

INVITATION FOR BIDS

Section 00020

1. OVERVIEW AND PROJECT INFORMATION

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

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

Project:	Ullrich WTP Low Service Pump Station Electrical Feed Renewal
Located at:	Austin, TX
CIP ID No.:	5335.016
Solicitation No.:	CLMC822

The Work consists of the construction of the Ullrich Low Service Pump Station electrical switchgear enclosure (Substation No. 4) and service road, the installation of ductbank and equipment pads for Austin Energy primary metering equipment, the installation of 919 LF of 4FTx5FT Ductbank, 585 LF of 12INx18IN Ductbank, the installation of 10 electrical manholes, renovation of the 480 volt power distribution system at the Low Service Pump Station, replacement of the medium voltage service transformer at the Powder Activated Carbon building, and all associated electrical, mechanical, and instrumentation work required to build a fully functional system.

2. BID DOCUMENTS

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

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

3. SUBMISSION OF BIDS

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

Sealed Bid may be mailed using address below:

Address for US Mail (If mailed to the physical address, the proposal will be returned unopened)	Address for Hand Delivery, FedEx, UPS or Courier
City of Austin	City of Austin, One Texas Center
Capital Contracting Office	Capital Contracting Office
P. O. Box 1088	505 Barton Springs Road, Suite 1045-C
Austin, Texas 78767-8845	Austin, Texas 78704

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

Public Bid Opening Update

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

Bidders may watch the bid opening online using the following Web link: [CCO Web Bid Opening Click Here](#)

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

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

ALL BIDS ARE DUE PRIOR TO (Austin time) 2:00 PM, Thursday October 22nd, 2020.

ALL COMPLIANCE PLANS ARE DUE PRIOR TO (Austin time) 2:00 PM, Thursday October 22nd, 2020.

BIDS WILL BE OPENED AT (Austin time) 3:00 PM, Thursday October 22nd, 2020.

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

4. VENDOR REGISTRATION AND NON-DISCRIMINATION

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

The City of Austin, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notifies

all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

5. MBE/WBE PROCUREMENT PROGRAM

All City procurements are subject to the City's Minority-Owned and Women-Owned Business Enterprise Procurement Program found at Chapter 2-9-A of the City Code, as amended. The Program provides Minority-Owned and Women-Owned Business Enterprises (MBEs/WBEs) or Disadvantaged Business Enterprises (DBEs) full opportunity to participate in all City contracts. Goals for MBE/WBE or DBE participation are stated for each solicitation. Information on achieving the goals or documenting good faith efforts to achieve the goals are contained in the MBE/WBE Procurement Program Package or DBE Procurement Program Package attached to the solicitation. When goals are established, Bidders are required to complete and return the MBE/WBE or DBE Compliance Plan with their Bid. If a Compliance Plan is not submitted prior to the date and time set forth in the solicitation, the Bid will not be accepted for consideration. (See Section 00820 for MBE/WBE requirements on "no goal" solicitations.)

6. BID GUARANTY

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

7. BONDS AND INSURANCE

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

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

8. WAGE COMPLIANCE

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

9. CONTRACT TIME

Contract Time is of the essence and all Work shall be substantially completed within 960 Calendar Days after date specified in the Notice to Proceed, in accordance with the Bid Form, Section 00300L.

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

Liquidated damages are one thousand six hundred and sixty dollars (\$1,660) per Calendar Day for failure to substantially complete the work and six hundred and fifty dollars (\$650) per Calendar Day for failure to achieve final completion within 30 Calendar Days after substantial completion, in accordance with the Bid Form, Section 00300L.

10. OWNER'S RIGHTS

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

11. PRE-BID CONFERENCE

A **mandatory** Pre-Bid Conference will be held on Thursday, September 17th at 10:00 AM (Austin time), via Microsoft Teams. [Click Here](#)

Attendance is mandatory unless otherwise stated. Bidders must attend any mandatory Pre-Bid Conference and are encouraged to attend any non-mandatory Pre-Bid Conference to ensure their understanding of OWNER's bidding and contracting requirements, particularly MBE/WBE or DBE Procurement Program requirements. If the Pre-Bid Conference is mandatory the Bidder must arrive and sign-in within fifteen (15) minutes of the scheduled start time of the meeting, otherwise the Bidder will not be allowed to submit a Bid for the project.

12. ANTI-LOBBYING AND PROCUREMENT

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

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

13. AUTHORIZED CONTACT PERSONS

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

PROJECT MANAGER: Robyn Haasch, PMP, 512-974-2624, email robyn.haasch@austintexas.gov

CAPITAL CONTRACTING OFFICE CONTACT: Steven Cocke, phone 512-974-7998, email steven.cocke@austintexas.gov

SMALL & MINORITY BUSINESS RESOURCES DEPARTMENT CONTACT: Kenneth Kalu, phone 512-974-7621, email kenneth.kalu@austintexas.gov

END

INSTRUCTIONS TO BIDDERS

Section 00100

1. PREPARATION OF BID

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

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

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

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

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

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

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

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

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

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

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

1.10.1. FINDINGS; PURPOSE.

- (A) The council finds that persons who enter a competitive process for a city contract voluntarily agree to abide by the terms of the competitive process, including the provisions of this article.
- (B) The council finds that it is in the City's interest:
 - (i) to provide the most fair, equitable, and competitive process possible for selection among potential vendors in order to acquire the best and most competitive goods and services; and
 - (ii) to further compliance with State law procurement requirements.
- (C) The council intends that:
 - (i) each response is considered on the same basis as all others; and
 - (ii) respondents have equal access to information regarding a solicitation, and the same opportunity to present information regarding the solicitation for consideration by the City.

1.10.2. APPLICABILITY.

- (A) This article applies to all solicitations except:
 - (i) City social service funding;
 - (ii) City cultural arts funding;
 - (iii) federal, state or City block grant funding;
 - (iv) the sale or rental of real property;
 - (v) interlocal contracts or agreements; and
 - (vi) solicitations specifically exempted from this article by council.
- (B) Absent an affirmative determination by the council, the purchasing officer has the discretion to apply this article to any other competitive process.
- (C) City Code Section 1-1-99 (*Offenses; General Penalty*) does not apply to this article.

1.10.3. DEFINITIONS.

In this article:

- (A) AGENT means a person authorized by a respondent to act for or in place of the respondent in order to communicate on behalf of that respondent. Each of the following is presumed to be an agent:
 - (i) a current full-time or part-time employee, owner, director, officer, member, or manager of a respondent;

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

(B) AUTHORIZED CONTACT PERSON means a City employee designated in a City solicitation as the point of contact for all purposes for that solicitation.

(C) CITY EMPLOYEE is defined in Section 2-7-2 (*Definitions*), and further includes an independent contractor hired by the City with respect to the solicitation.

(D) CITY OFFICIAL is defined in Section 2-7-2 (*Definitions*).

(E) NO-LOBBYING PERIOD means the period of time beginning at the date and time a solicitation is published and continuing through the earliest of the following:

- (i) the date the last contract resulting from the solicitation is signed;
- (ii) 60 days following council authorization of the last contract resulting from the solicitation; or
- (iii) cancellation of the solicitation by the City

(F) PURCHASING OFFICER means the City employee authorized to carry out the purchasing and procurement functions and authority of the City.

(G) RESPONSE means a written offer or submission in reply to a solicitation.

(H) RESPONDENT means a person or entity that has timely submitted or subsequently timely submits a response to a City solicitation, even if that person subsequently withdraws its response or has been disqualified by the City for any reason. Respondent includes:

- (i) a subsidiary or parent of a respondent;
- (ii) a joint enterprise, joint venture, or partnership with an interest in a response and in which a respondent is a member or is otherwise involved, including any partner in such joint enterprise, joint venture, or partnership; and
- (iii) a subcontractor to a respondent in connection with that respondent's response.

(I) SOLICITATION means an opportunity to compete to conduct business with the City that requires council approval under City Charter Article VII Section 15 (*Purchase Procedure*), and includes, without limitation:

- (i) an invitation for bids;
- (ii) a request for proposals;
- (iii) a request for qualifications;
- (iv) a notice of funding availability; and
- (v) any other competitive solicitation process for which the purchasing officer, in the purchasing officer's sole discretion, affirmatively determines this article should apply in accordance with Section 2-B.

1.10.4. RESTRICTION ON LOBBYING.

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

- (A) a respondent or an agent shall not communicate directly with a City official or a City employee, or both in order to:
- (i) provide substantive information about any respondent or response with respect to the solicitation to which the communication relates;
 - (ii) encourage the City to reject one or more of the responses to the solicitation to which the communication relates;
 - (iii) convey a complaint about the solicitation to which the communication relates; or
 - (iv) ask any City official or City employee to favor or oppose, recommend or not recommend, vote for or against, consider or not consider, or take action or refrain from taking action on any vote, decision, or agenda item regarding the solicitation to which the communication relates.
- (B) a City official shall not contact or communicate with a respondent regarding a response or the solicitation to which the no-lobbying period applies;
- (C) a City employee, other than the authorized contact person, shall not contact or communicate with a respondent regarding a response or the solicitation to which the no-lobbying period applies.

1.10.5. PERMITTED COMMUNICATIONS.

The following communications are permitted under this article at any time:

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

1.10.6. MODIFICATION OF RESTRICTION.

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

1.10.7. NOTICE.

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

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

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

1.10.8. DISCLOSURE OF VIOLATION.

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

1.10.9. ENFORCEMENT.

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

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

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

- (1) written notice of the disqualification imposed pursuant to Section 10 (*Disqualification; Contract Voidable*);
- (2) written notice of the right to protest the disqualification imposed;
- and
- (3) written notice of the right to request an impartial hearing process.

1.10.10. DISQUALIFICATION; CONTRACT VOIDABLE.

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

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

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

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

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

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

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

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

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

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

or subgoals.

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

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

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

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

2. ESTIMATES OF QUANTITIES (UNIT PRICE CONTRACTS ONLY)

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

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

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

4. BID GUARANTY

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

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

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

5. PERFORMANCE AND PAYMENT BONDS

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

6. CONSIDERATION OF BID AMOUNT

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

7. SUBMISSION OF BID

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

- 7.1** One copy of Bid form (Section 00300L or 00300U) completed and signed.
- 7.2** Acknowledgment of receipt of Addenda issued in spaces provided in Bid form.
- 7.3** Required Bid guaranty (copy of Bid guaranty if submitted electronically via Austin Finance Online).
- 7.4** Required Information indicated in Drawings or Project Manual as specified in Section 00820.
- 7.5** One copy of Total Bid Form if bid is submitted electronically via Austin Finance Online.

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

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

disqualification.

