway Retroflex System or approved equivalent).

Lighting – 40W LED @ 162 Lumens/Watt

Battery – 24V – 60A Lithium Ion 1.8KWH (12+ years life expectancy, Minimum 5-day, autonomous runtime, Dimensions 47in x 5.5in x 1.63in)

Controller – Electronic MPPT charge controller/regulator (Victron Energy MPPT SmartSolar Charge Controller with Integrated Bluetooth or approved equivalent).

16650.3 Submittals

The contractor shall provide renderings and photographic mockups of proposed solar lamp post for approval by the Landscape Architect and/or Engineer.

16650.4 Field Verification/Testing

Solar Panel/Array - Use a multimeter to test the panel voltage. This test must be done during the day. Open circuit voltage (VoC) shall be at least 37.1 V, max power voltage (Vmpp) shall be 29.5 V, and the short circuit current (Isc) shall be 4.7 amps.

Battery Test – Each battery shall be cycle tested to verify voltage, max discharge rate and watt-hour design life.

16650.5 Construction Methods

A. Examination
   1. Do not begin installation until foundations have been properly prepared.
   2. If foundation preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

B. Preparation
   1. Clean surfaces thoroughly prior to installation.
   2. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Installation

1. Install in accordance with manufacturer's instructions.

D. Protection

3. Protect installed products until completion of project.
4. Touch-up, repair or replace damaged products before Substantial Completion.

16650.6 Measurement

Solar Lamp Post

This item shall be measured “per each” complete in place and shall include furnishings, fabricating, transporting, erecting and installing each solar lamp post, including all material, labor, tools, equipment, barricading and incidentals necessary to complete the work.

16650.7 Payment

The work performed and material furnished as prescribed by this item, measured as provided under "Measurement" will be paid for at the unit price bid for "20’ Tall Solar Lamp Post“, which price shall be full compensation for furnishing all materials, including necessary preparation, hauling and erection, and for all labor, tools, equipment and incidentals necessary to complete the work. Payment will be made under one of the following:

Pay Item No. SS16650S-A1:	20’ Tall Solar Lamp Post	Per Each.

End

CITY OF AUSTIN
PUBLIC WORKS DEPARTMENT
ENGINEERING SERVICES DIVISION

GENERAL CONSTRUCTION NOTES:

1. THE PROJECT MANUAL CONTAINS IMPORTANT INFORMATION THAT IS NOT REPEATED IN THE PLAN SET. THE CONTRACTOR SHALL KEEP THE PROJECT MANUAL ON SITE AND IMMEDIATELY AVAILABLE TO THOSE PERSONS PERFORMING THE WORK. UPON REQUEST, THE CONTRACTOR SHALL PRESENT THIS COPY OF THE PROJECT MANUAL TO THE CONSTRUCTION INSPECTOR, ENGINEER OR PROJECT MANAGER.

2. THE CONTRACTOR WILL NOTIFY THE OWNER'S REPRESENTATIVE FORTY-EIGHT (48) HOURS IN ADVANCE OF BEGINNING ANY CONSTRUCTION IN THE RIGHT OF WAY OR EASEMENTS.

3. CONTRACTOR AND SUB-CONTRACTORS MUST BE LICENSED BY THE CITY OF AUSTIN FOR CONDUCTING WORK WITHIN THE STREET RIGHT OF WAY, ALLEYS, OR EASEMENTS.

4. CONTRACTOR MUST OBTAIN RIGHT OF WAY EXCAVATION PERMITS, FOR EACH PROJECT LOCATION, FROM ROW MANAGEMENT DIVISION (512-974-7180) PRIOR TO COMMENCEMENT OF WORK. CONTRACTOR SHALL PROVIDE A ONE CALL CENTER CONFIRMATION NUMBER BEFORE BEING ISSUED AN EXCAVATION PERMIT.
"ONE CALL" PHONE NUMBER: 811.

5. PRE-CONSTRUCTION MEETINGS: THERE ARE TWO ENTITIES THAT HOLD PRE-CONSTRUCTION MEETINGS. THESE MEETINGS TYPICALLY DO NOT OCCUR AT THE SAME TIME. FOR PRE-CONSTRUCTION MEETING HELD BY CONSTRUCTION INSPECTION DIVISION, SEE PROJECT MANUAL SECTION 01200; FOR ENVIRONMENTAL PRE-CONSTRUCTION MEETING, SEE ENVIRONMENTAL NOTES.