Sealed Bids may be mailed using the address below:

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

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

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

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

8. WITHDRAWAL OF BID

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

9. REJECTION OF BIDS

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

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

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

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

9.1.4 Evidence of collusion among Bidders.

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

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

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

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

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

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

9.2 The following may be cause to reject a Bid:

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

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

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

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

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

9.2.6 Failure to acknowledge receipt of Addenda.

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

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

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

9.2.10 Failure to timely execute Contract after award.

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

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

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

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

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

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

10. PROTEST PROCEDURES

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

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

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

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

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

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

Bidding Requirements, Contract Forms and Conditions of the Contract

- .1** your name, address, telephone, and email address;
- .2** the solicitation number and the CIP number, if applicable;
- .3** a detailed statement of the factual grounds for the protest, including copies of any relevant documents.

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

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

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

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

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

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

- .1** OWNER urgently requires the supplies or services to be purchased, or
- .2** Failure to make an award promptly will unduly delay delivery or performance.

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

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

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

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

11. SUBMISSION OF POST BID INFORMATION

11.1 Prior to determination of the certified low Bidder, the three (3) apparent low Bidders

must submit to OWNER the following information within three (3) business days of receipt of notice of apparent low Bidder status by the OWNER:

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

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

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

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

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

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

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

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

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

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

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

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

12. AWARD AND EXECUTION OF CONTRACT

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

resident Bidder would be required to underbid the nonresident Bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located.

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

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

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

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

13. PARTNERING

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

14. ROCIP REQUIREMENTS

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

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

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

15. SIGNATURE REQUIREMENTS

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

16. CONTRACTOR EVALUATION

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

17. TEXAS ETHICS COMMISSION CERTIFICATE OF INTERESTED PARTIES DISCLOSURE FORM

17.1 Definitions:

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

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

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

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

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

17.2.3 Include the City's contract identification number,

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

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

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

END



PUBLIC WORKS DEPARTMENT

PROJECT MANUAL Contract Documents and Technical Specifications

VOLUME 1 of 2

Ullrich WTP Low Service Pump Station Electrical Feed Renewal

C.I.P PROJECT NUMBER: 5335.016

SOLICITATION NUMBER: CLMC822

**CITY OF AUSTIN
Public Works Department
PO Box 1088
Austin, TX 78767**



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16524	07/13/20	480 Volt Automatic Transfer Switch
16550	07/13/20	Grounding
16600	07/13/20	Disconnect Switches and Enclosed Circuit Breakers
16800	07/13/20	Calibration, Testing, and Settings

Division 17 – Instrumentation and Control

17100	07/13/20	Process Instrumentation and Control Systems (PCIS)
17200	07/13/20	Instrumentation and Control Cabinets and Associated Equipment
17380	07/13/20	Field Instrumentation and Sensing Devices
17600	07/13/20	Distributed Control System

VOL. 2 of 2 03/01/17 **MBE/WBE Procurement Program Package**

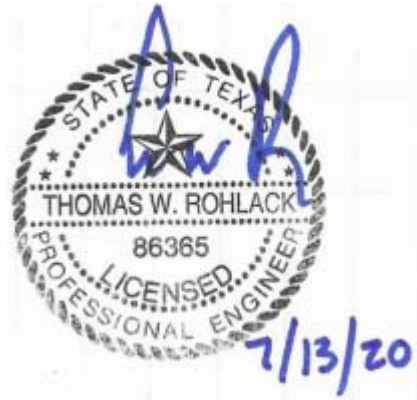
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ULLRICH WATER TREATMENT PLANT
LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

CONTRACT DOCUMENTS

JULY 2020



CAS Consulting & Services, Inc.

TBPE Firm No. 3572

SECTIONS

02442, 03462, SP 609S

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ULLRICH WATER TREATMENT PLANT
LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

CONTRACT DOCUMENTS

JULY 2020



HDR Engineering, Inc.

TBPE Firm No. F-754

SECTIONS

01060, 01143, 01321, 01640, 01701, 01792, 02072, 02220, 0400, 11005

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ULLRICH WATER TREATMENT PLANT
LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

CONTRACT DOCUMENTS

JULY 2020



SECTIONS

03300
HDR Engineering, Inc.

TBPE Firm No. F-754

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ULLRICH WATER TREATMENT PLANT
LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

CONTRACT DOCUMENTS

JULY 2020



Encotech Engineering Consultants

TBPE Firm No. 1141

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ULLRICH WATER TREATMENT PLANT
LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

CONTRACT DOCUMENTS

JULY 2020



13 July 2020

MWM DesignGroup

TBAE Firm No. 1452

SECTIONS

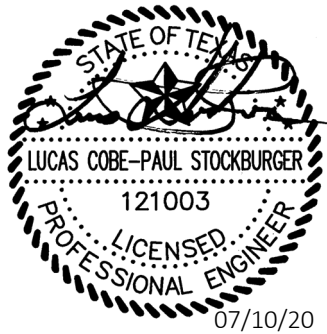
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ULLRICH WATER TREATMENT PLANT
LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

CONTRACT DOCUMENTS

JULY 2020



Encotech Engineering Consultants

TBPE Firm No. 1141

SECTIONS

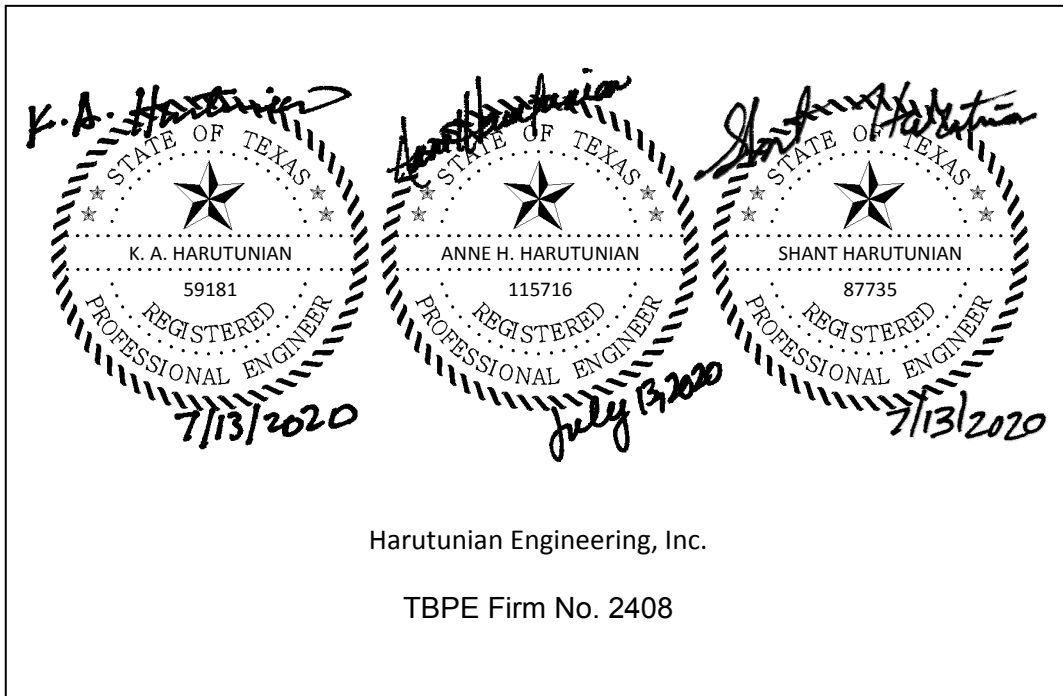
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ULLRICH WATER TREATMENT PLANT
LOW SERVICE PUMP STATION ELECTRICAL FEED RENEWAL

CONTRACT DOCUMENTS

JULY 2020



SECTIONS

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16480, 16500, 16524, 16550, 16600, 16800, 17100, 17200, 17380, 17600

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GEOTECHNICAL DATA

Section 00220

1. OVERVIEW

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

Geologic Assessment, dated October 11, 2019, prepared by Baer Engineering and Environmental Consulting Inc. is included here as Appendix A.

Subsurface Conditions Assessment, dated April 20, 2020, prepared by HDR Engineering Inc. is included here as Appendix B.

The requirements in the Drawings and Specifications shall be used in the event of a conflict between this report and the Drawings and Specifications.

Refer to Section 01143, Coordination with Owner's Operations for coordination requirements related to the Owner conducting additional geotechnical investigations after the Contractor completes rough grading and clearing and before constructing the building foundation.

END

Geologic Assessment

Texas Commission on Environmental Quality

For Regulated Activities on The Edwards Aquifer Recharge/transition Zones and Relating to 30 TAC §213.5(b)(3), Effective June 1, 1999

To ensure that the application is administratively complete, confirm that all fields in the form are complete, verify that all requested information is provided, consistently reference the same site and contact person in all forms in the application, and ensure forms are signed by the appropriate party.

Note: Including all the information requested in the form and attachments contributes to more streamlined technical reviews.

Signature

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. My signature certifies that I am qualified as a geologist as defined by 30 TAC Chapter 213.

Print Name of Geologist: Mark Sloop

Telephone: 512-453-3733

Date: October 11, 2019

Fax: _____

Representing: Baer Engineering and Environmental Consulting, Inc. TBPG No. 50030 (Name of Company and TBPG or TBPE registration number)

Signature of Geologist:





Regulated Entity Name: Austin Water Utility

Project Information

1. Date(s) Geologic Assessment was performed: April 4 and August 28, 2019

2. Type of Project:

☒ WPAP
☐ SCS

☐ AST
☐ UST

3. Location of Project:

☒ Recharge Zone
☐ Transition Zone
☐ Contributing Zone within the Transition Zone

4. ☒ **Attachment A - Geologic Assessment Table.** Completed Geologic Assessment Table (Form TCEQ-0585-Table) is attached.
5. ☒ Soil cover on the project site is summarized in the table below and uses the SCS Hydrologic Soil Groups* (Urban Hydrology for Small Watersheds, Technical Release No. 55, Appendix A, Soil Conservation Service, 1986). If there is more than one soil type on the project site, show each soil type on the site Geologic Map or a separate soils map.

Table 1 - Soil Units, Infiltration Characteristics and Thickness

Soil Name	Group*	Thickness(feet)
TeF	D	0 to 40 inches
TeE	D	0 to 40 inches

** Soil Group Definitions (Abbreviated)*

- A. Soils having a high infiltration rate when thoroughly wetted.
- B. Soils having a moderate infiltration rate when thoroughly wetted.
- C. Soils having a slow infiltration rate when thoroughly wetted.
- D. Soils having a very slow infiltration rate when thoroughly wetted.

6. ☒ **Attachment B – Stratigraphic Column.** A stratigraphic column showing formations, members, and thicknesses is attached. The outcropping unit, if present, should be at the top of the stratigraphic column. Otherwise, the uppermost unit should be at the top of the stratigraphic column.
7. ☒ **Attachment C – Site Geology.** A narrative description of the site specific geology including any features identified in the Geologic Assessment Table, a discussion of the potential for fluid movement to the Edwards Aquifer, stratigraphy, structure(s), and karst characteristics is attached.
8. ☒ **Attachment D – Site Geologic Map(s).** The Site Geologic Map must be the same scale as the applicant's Site Plan. The minimum scale is 1": 400'
 Applicant's Site Plan Scale: 1" = 400'
 Site Geologic Map Scale: 1" = 400'
 Site Soils Map Scale (if more than 1 soil type): 1" = 400'
9. Method of collecting positional data:
 - ☒ Global Positioning System (GPS) technology.
 - ☐ Other method(s). Please describe method of data collection: _____
10. ☒ The project site and boundaries are clearly shown and labeled on the Site Geologic Map.
11. ☒ Surface geologic units are shown and labeled on the Site Geologic Map.

12. ☒ Geologic or manmade features were discovered on the project site during the field investigation. They are shown and labeled on the Site Geologic Map and are described in the attached Geologic Assessment Table.
- ☐ Geologic or manmade features were not discovered on the project site during the field investigation.
13. ☒ The Recharge Zone boundary is shown and labeled, if appropriate.
14. All known wells (test holes, water, oil, unplugged, capped and/or abandoned, etc.): If applicable, the information must agree with Item No. 20 of the WPAP Application Section.
- ☐ There are _____ (#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply.)
- ☐ The wells are not in use and have been properly abandoned.
- ☐ The wells are not in use and will be properly abandoned.
- ☐ The wells are in use and comply with 16 TAC Chapter 76.
- ☒ There are no wells or test holes of any kind known to exist on the project site.

Administrative Information

15. ☒ Submit one (1) original and one (1) copy of the application, plus additional copies as needed for each affected incorporated city, groundwater conservation district, and county in which the project will be located. The TCEQ will distribute the additional copies to these jurisdictions. The copies must be submitted to the appropriate regional office.

Fredericksburg
Group (Kfr)



Ked

Edwards Limestone and Commanche Creek Limestone,
undivided. 300-350 feet thick

Kwa

Walnut Clay - 125-150 feet thick

Kgr

Glen Rose Formation - 400+ feet thick

Legend



Limestone



Clay



Baer Engineering
and Environmental Consulting, Inc.

DRAWN BY:

JCC

CHECKED BY:

MS

SCALE:

None



Stratigraphic Column
Ullrich WWTP Lower Pump Station

HDR, Inc.
BAER ENGINEERING PROJECT NO.: 172081.010



ATTACHMENT C – SITE GEOLOGY

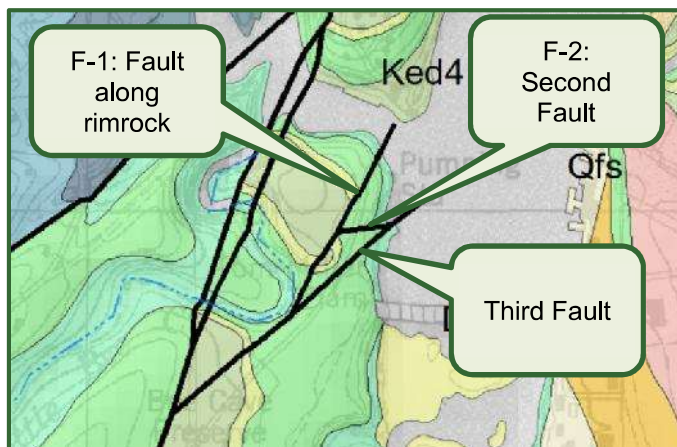
The site is located in the Edwards Aquifer Recharge Zone (EARZ), as shown on Figure C-1. This is a Texas Commission on Environmental Quality (TCEQ)-designated area, created to protect the aquifer from the effects of anthropogenic activities. The EARZ is a karst zone where surface features are known to connect directly to the aquifer. Karst features include caves, solution cavities, and sink holes.

ATTACHMENT D shows the outcrop geology of the project area and surroundings, and shows the location of the Ullrich Waste Water Treatment Plant (WTPP) lower pump station (Site). The Site lies above formations of the Late Cretaceous age Fredericksburg Group, undivided (Kfr) (USGS 2018). Kfr comprises the lower Edwards Aquifer unit and lower confining layers. Kfr overlies the Early Cretaceous Upper Glen Rose Limestone, which is exposed at the ground surface in outcrops northwest of the Site beyond normal faults associated with the Balcones Fault zone. A stratigraphic column showing the relationships of these geologic formations is included as **ATTACHMENT B**.

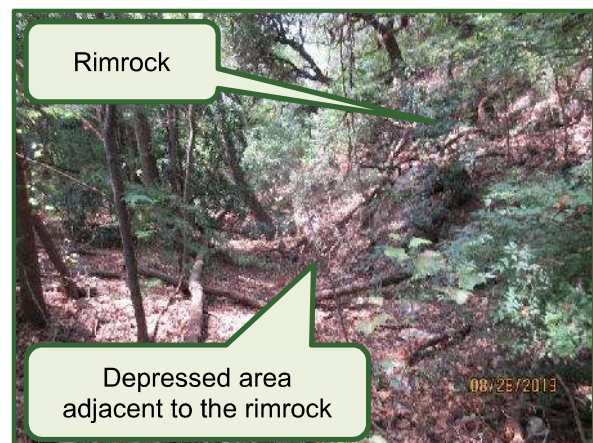
FIELD OBSERVATIONS / DESCRIPTION OF FEATURES

On April 4 and August 28, 2019, Mr. Mark Sloop, P.G. (TX12157), a Baer Engineering Staff Geologist, conducted a field survey of geologic and manmade features at the Site. The Site was surveyed in transects, north to south, spaced 50 feet apart, as topography allowed. Features observed on the Site were documented and located using a hand-held GPS unit.

The Site is adjacent to the Colorado River and south of the mouth of Little Bee Creek. The site slopes downward from south to north. The area was heavily vegetated at the time of the field visit. The site is very close to the Colorado River, a major drinking water source for Austin.



Two faults were identified during the field survey, and are described on the Geologic Assessment Table included as Attachment A. The fault features are identified as F-1 and F-2 and are described below.



Feature F-1, Fault. Canyon rimrock, as defined by the City of Austin, was observed at the Site, running approximately 450 feet in length, oriented N 30° E. The rimrock is approximately 40 feet high. A depression was observed along the base of the entire length of the rimrock, just outside of the proposed limits of construction. The depression extends approximately four feet below the ground surface at its greatest depth, and is filled with leaf litter and fallen tree branches. A photograph of the F-1 rimrock feature and

depression along the base is presented above, to the right. Upon comparison to the 1997 Bureau of Economic Geology (BEG) Austin West Quadrangle geologic map, the canyon rimrock, and depressed area at the base appear to be the surface expressions of a mapped normal fault transecting the Site northeast to southwest, trending sub-parallel to the Balcones fault system. The depression adjacent to the rimrock extended to at or below the elevation of the Colorado River. Records list 0.05 inches of rainfall in the area of the Site the evening before the site visit on April 4th. The F-1 depression did not have standing water following the rain event. This fact and the volume of leaf litter in the depressed area suggests the likelihood of rapid infiltration of surface water into the feature. The proposed alignment would be upgradient of the depression and runoff from the Site would likely reach the depression.

Feature F-2, Fault. A second normal fault is depicted on the BEG geologic map on the Site and appears to coincide with a change in slope observed along the foot path on the eastern side of the Site near the Colorado River. This is a conjugate fault to Feature F-1, and did not have an associated depression. The geologist did not observe signs of infiltration associated with Feature F-2.

A third fault is depicted on the geologic map. The geologist did not observe an associated surface expression for the feature.

GEOLOGIC OPINION

A summary of features found during the field survey is presented in the table below.

#	FEATURE	SENSITIVE
F-1	Fault	Yes
F-2	Fault	No

The normal fault trending northeast on the Site, identified as F-1, appears to allow for rapid infiltration in the depressed area at the base of rimrock. Baer Engineering considers this to be a sensitive feature, based on the scoring in **Attachment A**.

GEOLOGIC ASSESSMENT TABLE

A geologic assessment table (**ATTACHMENT A**) was prepared in accordance with TCEQ document F-0585 – Instructions to Geologists for Geologic Assessments.

It should be noted, if additional sensitive features are encountered during construction, work in the area must cease and the TCEQ regional office must be notified, per 30 TAC §213.5(f)(2).

LIMITATIONS

Recognize that special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions. Even a comprehensive sampling and testing program, implemented with the appropriate equipment and experienced personnel under the direction of a trained professional who functions in accordance with a professional standard of care may fail to detect certain conditions, because they are hidden and therefore cannot be considered in development of a subsurface exploration program. For similar reasons, actual environmental, geologic and geotechnical conditions that the scientist properly infers to exist between sampling points may differ significantly from those that actually exist. The passage of time must also be considered. Recognize that, due to natural occurrences or direct or indirect human intervention at the site or distant from it, actual conditions discovered may quickly change. Realize that nothing can be done to eliminate these risks altogether, but certain techniques can be applied by the scientist to help reduce them to that level deemed tolerable by client. The scientist is available to explain these risks and risk reduction methods to client but, in any event, the scope

of services included with this agreement is that which client agreed to or selected in light of his own risk preferences and other considerations.

REFERENCES

USDA, 2019. United States Department of Agriculture, Natural Resource Conservation Service, Web Soil Survey webpage: <http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>
Last accessed September 9, 2019.


USGS, 2019. United States Geological Survey, online Texas Geology Web Map viewer: <http://txpub.usgs.gov/DSS/texasgeology/> Last accessed September 9, 2019.

BEG, 2019. University of Texas, Bureau of Economic Geology, Austin West Quadrangle, 1979: <https://repositories.lib.utexas.edu/handle/2152/32709>, Last Accessed September 9, 2019.