6. THE CONTRACTOR SHALL NOTIFY EACH OF THE FOLLOWING ENTITIES OF THE CONSTRUCTION SCHEDULE AT LEAST TWO WEEKS IN ADVANCE OF PROPOSED CONSTRUCTION OPERATIONS AND PROVIDE PERTINENT INFORMATION ABOUT LANE CLOSURES AND DETOURS.

AUSTIN FIRE DEPARTMENT	512-974-0130
AUSTIN POLICE DEPARTMENT	512-974-5000
EMERGENCY MEDICAL SERVICES	512-978-0440
AUSTIN INDEPENDENT SCHOOL DISTRICT	512-414-9832
CAPITAL METRO TRANSIT AUTHORITY	512-389-7400
U.S. POSTAL SERVICE	512-342-1236
UNIVERSITY OF TEXAS	
(Facilities Services)	512-471-4110
(Parking and Trans)	512-471-7275
(Utilities and Energy Mgmt)	512-471-1600
(University Police)	512-471-4441
(Project Mgmt & Const. Svcs)	512-471-3042
STATE OF TEXAS	
DPS TEXAS HWY PATROL (Region 7 Austin Capitol)	512-463-3473

7. THE INFORMATION SHOWN ON THESE DRAWINGS INDICATING TYPE AND LOCATION OF SURFACE, SUBSURFACE, AND AERIAL UTILITIES IS NOT GUARANTEED TO BE EXACT OR COMPLETE. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE EXACT TYPE AND LOCATION OF ALL UTILITIES AFFECTED BY THE CONSTRUCTION IN ORDER TO AVOID DAMAGING THOSE UTILITIES.

8. THE CONTRACTOR SHALL COORDINATE WITH OTHER CONTRACTORS AND UTILITIES IN THE VICINITY OF THIS PROJECT. THIS INCLUDES, BUT IS NOT LIMITED TO, GAS, WATER, WASTEWATER ELECTRIC, TELEPHONE, CABLE TELEVISION, PETROLEUM PIPELINES, FIBER OPTIC, STREET, DRAINAGE, AND ANY OTHER WORK OCCURRING IN OR NEAR THE PROJECT SITE. ONCE THE CONTRACTOR BECOMES AWARE OF A POSSIBLE CONFLICT, IT IS THE CONTRACTOR'S RESPONSIBILITY TO NOTIFY THE OWNER'S REPRESENTATIVE IMMEDIATELY, BUT NO LATER THAN TWENTY-FOUR (24) HOURS AFTER DISCOVERY.

9. SHOULD THE CONTRACTOR DAMAGE A UTILITY DURING THE COURSE OF THE WORK, THE CONTRACTOR SHALL IMMEDIATELY ARRANGE FOR REPAIR AND RESTORATION OF THE DAMAGED UTILITY. THE EXPENSE FOR THESE REPAIRS WILL BE AT THE CONTRACTOR'S SOLE EXPENSE.

10. ALL EXISTING STRUCTURES, FACILITIES, AND UTILITIES DAMAGED BY CONSTRUCTION SHALL BE REMOVED AND RESTORED WITH MATERIALS EQUAL TO OR BETTER THAN THE ORIGINAL AND TO CONDITIONS EQUAL TO OR BETTER THAN THE ORIGINAL. UNLESS OTHERWISE NOTED IN THE PLANS, THIS WILL NOT BE MEASURED AND PAID FOR DIRECTLY, BUT SHALL BE AT THE CONTRACTOR'S SOLE EXPENSE.

11. SLOPES OF ROADWAY CUTS AND EMBANKMENTS DAMAGED BY ANY OPERATION OF THE CONTRACTOR DURING THE EXECUTION OF THIS PROJECT SHALL BE REPAIRED AND RESTORED TO THE ORIGINAL PRE-CONSTRUCTION CONDITION. BACKFILL AND FILL PLACED DURING REMEDIAL GRADING SHALL BE COMPACTED TO AT LEAST 95% COMPACTION AND TO THE SATISFACTION OF THE ENGINEER AND GOVERNING AUTHORITIES.

12. NO GEOTECHNICAL INFORMATION HAS BEEN COMPILED SPECIFICALLY FOR THIS PROJECT. GENERAL SOILS MAPS CAN BE FOUND AT www.nrcs.usda.gov.

13. SEE PROJECT MANUAL SECTION 01300 FOR PRODUCT SUBMITTAL REQUIREMENTS.

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STREET AND BRIDGE SPECIAL NOTE:

ALL DAMAGE CAUSED DIRECTLY OR INDIRECTLY TO THE STREET SURFACE, SIDEWALK, DRIVEWAY, CURB & GUTTER, OR SUBSURFACE OUTSIDE OF THE PAVEMENT CUT AREA SHALL BE REGARDED AS A PART OF THE STREET CUT REPAIR. THIS INCLUDES ANY SCRAPES,GOUGES, CUTS, CRACKING, DEPRESSIONS, AND/OR ANY OTHER DAMAGE CAUSED BY THE CONTRACTOR DURING THE EXECUTION OF THE WORK. THESE REPAIR AREAS WILL BE INCLUDED IN THE TOTAL AREA OF RESTORATION. THESE AREAS SHALL BE SAW CUT IN STRAIGHT, NEAT LINES PARALLEL TO THE EXCAVATION OR UTILITY TRENCH AND TO THE NEXT EXISTING JOINT FOR SIDEWALKS AND CURB & GUTTER. ALL SUCH REPAIRS SHALL BE AT THE CONTRACTOR'S EXPENSE AND SHALL MEET ALL CITY TESTING REQUIREMENTS, STANDARDS, AND SPECIFICATIONS.

SEQUENCE OF CONSTRUCTION

1. SEE ENVIRONMENTAL NOTES FOR SEQUENCE OF CONSTRUCTION AND NECESSARY PRE- AND POST-INSPECTIONS BY ENVIRONMENTAL INSPECTOR.
2. DEMOLITION SHOULD ONLY INCLUDE AREAS THAT WILL BE RE-CONSTRUCTED WITHIN TWO WEEKS UNLESS OTHERWISE APPROVED BY OWNER'S REPRESENTATIVE.

REV NO.	BY	DATE	REVISION DESCRIPTION
1	KS	2/1/2021	REVISED GENERAL NOTES

STATE OF TEXAS
KEVIN SWEAT
92023
LICENSED
PROFESSIONAL ENGINEER
2021-02-01

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY KEVIN SWEAT
LIC. # 92023

I CERTIFY THAT THESE DRAWINGS ARE COMPLETE, ACCURATE AND ADEQUATE FOR THEIR INTENDED PURPOSES, INCLUDING CONSTRUCTION, BUT ARE NOT AUTHORIZED FOR CONSTRUCTION UNTIL FORMAL CITY APPROVAL.