ATTACHMENTS

- ATTACHMENT A – Geologic Assessment Table
- ATTACHMENT B – Stratigraphic Column
- ATTACHMENT D – Site Geologic Map
- ATTACHMENT D – Site Soils

PREPARED BY


Mark Sloop, P.G. (TX 12157)
Staff Geologist

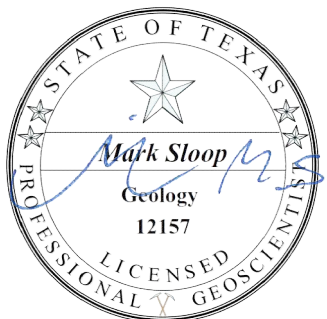








Figure C-1

-  TCEQ Edwards Aquifer Contributing Zone
-  TCEQ Edwards Aquifer Recharge Zone
-  Site

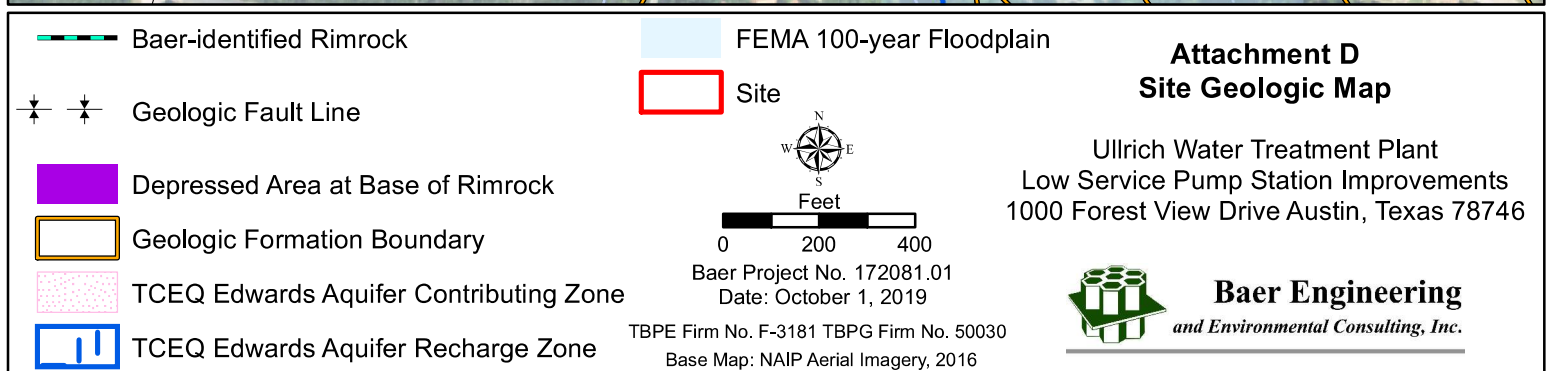
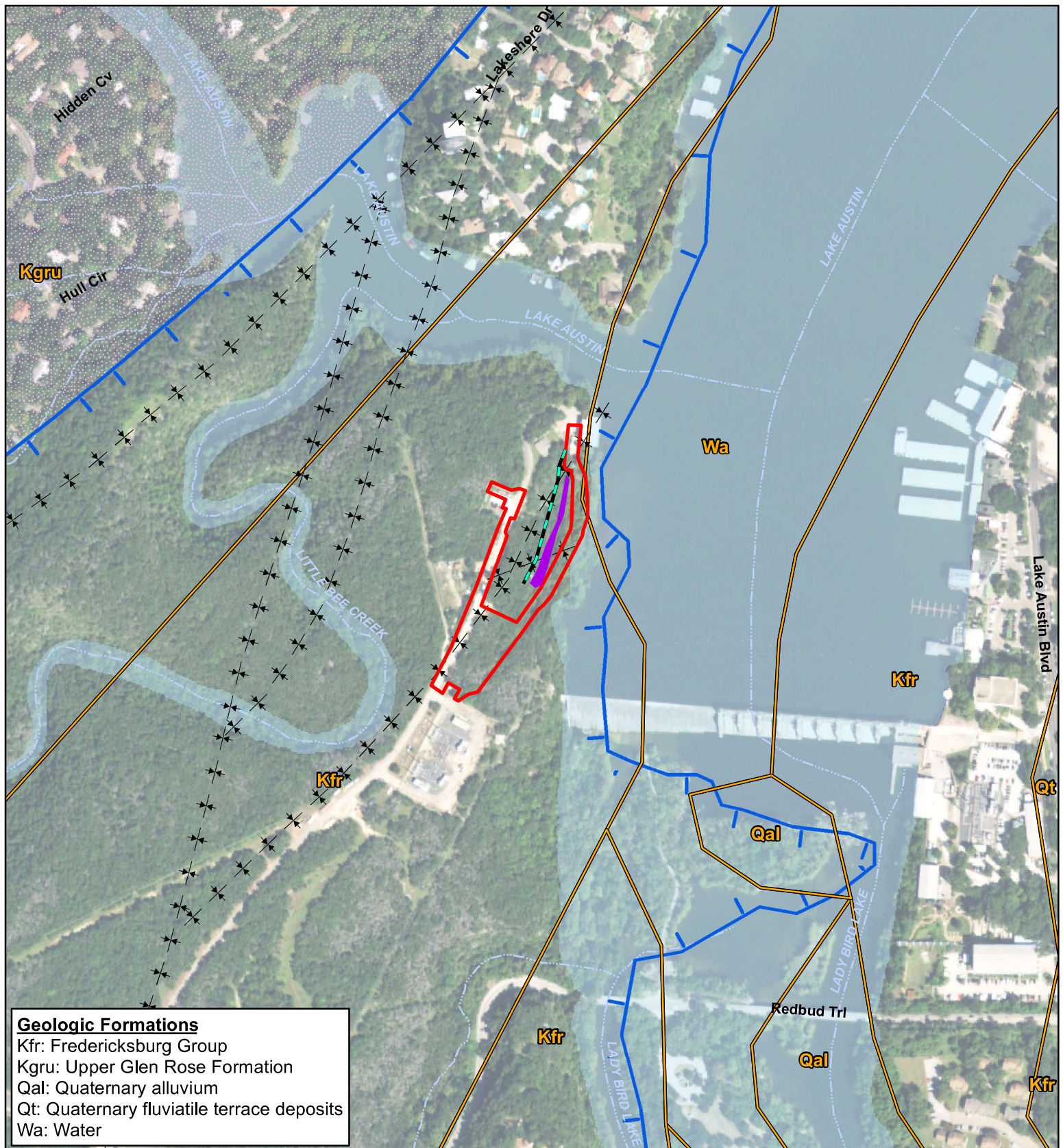

 Feet
 0 200 400
 Baer Project No. 172081.01
 Date: October 1, 2019

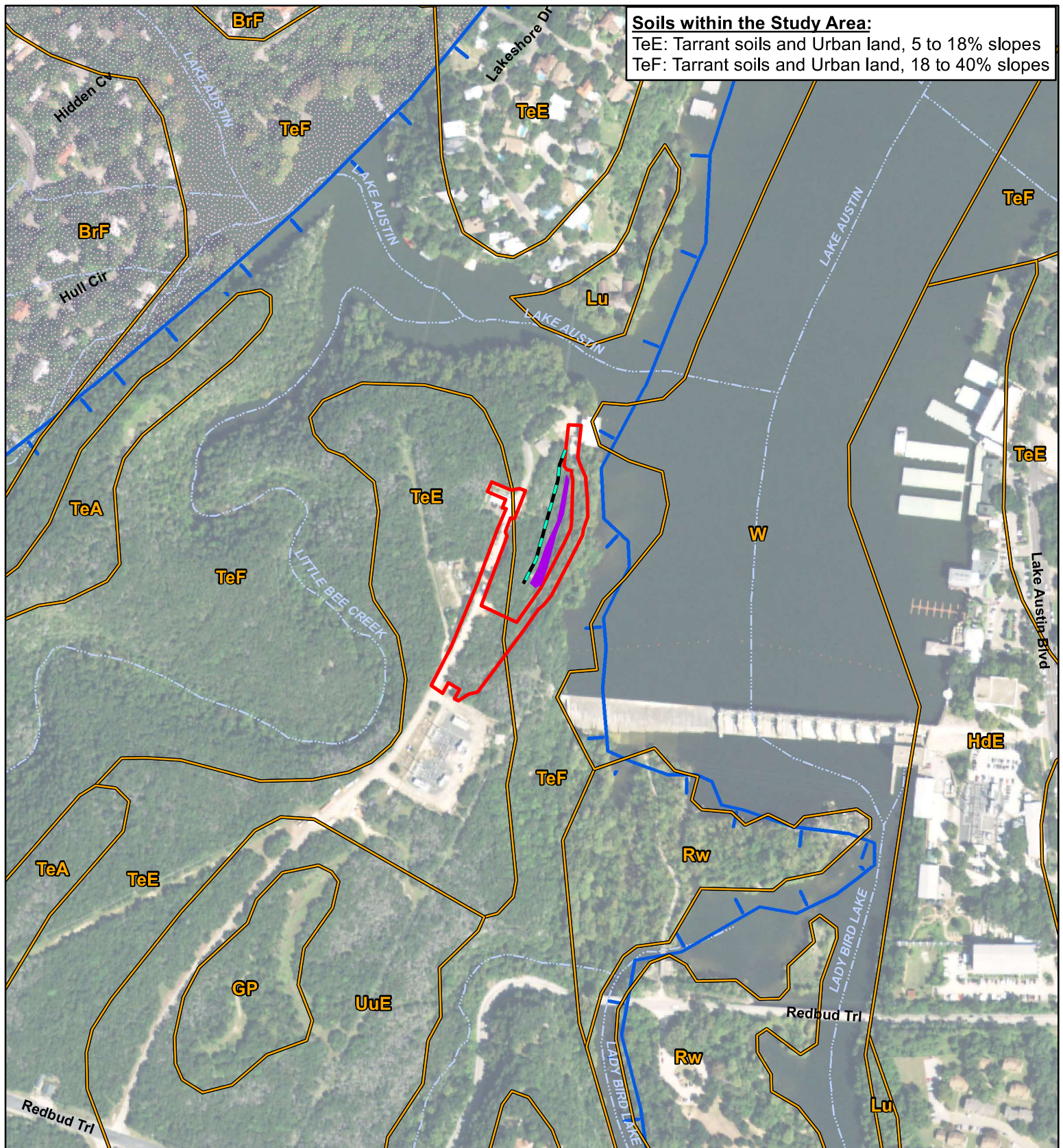
Ullrich Water Treatment Plant
 Low Service Pump Station Improvements
 1000 Forest View Drive Austin, Texas 78746

TBPE Firm No. F-3181 TBPG Firm No. 50030
 Base Map: ESRI World Street Map



Baer Engineering
 and Environmental Consulting, Inc.





Soils within the Study Area:

TeE: Tarrant soils and Urban land, 5 to 18% slopes
 TeF: Tarrant soils and Urban land, 18 to 40% slopes

-  Baer-identified Rimrock
-  Depressed Area at Base of Rimrock
-  TCEQ Edwards Aquifer Contributing Zone
-  TCEQ Edwards Aquifer Recharge Zone
-  Travis County Soils
-  Site



Feet
 0 200 400

Baer Project No. 172081.01
 Date: October 1, 2019

TBPE Firm No. F-3181 TBPG Firm No. 50030

Base Map: NAIP Aerial Imagery, 2016

Attachment E: Site Soils

Ullrich Water Treatment Plant
 Low Service Pump Station Improvements
 1000 Forest View Drive Austin, Texas 78746



Baer Engineering
 and Environmental Consulting, Inc.