CITY OF AUSTIN, TEXAS
PUBLIC WORKS DEPARTMENT
ENGINEERING SERVICES DIVISION

RED RIVER
ENHANCEMENT

GENERAL CONSTRUCTION NOTES

NOTES	NAME	DATE
SURVEY BY		
DRAWN BY	DS	
DESIGNED BY	CN	
CHECKED BY	ESD	
REVIEWED BY	KS	

ESD
ENGINEERING SERVICES DIVISION

GP-2020-____.PWD

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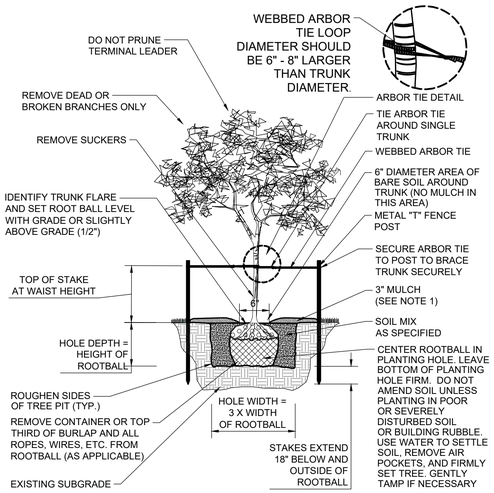
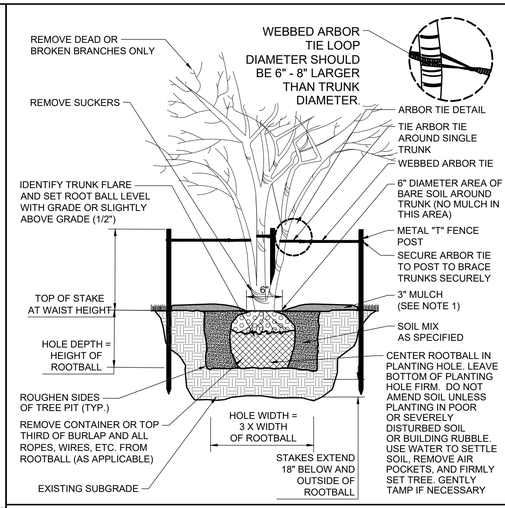
SWEAT, KEVIN



NOTES:
1. DO NOT PLACE MULCH IN CONTACT WITH PLANT TRUNK.
2. REMOVE NURSERY-APPLIED TREE WRAP, TAPE, OR STRING FROM TREE TRUNK AND CROWN. REMOVE ANY TAGS OR LABELS.
3. STAKING OF TREES SHALL ONLY BE PERMITTED WHERE SITE OR TREE CONDITIONS ARE SUCH THAT THE TREES ARE ANTICIPATED TO BE UNSTABLE.
4. POST AND TIES TO BE INSTALLED WITHOUT HARMING THE TREE (E.G. NON-BINDING STRAPS, POSTS SET OUTSIDE THE ROOTBALL) AND MUST BE REMOVED AFTER ONE YEAR.
5. SEE ANSI A300 (PART 1) FOR INFORMATION REGARDING PRUNING.
6. SEE ANSI Z60.1 FOR NURSERY STOCK STANDARDS.

	TREE PLANTING - SINGLE TRUNK	SD-L-P01 1 OF 1



NOTES:
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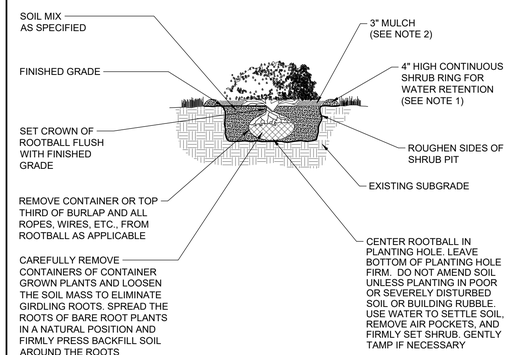
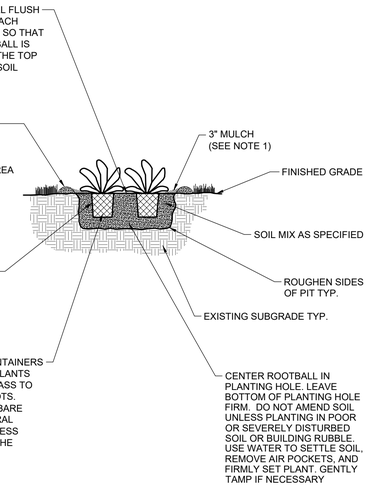
6. SEE ANSI Z60.1 FOR NURSERY STOCK STANDARDS.

	TREE PLANTING - MULTI TRUNK	SD-L-P02 1 OF 1



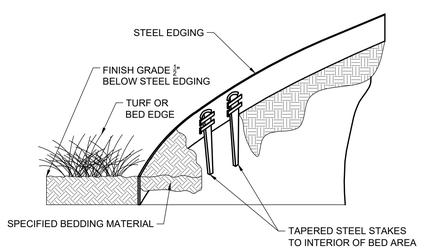
NOTES:
1. SHRUB RING FOR WATER RETENTION TO BE USED ONLY IF SHRUB IS NOT IN A CONTINUOUS BED AREA.
2. DO NOT PLACE MULCH IN CONTACT WITH PLANT TRUNK.
3. SEE ANSI Z60.1 FOR NURSERY STOCK STANDARDS.