Travis County, Texas

TeE—Eckrant soils and Urban land, 5 to 18 percent slopes

Map Unit Setting

National map unit symbol: 2ylv6

Elevation: 500 to 800 feet

Mean annual precipitation: 33 to 36 inches

Mean annual air temperature: 67 to 69 degrees F

Frost-free period: 220 to 270 days

Farmland classification: Not prime farmland

Map Unit Composition

Eckrant and similar soils: 70 percent

Urban land: 25 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eckrant

Setting

Landform: Ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Residuum weathered from limestone

Typical profile

A1 - 0 to 5 inches: very stony clay

A2 - 5 to 8 inches: extremely flaggy clay

R - 8 to 30 inches: bedrock

Properties and qualities

Slope: 5 to 18 percent

Percent of area covered with surface fragments: 0.0 percent

Depth to restrictive feature: 6 to 14 inches to lithic bedrock

Natural drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat):

Moderately low to moderately high (0.06 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 40 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: Very low (about 0.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Low Stony Hill 29-35 PZ (R081CY360TX)
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Brackett

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Adobe 29-35 PZ (R081CY355TX)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Travis County, Texas
Survey Area Data: Version 21, Sep 12, 2019

Travis County, Texas

TeF—Eckrant soils and Urban land, 18 to 40 percent slopes

Map Unit Setting

National map unit symbol: 2ylv2

Elevation: 500 to 800 feet

Mean annual precipitation: 33 to 36 inches

Mean annual air temperature: 67 to 69 degrees F

Frost-free period: 220 to 270 days

Farmland classification: Not prime farmland

Map Unit Composition

Eckrant and similar soils: 80 percent

Urban land: 15 percent

Minor components: 5 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Eckrant

Setting

Landform: Ridges

Landform position (two-dimensional): Backslope

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Residuum weathered from limestone

Typical profile

A1 - 0 to 5 inches: very stony clay

A2 - 5 to 8 inches: extremely flaggy clay

R - 8 to 30 inches: bedrock

Properties and qualities

Slope: 18 to 40 percent

Percent of area covered with surface fragments: 0.0 percent

Depth to restrictive feature: 6 to 14 inches to lithic bedrock

Natural drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat):

Moderately low to moderately high (0.06 to 0.57 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 40 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: Very low (about 0.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: Steep Rocky 29-35 PZ (R081CY363TX)
Hydric soil rating: No

Description of Urban Land

Typical profile

M - 0 to 10 inches: material

Minor Components

Brackett

Percent of map unit: 5 percent
Landform: Ridges
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: Steep Adobe 29-35 PZ (R081CY362TX)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Travis County, Texas
Survey Area Data: Version 21, Sep 12, 2019

Technical Memorandum

Date: April 20, 2020

Project: Ullrich WTP Low Service Pump Station Replacement

To: COA-Water Utility; Design Team; Project Files

Proj. # 10123906

From: Rolland Boehm, PE

Subject: Subsurface Conditions Assessment



1. Introduction

The City of Austin (COA) will be replacing their existing 15kV switchgear facility at the Ullrich Water Treatment Plant Low Service Pump Station (LSPS). HDR has completed design of the new facility, which will be enclosed within a concrete/masonry building immediately adjacent and west of Forest View Drive. In addition to the switchgear, the project also includes a system of electrical duct banks consisting of buried concrete box enclosures. The main or primary duct bank alignment will extend approximately 750 feet from a point near the switchgear building to the LSPS. Other ancillary features include an asphalt access road, paved parking areas, retaining walls, manholes, concrete pads, and box culverts.

The new switchgear facility or building site is located approximately 800 feet north of the existing switchgear and 325 feet from Lake Austin/Colorado River. Attached *Figure 1* provides an aerial view of the project site, including the proposed location for the switchgear facility and primary duct bank alignment.

2. Purpose and Limitations

This memorandum provides a subsurface conditions assessment within the project area. The primary purpose is to provide prospective construction bidders with a professional opinion on the expected or likely subsurface conditions to be encountered. It has been completed based on review of published geological information, relevant historical borings within the project vicinity, and a limited number of project specific exploratory borings. Variations in the subsurface conditions described in this memorandum should be expected. There is no warranty, either expressed or implied.

3. Surface Conditions

The ground surface at the building site generally ranges from El. 565 to 550 feet. This compares to a surface elevation of approximately 512 feet at the existing switchgear. The surface at the building site can generally be described as dense rocky woods. The building site is currently not accessible by vehicle.

The ground surface along the primary duct bank alignment is similar, though generally less tree covered with more significant rock outcropping features. The surface along the alignment drops in elevation from 560 feet to 510 feet (south to north), with most of the elevation drop occurring within the southern half of the alignment.

The entire project site is located within the 500-year floodplain and Edwards Aquifer Recharge Zone.

4. Geological Setting

According to the Geologic Atlas of Texas, Austin Sheet (University of Texas Bureau of Economic Geology, 1974) and Environmental Geology of the Austin Area: An Aid to Urban a Planning (University of Texas Bureau of Economic Geology, 1976), the project is located on the Edwards Formation and the Walnut Formation. The Edwards Formation consist of limestone, dolomite and chert, while the Walnut Formation consists of limestone, marl, marly limestone. The limestone of the Edwards Formation is aphanitic to fine grained, while the dolomite is fine to very fine grained. The limestone is kastic often exhibiting avuggy texture with random larger solution features (e.g. voids and caves). The amount of chert found in the formation varies from bed to bed. The Edwards Limestone is massive to thin bedded and, in areas of weathering, recrystallized and cavernous, forming an aquifer. Thickness ranges from 60 to 360 feet, with the formation thinning out northward. The Walnut Formation is fine to medium grained and thick to thin bedded. The formation consists of five separate units, each approximately 30 feet thick.

Site soils are derived mostly from weathered limestone. At higher elevations the soil profile or zone is relatively thin and rocky. At lower elevations the soil thicknesses can be greater and possibly include recent alluvium material from the adjacent Colorado River

A Geologic Assessment was performed for this project by Baer Engineering and Consulting, Inc. (Baer). The associated report (dated October 11, 2019) provides further description and detail of the geological setting, including three previously mapped geologic fault lines. Baer was able to identify two of the fault lines in the field, whereas the third mapped fault line was not observable. Geologic fault lines within the Austin area are generally considered to be inactive.

5. Geotechnical Borings

5.1 Historical Borings

The COA provided two historical boring logs that were completed in the general vicinity of the site. The approximate location of these borings (R-1 and V-1) is provided on the attached *Figure 2*. Copies of the boring logs can be found in Attachment A.

Based on the logs, each boring was drilled to a depth of 20 feet and essentially encountered limestone the entire length. The logs indicate the limestone is light colored (with staining) and fractured, which is characteristic of the Edwards Limestone Formation. The percent recovery and rock quality designation (RQD) values from retrieved core samples ranged from 6% to 80% and 0% to 36%, respectively. The results from laboratory unconfined compressive testing ranged from 152.7 to 725.9 tons per square foot.

5.2 Switchgear Building Site

An exploratory boring had originally been planned within the footprint of the proposed switchgear building. However, the boring was abandoned due to access and clearing restrictions. A follow-up site reconnaissance of the area generally confirmed limestone at or near the surface. For purposes of design, the subsurface conditions were assumed to consist of residual soils and rock fragments to a depth of 5 feet or less, underlain by Edwards Limestone to a depth of at least 40 feet.

At least two exploratory borings are required to be completed at the building site following clearing activities to confirm the assumed subsurface conditions. The detailed requirements for completing these borings have been incorporated into the Construction Contract documents as a submittal requirement. The findings from the exploratory borings (and associated lab testing) are subject to Engineer review and approval.

5.3 Primary Duct Bank Alignment

An initial boring (B-01A) was completed in December of 2018 near the north end of the primary duct bank alignment, as illustrated on *Figure 3*. HDR's subconsultant, Holt Engineering Inc. (Holt), drilled and sampled the boring to a depth of 30 feet. The boring encountered three feet of Fill of underlain by alluvial soils. The upper three feet of the alluvial soils at this location consist of very soft Fat Clay, underlain by a thick deposit of very loose water bearing Silty Sand. The alluvial Silty Sand persisted to the boring termination depth. A more detailed description of the encountered materials are indicated on boring logs provided in Attachment B.

Not encountering bedrock at boring B-01A was somewhat unexpected, given rock outcropping were observed within the general vicinity. This prompted HDR to engage Holt to drill and sample three additional borings along the northern two-thirds of the duct bank alignment. The purpose of the three additional borings (B-01 thru B-03) was to better identify the lateral and vertical extents of the fill and alluvial soils that were encountered in boring B-01A. The additional borings were drilled in February of 2020, ranging in depth from 30 to 40 feet below ground surface. The approximate boring locations are also illustrated on *Figure 3*. The boring logs are provided in Attachment B and summarized below:

Boring B-01 (Depth = 40 Feet and Surface Elevation = 497.1 ft)

0 to 11.5 feet	Fill – mixture of clay-sand-silt w/rocks
11.5 to 38 feet	soft to very loose Fat to Lean Clay, increasing sand w/ depth (Alluvial)
39 to 40 feet	hard, Limestone

Boring B-02 (Depth = 31 feet and Elevation = 496.3 feet)

0 to 2.5 feet	Fill – mixture of clay-sand-silt w/rocks
2.5 to 7 feet	firm to soft Sandy Clay w/ limestone rocks (Alluvial)
7 to 19 feet	very soft to soft Fat Clay with sand (Alluvial)
19 to 20 feet	limestone fragments, cobbles and/or boulders
20 to 29 feet	firm Sandy Lean Clay (Alluvial)
29 to 31 feet	hard limestone

Boring B-03 (Depth = 30 feet and Elevation = 503.7 feet)

0 to 7 feet	Fill – mixture of clay-sand-silt w/limestone rock fragments
7 to 30 feet	hard limestone w/silt layers, upper 2 feet severely fractured

Stratigraphy Along Alignment

Exposed weathered limestone was noted along the duct bank alignment during a site reconnaissance. The exposed limestone started approximately 75 feet south of boring B-03 and generally persisted all the way to the switchgear facility. The exposed limestone along this stretch of ground is often highly weathered, and at times consisting of rock fragments with soil in-fills. Based on experience, the highly weathered zone is likely limited to the upper two feet or less.

Based on the boring information, a variable amount of Fill exists along the alignment between the bedrock exposure point all the way to the north end of the proposed duct bank. Underlying the Fill are natural Alluvial deposits, ranging from Silty Sand to Sandy Clay to Clay. The underlying Edwards Limestone is hard with thin soil layers/seams and generally of poor quality. The top of limestone appears to dip sharply downward between borings B-02 and B-03 and then dips slightly less between borings B-02 and B-01. The estimate top of bedrock elevation (per boring) is presented in Table 1.

Table 1 - Bedrock Elevation

Boring	Approximate Bedrock Elevation (ft)
B-01	458.2
B-02	467.3
B-03	496.7

The limestone bedrock was cored at boring B-03 from 7 feet to the termination depth of 30 feet. The percent recovery and rock quality designation (RQD) values from retrieved core samples ranged from 38% to 70% and 0% to 50%, respectively. The results from laboratory unconfined compressive testing ranged from 115.0 to 538.6 tons per square foot. The percent recovery and RQD values, and the unconfined compressive strength test results are generally consistent with the findings in historical boring R-1 and V-1.

Groundwater

Boring B-03 was dry to a depth of 7 feet and thereafter rock coring with water was initiated. The addition of coring fluid (water) negated the ability to measure natural groundwater. Groundwater was however noted and recorded during completion of auger borings (B-01A, B-01, and B-02). The depth of encountered ranged from 3.2 feet to 6.8 feet or elevation 489.5 feet to 491.3 feet. These types of water level readings are generally considered short term, suggesting the water level in the borehole may not have been completely equalized with the surrounding water table during the drilling process. However, in all cases the water level measurements are reasonably consistent with the level of Lake Austin, which is generally near El. 493 feet. Given the very close proximity to Lake Austin (<50 feet), it is reasonable to expect the water table to be at the same elevation as the lake.

6. Excavations

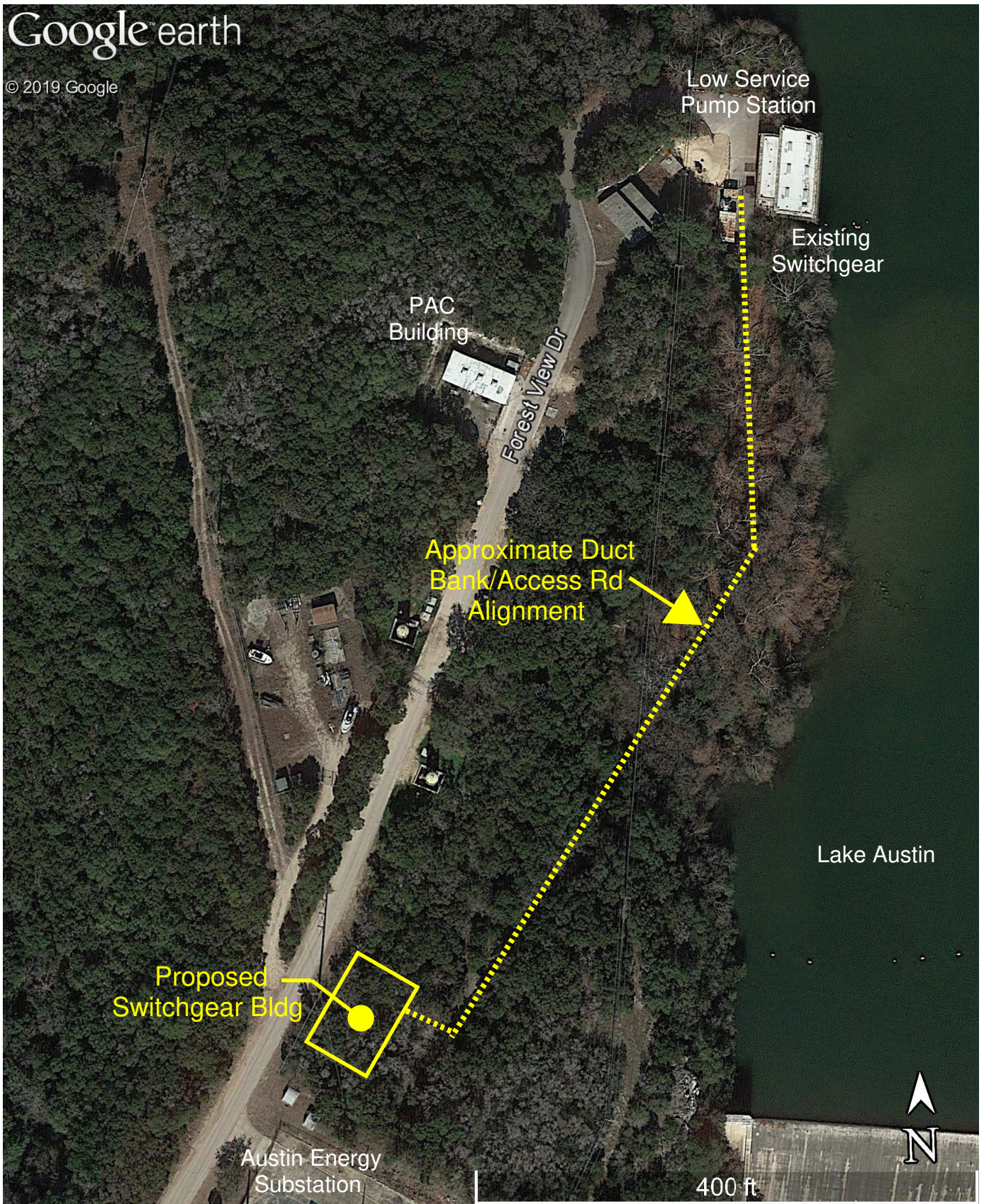
For the most part the Contractor should expect to excavate a significant amount of rock material during site preparation, as well as installation of the duct bank(s) and drilled shafts. The rock mass quality of the Edwards Limestone Formation is generally poor, due to the presence of fractures, vugs, and voids. The presence of fractures within the rock mass should lessen the difficulty in excavating the otherwise hard to very hard Edwards Limestone. However, when developing an excavation plan within this formation it is best to expect areas or zones of less fractured rock.

7. Dewatering

A significant amount of the primary duct bank alignment will be installed within saturated alluvial soils. Based on the borings, a significant portion of these saturated soils are capable of transmitting groundwater. Meaning excavations that extend below the water table may need to be dewatered. In general, excavations that extend a limited distance below the water table, such as 2 to 4 feet, should be compatible with a sump and pump dewatering method. However, excavations that extend further below the water table may require a more aggressive dewatering method (e.g. well points), depending on the actual composition of the surrounding alluvial soil.