	SHRUB PLANTING	SD-L-P03 1 OF 1



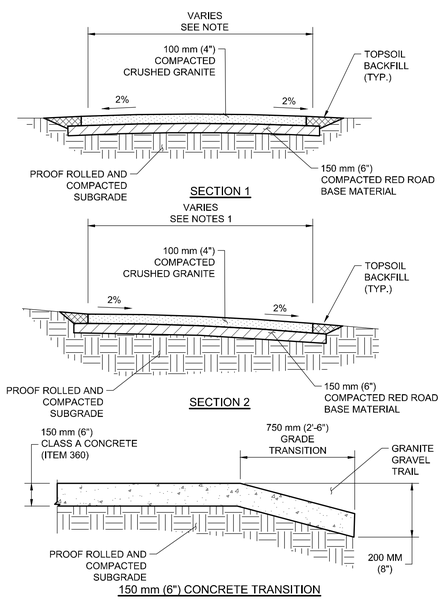
NOTES:
1. DO NOT PLACE MULCH IN CONTACT WITH PLANT TRUNK.
2. SEE ANSI Z60.1 FOR NURSERY STOCK STANDARDS.

	PERENNIAL / GROUND COVER PLANTING	SD-L-P04 1 OF 1



NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.

	STEEL LANDSCAPE EDGING	SD-L-H01 1 OF 1



NOTES:
1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH ENGINEERING DRAWINGS.
2. EXISTING TREES, PROPERTY AND PUBLIC RIGHT-OF WAYS SHALL BE PROTECTED FROM DAMAGE BY TRUCKS AND/OR EQUIPMENT.
3. THE GRANITE GRAVEL WEARING COURSE SHALL BE 100 mm (4"), COMPACTED.
4. THE WEARING MATERIAL SHALL BE COMPRISED OF UNWASHED GRANITE AGGREGATE AND RED CLAY FINES THAT CONFORM TO STANDARD SPECIFICATION ITEM SECTION 1301S.3, "MATERIAL".
5. UPON COMPLETION OF TRAIL CONSTRUCTION, ALL GRANITE GRAVEL SHALL BE REMOVED FROM ADJOINING HARD SURFACES (I.E. RETAINING CURB/WALL, SIDEWALKS, RUBBER SAFETY SURFACES, PLAYSCAPE DECKS OR RAMPS).
6. ALL ADJACENT HARD SURFACES, SUCH AS CURBS OR WALKS, SHALL BE INSTALLED PRIOR TO INSTALLATION OF GRANITE GRAVEL.

CITY OF AUSTIN DEPARTMENT OF PUBLIC WORKS	GRANITE GRAVEL HIKE AND BIKE TRAILS	
RECORD COPY SIGNED BY BILL GARDNER 8/16/04 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 1301S-1 1 OF 2

CITY OF AUSTIN DEPARTMENT OF PUBLIC WORKS	GRANITE GRAVEL HIKE AND BIKE TRAILS	
RECORD COPY SIGNED BY BILL GARDNER 8/16/04 ADOPTED	THE ARCHITECT/ENGINEER ASSUMES RESPONSIBILITY FOR APPROPRIATE USE OF THIS STANDARD.	STANDARD NO. 1301S-1 2 OF 2

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REV NO.	BY	DATE	REVISION DESCRIPTION
1	KS	2/12/2021	ADDED DETAIL

STATE OF TEXAS
KEVIN SWEAT
92023
LICENSED PROFESSIONAL ENGINEER
2021-02-01

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY KEVIN SWEAT LIC. # 92023

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CITY OF AUSTIN, TEXAS
PUBLIC WORKS DEPARTMENT
ENGINEERING SERVICES DIVISION

RED RIVER ENHANCEMENT

LANDSCAPE DETAILS

NOTES	NAME	DATE
SURVEY BY		
DRAWN BY	DS	
DESIGNED BY	CN	
CHECKED BY	ESD	
REVIEWED BY	KS	

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HORIZONTAL SCALE IN FEET

GP-2020-____.PWD

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SWEAT, KEVIN