Google earth

© 2019 Google



Site Plan
Ullrich WTP Low Service Pump
Station Replacement

DATE

01/08/20

FIGURE

1

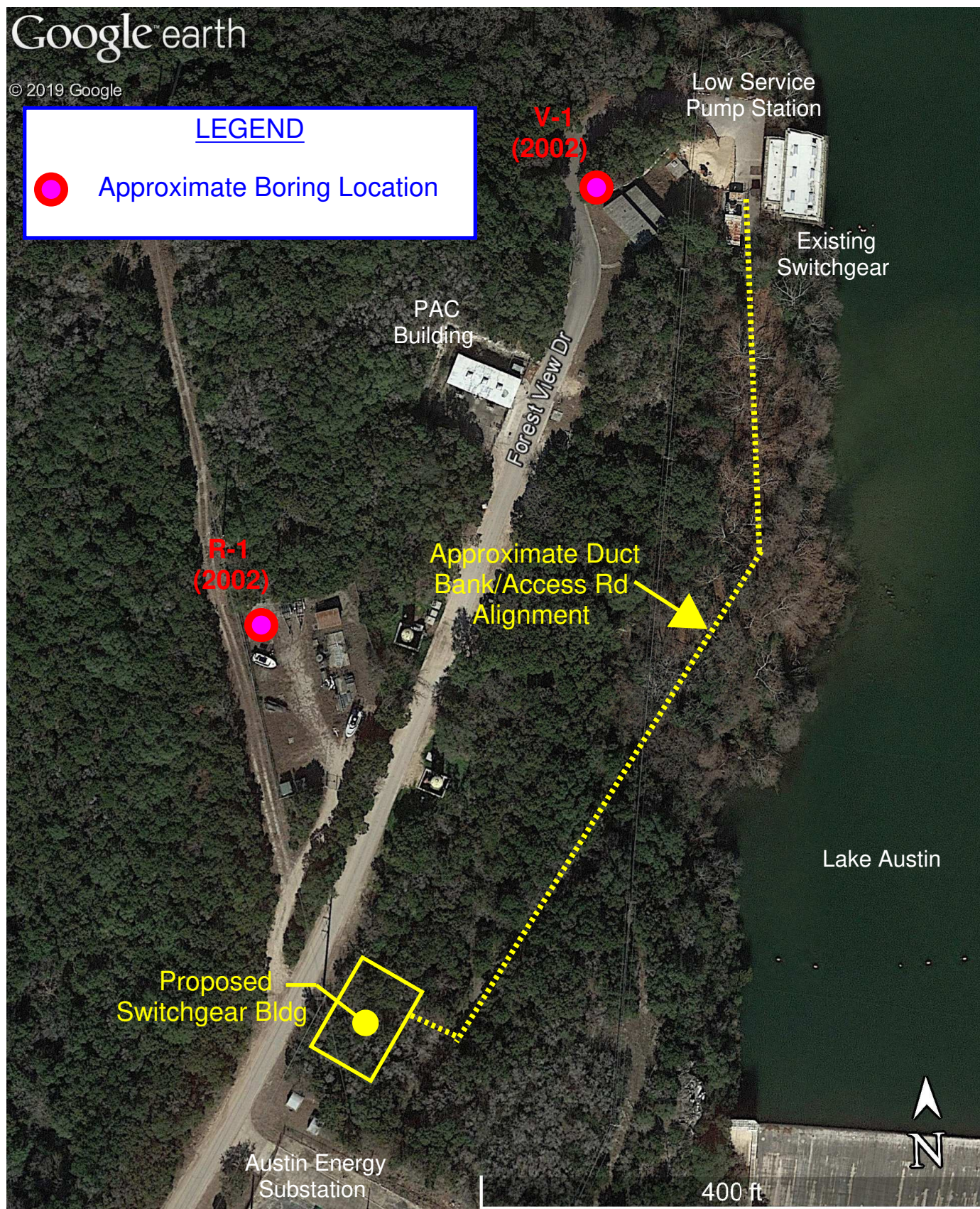
Google earth

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LEGEND



Approximate Boring Location



Historical Boring Locations
Ullrich WTP Low Service Pump
Station Replacement

DATE

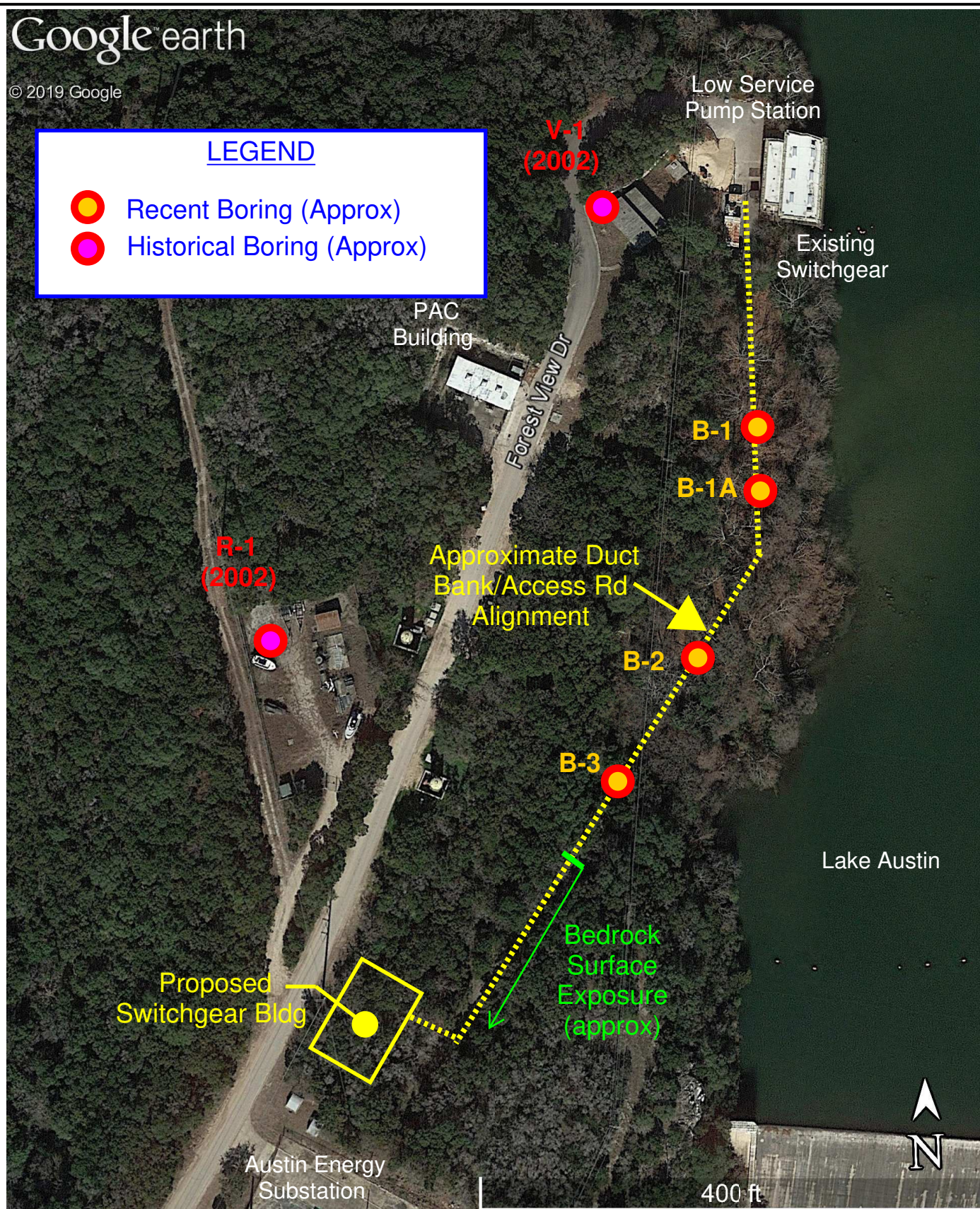
04/02/20

FIGURE

2

LEGEND

- Recent Boring (Approx)
- Historical Boring (Approx)



ATTACHMENT A

LOG OF BORING

Project: Ullrich Water Treatment Plant Expansion

Boring No.: R-1

Groundwater during drilling: none

Groundwater after drilling: N/A

Date: 9-30-02

Northing: 8,364,366.3

Easting: 6,424,214.6

Project No.: 02-107GA-0

Elevation: 573.69 feet

Station: --

Offset: --

ELEV. DEPTH, FEET	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	SOIL/ROCK CLASSIFICATION	% PASSING NO. 200 SIEVE	DRY DENSITY PCF	<div> <div> SHEAR STRENGTH, TSF 0.5 1.0 1.5 2.0 </div> <div> MOISTURE CONTENT, % PLASTIC LIMIT LIQUID LIMIT 10 20 30 40 50 60 70 80 90 </div> </div>
0	R = 76% RQD = 0%	Whitish tan LIMESTONE ; fractured w/ yellow staining on fracture faces; rare, small chert fragments; rare crystals; minor amounts of fossils			
570					
5	R = 62% RQD = 8%	- compressive strength 152.7 tsf			
565		- heavily fractured; yellow and orange staining on fracture faces			
10	R = 80% RQD = 36%	- compressive strength 240.3 tsf			
560		- whitish gray; minor fracturing			
15	R = 76% RQD = 12%	- water loss at 14.0'			
550		- compressive strength 725.9 tsf			
20		- whitish gray w/ red clay on fractures; moderately fractured; calcite crystal coating on some fracture faces			
555					
25					
550					
30					
545					
35					
540					

Shear Types: ● = Hand Penet. ■ = Torvane ▲ = Unconf. Comp. * = UU Triaxial

See Plate 3 for boring location.

PLATE 12

HV Associates, Inc.

Geotechnical, Environmental & Materials Engineers

LOG OF SOIL BORING 02-107GA ULLRICH WWTP GPJ HVJ/GDT 7/1/03

LOG OF BORING

Project: Ullrich Water Treatment Plant Expansion

Boring No.: V-1

Groundwater during drilling: none

Groundwater after drilling: N/A

Date: 10-7-02

Northing: 8,364,604.2

Easting: 6,424,598.3

Project No.: 02-107GA-0

Elevation: 542.62 feet

Station: --

Offset: --

ELEV. DEPTH, FEET	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	SOIL/ROCK CLASSIFICATION	% PASSING NO. 200 SIEVE	DRY DENSITY PCF	<div> <p>SHEAR STRENGTH, TSF</p> <p>MOISTURE CONTENT, %</p> <p>PLASTIC LIMIT LIQUID LIMIT</p> </div>									
0	PP = 4.5 tsf	Light brown and tan FILL MATERIAL w/ sand and gravel												
540	R = 43% RQD = 0%	Whitish tan and white weathered LIMESTONE w/ yellow stains												
5	R = 50% RQD = 0%	- light gray and tan w/ calcite; very fractured; weathered												
535		- compressive strength 175.7 tsf												
10	R = 6% RQD = 0%	- light gray; vuggy												
530		- gray and tan; weathered												
15	R = 10% RQD = 0%													
525														
20														
520														
25														
515														
30														
510														
35														

Shear Types:

● = Hand Penet.

■ = Torvane

▲ = Unconf. Comp.

* = UU Triaxial

See Plate 3 for boring location.

PLATE 19

LOG OF SOIL BORING 02-107GA ULLRICH WWTP GPJ HVJ GDT 7/1/03

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ATTACHMENT B

ULLRICH WATER TREATMENT PLANT 1000 FOREST VIEW DRIVE AUSTIN, TEXAS				LOG OF BORING B- 01A						
DATE DRILLED : 12-05-18		BORING DEPTH : 30.0 FEET		NOTES : Water level 3.2' upon completion of drilling operation. Latitude and longitude approximated with Google Earth, elevation unavailable. ELEVATION : 494.5 ft (est)						
DRILLER : John Webb		WATER LEVEL : 3.2 FEET								
DRILLING METHOD : 4" Flight Augers				LAT : 10080532.121		LONG. : 3099753.102				
DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT (%)	PLASTICITY INDEX	% PASSING #200 SIEVE
			Fill - Unclassified tan & light brown clayey silty sand w/ limestone rock & fragments	18						
			FAT CLAY (CH), brown, silty, very sandy, very soft	4		75.6		100	73	42.7
5			Water level 3.2 feet	3		32.7		55	35	62.6
			SAND, brown, silty, clayey, very loose	4						
10				4		24.9		22	8	20.0
15				2						
			SAND, light brown, silty, clayey, very loose	0						
20				0						
25				0						
30			Terminated @ 30 feet	0						
35										
40										
45										
50										


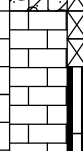
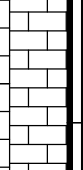
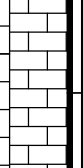
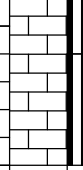
LOG OF BORING B-01

ELEVATION : 497.1 FEET

LAT : 10080582.2430 LONG. : 3099772.6010

















LOG OF BORING 10-33918 - ULLRICH WATER TREATMENT PLANT, 6800 N. F.M. 620, AUSTIN, TX.GPJ HOLT ENGINEERING.GDT 3/3/20

ULLRICH WATER TREATMENT PLANT 1000 FOREST VIEW DRIVE AUSTIN, TEXAS				LOG OF BORING B-02B						
DATE DRILLED : 02-03-20		BORING DEPTH : 31.0 FEET		NOTES : Water level 6.8' upon completion of drilling operation.						
DRILLER : John Webb		WATER LEVEL : 6.8 FEET								
DRILLING METHOD : 4" Flight Augers				LAT : 10080410.0420 LONG. : 3099709.7560						
DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT (%)	PLASTICITY INDEX	% PASSING #200 SIEVE
5			Fill - Unclassified tan & light brown clayey sandy silt w/ small to large limestone rock	38						
			CLAY, dark brown, very silty, sandy w/ scattered small to large limestone rock ,firm to soft	11						
			Water level 6.8 feet	8						
			FAT CLAY (CH), brown and light brown, very soft, increasing sand content	2						
10				0		47.5		54	35	99.0
15				0						
20			-- 19.0' - 20.0' - w/ scattered small to large limestone rock	6						
			SANDY LEAN CLAY (CL), tan, very silty, firm							
25				13		23.1		23	8	63.6
30			LIMESTONE, tan (Ked) -- 29.0' - 31.0' - hard, severely fractured -- 30.0' - 31.0' - hard, solid							
			Terminated @ 31 feet							
35										
40										
45										
50										

ULLRICH WATER TREATMENT PLANT 1000 FOREST VIEW DRIVE AUSTIN, TEXAS								LOG OF BORING B-03						
DATE DRILLED : 02-03-20				BORING DEPTH : 30.0 FEET				NOTES : Dry prior to coring at 9.0'. Water loss 50% at 11.0'-21.0'. Water loss 100% at 21.0'-30.0'. Hole dry upon completion of drilling operation. ELEVATION : 503.7 FEET						
DRILLER : John Webb				WATER LEVEL :										
DRILLING METHOD : 4" Flight Augers								LAT : 10080310.5150 LONG. : 3099668.3610						
DEPTH (feet)	GRAPHIC LOG	SAMPLE	SOIL DESCRIPTION	% CORE RECOVERY	RQD (%)	DRILLING RATE (MIN./FT.)	CORE INTERVAL (FEET)	BLOWS PER FOOT	UCC STR. (TSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT (%)	PLASTICITY INDEX	% PASSING #200 SIEVE
5			Fill - Unclassified light brown & tan clayey silt, very sandy, w/ small to large limestone rock					36						
			Fill - Unclassified tan & light brown clayey sandy silt, w/ thick small to very large limestone rock					19						
10			LIMESTONE, tan (Ked) -- 7.0' - 8.5' - severely fractured, w/ thin light brown silt layers -- 8.5' - 16.5' - hard w/ thin stiff to very stiff silt layers	42	0		9.0	50/6" 50/5"				27	12	26.8
						11.4	115.0	1.8	152.5					
15			-- 16.5' - 23.0' - hard w/ scattered thin firm reddish clayey silt layers	40	8		16.4							
						21.4	420.9	0.6	155.1					
20			-- 21.0' - 100% water loss	70	50		21.4							
						26.0	538.6	1.2	155.0					
25			-- 23.0' - 30.0' - hard w/ numerous thin firm to stiff silt layers	54	28		26.0							
						30.0								
30			Terminated @ 30 feet	38	10		30.0							
35														
40														
45														
50														

BORING LOGS – TERMS & SYMBOLS

SOIL TYPES

 Silt	 Clay	 Sand	 Silty Clay or Clayey Silt
 Silty Sand	 Clayey Sand	 Gravel	 Shale
 Limestone	 Rock/Fragments	 Crushed limestone base	 Tan Limestone w/Interbedded Silt Layers
 Silty clay w/Gravel	 Asphalt	 Sandstone	 Concrete

SAMPLER TYPES

 Standard Penetration Test	 Rock Core	 Seamless Push Shelby Tube	 Grab Sample
---	---	---	---

PARTICLE SIZE (ASTM D2487)

Boulders	>12 in.	Coarse Sand	5 mm – 2 mm	Silt	0.075 mm – 0.005 mm
Cobbles	12 in. – 3 in.	Medium Sand	2 mm – 0.4 mm	Clay	< 0.005 mm
Gravel	3 in. – 5 mm	Fine Sand	0.4 mm – 0.075 mm		

STRENGTH OF COHESIVE SOILS

CONSISTENCY	COMPRESSIVE STRENGTH (TSF)
Very Soft	< 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	> 4.0

DENSITY OF GRANULAR SOILS

NUMBER OF BLOWS PER FT., N	RELATIVE DENSITY
0 – 4	Very Loose
4 – 10	Loose
10 – 30	Medium Dense
30 – 50	Dense
Over 50	Very Dense

Structure Description (ASTM D2488)

Stratified	Alternating layers of varying material or color with layers at least 6 mm thick
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay
Homogeneous	Same color and appearance throughout

Percentages of Sand & Gravel (ASTM D2488)

Trace	< 5%
Few	5% to 10%
Little	15% to 25%
Some	30% to 45%
Mostly	50% to 100%

Criteria for Describing Moisture Conditions (ASTM D2488)

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

LUMP SUM BID FORM

Section 00300L

City Manager
Austin, Texas

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

Solicitation No.:	CLMC822
Project:	Ullrich WTP Low Service Pump Station Electrical Feed Renewal
CIP ID No.:	5335.016

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

BASE BID	\$
Base Bid includes Trench Excavation Safety Systems & Special Shoring		

- The "Base Bid" amount must be used in the MBE/WBE Compliance Plan Summary Page to determine subcontractor participation levels for the established MBE/WBE procurement goals.
- The "Base Bid" amount becomes the Bidder's "TOTAL BID" if allowances and/or alternates are not included.

TRENCH EXCAVATION SAFETY SYSTEMS UNIT PRICES: The undersigned Bidder agrees that the Base Bid Price for the Work, listed above, includes the following amounts in the Bid for excavation safety systems as specified in Item Number 509S of the Specifications and in case of an authorized adjustment to the scope of Work, the following unit price(s) will be used in adjusting the Contract Amount:

Item	Quantity	Unit	Item Description	Unit Price	Amount
509S-1		LF	Trench Excavation Safety Protection Systems (all depth)	\$	\$

ALLOWANCES:

Allowance No. 1:	Security System	\$ 200,000
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BASE BID PLUS ALLOWANCES:

		\$
--	--	----

ALTERNATES:

ALTERNATE NO. 1:	Alternate Water Quality Controls	\$
------------------	----------------------------------	----

Bidding Requirements, Contract Forms and Conditions of the Contract

TOTAL BID	\$
Includes Base Bid plus Subtotal Allowances and Alternate 1, (if accepted at Contract Execution)		

Notes:

1. For a more detailed explanation of Bid allowances, see Section 01020.
2. **MINIMUM WAGES:** Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) for Building Construction and Heavy and Highway Trades "AS APPLICABLE" and/or the minimum wage required by City of Austin Ordinance No. 20160324-015, whichever is higher. The Total Minimum Wage required can be met using any combination of cash and non-cash qualified fringe benefits provided the cash component meets or exceeds the minimum wage required.

UNIT PRICES: The undersigned Bidder agrees that, in case of an authorized adjustment to the scope of Work shown, the following unit price(s) will be used in adjusting the Contract Amount:

Item Description	Unit Price	Per	Unit
Exceeding total vertical footage of pier installations, per Sections 420S and SP 420S, as shown on Drawings, including all labor and material. Exceeded total cumulative footage shall be approved by Owner in writing prior to or during installations.	\$	Per	VF
Void and water flow mitigation			
658S-1 Temporary Void Protection (Plywood Planking)	\$	Per	EA
658S-2 Controlled Low Strength Material for Mitigation	\$	Per	CY
658S-3 Pea Gravel-Filled Polypropylene Bags for Void Mitigation	\$	Per	EA
658S-4 3 to 5 Inch Rock for Void Mitigation	\$	Per	CF
658S-5 Filter Fabric for Void Mitigation	\$	Per	SY
658S-6 Permanent Turf Reinforcement Mat for Void Mitigation	\$	Per	SY
658S-7 Low Slump Concrete	\$	Per	CF
658S-8 Special Trench Safety Associated with Observation of Voids and/or Flowing Water	\$	Per	FT
658S-9 Downtime Associated with Observations of Voids and/or Flowing Water	\$	Per	Day

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

Bidding Requirements, Contract Forms and Conditions of the Contract

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

GEOTECHNICAL DATA ACKNOWLEDGEMENT: The undersigned Bidder certifies that the Bidder has read and understands the Geotechnical Data Report and all other geotechnical related information provided in the Contract Documents, including all Addenda. **The Bidder acknowledges and agrees that the Geotechnical Data represents the subsurface conditions reasonably anticipated to be encountered during construction. The Geotechnical Data will be used to evaluate whether subsurface conditions differ materially from those indicated in the Geotechnical Data Report.**

TIME OF COMPLETION: The undersigned Bidder agrees to commence work on the date specified in the written "Notice to Proceed" to be issued by the OWNER and to substantially complete construction of the improvements, as required by the Project Manual, Drawings and Addenda for the Work within nine hundred and sixty days (960) Calendar Days.

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

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

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

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

Therefore, the Bidder and the OWNER agree that for each and every Calendar Day the Work or any portion thereof, remains incomplete after the Substantial Completion date as established by the above paragraph, "Time of Completion", payment will be due to the Owner in the amount of one thousand six hundred and sixty dollars (\$1,660) per Working Day as liquidated damages, not as a penalty, but for delay damages to the OWNER.

If both Substantial and Final Completion dates have been specified, the Bidder and the OWNER further agree that for each and every Calendar Day the Work or any portion thereof, remains incomplete after the Final Completion date as established by the above paragraph, "Time of Completion", payment will be due to the OWNER in the amount of six

Bidding Requirements, Contract Forms and Conditions of the Contract

hundred and fifty dollars (\$650) per Calendar Day as liquidated damages, not as a penalty, but for delay damages to the OWNER. Such amount shall be deducted by the OWNER from any Contract payment due.

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

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

ADDENDUM: The undersigned acknowledges receipt of the following addenda:

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

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

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

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

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

____ MBE/WBE Compliance Document

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

____ Bid Guaranty

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

Corporate Secretary, *if Bidder is a Corporation

Bidder

Email for Secretary

Authorized Signature/Print Name

(Seal)

Title

Date

Address

Telephone Number / FAX Number

Email for Person Signing Bid

Email for Bidder's Primary Contact Person

END

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TOTAL BID FORM

Solicitation No.:	CLMC822
Project:	Ullrich LSPS Electrical Feed Renewal Project
Bidder:	
Total Bid Amount: (includes Base Bid plus any Allowances or Alternates shown in Section 00300L)	

Notes:

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

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STATEMENT OF BIDDERS EXPERIENCE

Section 00400

Project Name:	Ullrich WTP Low Service Pump Station Electrical Feed Renewal
Name of Bidder:	
Solicitation Number:	CLMC822
CIP ID Number:	5335.016

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

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

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

POST-BID SUBMITTALS

ATTACHMENT A – BIDDER’S INFORMATION

ATTACHMENT B – EXPERIENCE REQUIREMENTS (GENERAL CONTRACTOR)

ATTACHMENT C – PROJECT MANAGER AND SUPERINTENDENT EXPERIENCE

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

ATTACHMENT E – AVAILABLE EQUIPMENT

ATTACHMENT F – AVAILABLE WORKFORCE

ATTACHMENT G – CURRENT PROJECTS

ATTACHMENT H – COMPLETED PROJECTS

ATTACHMENT I – BIDDER’S AUTHENTICATION

**ATTACHMENT A
BIDDER'S INFORMATION**

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

Solicitation Number:	CLMC822
CIP ID Number:	5335.016

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

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

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

E.	Has the Bidder ever defaulted on a contract?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
F.	Are there currently any pending judgements, claims, or lawsuits against the Bidder?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
G.	Does Bidder currently have any pending claims, judgements or lawsuits against any prior client?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
H.	Is the Bidder or its principals involved in any bankruptcy or reorganization proceedings?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

ATTACHMENT B

EXPERIENCE REQUIREMENTS (GENERAL CONTRACTOR)

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

Solicitation Number:	CLMC822
CIP ID Number:	5335.016

GENERAL CONTRACTOR EXPERIENCE:

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

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

Bidding Requirements, Contract Forms and Conditions of the Contract

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

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

ATTACHMENT C

PROJECT MANAGER & SUPERINTENDENT EXPERIENCE

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

Name of Bidder:	
Solicitation Number:	CLMC822
CIP ID Number:	5335.016

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

Project Manager (name): _____

Superintendent (name): _____

Note: Attach Resumes & Experience

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

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

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

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

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

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

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

SPECIFIC CONSTRUCTION EXPERIENCE ITEMS REQUIRED:

- ITEM 1. Furnish and/or installation of substation building with 15kV switchgear and associated ductbank

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

CONSTRUCTION EXPERIENCE DOCUMENTATION FORM	
EXPERIENCE ITEM NUMBER:	
Project Number:	
Does Bidder plan to self-perform this work?	<input type="checkbox"/> Yes <input type="checkbox"/> No
If "NO", provide the following Subcontractor's information:	
Company's Address:	
Permanent Address:	

Bidding Requirements, Contract Forms and Conditions of the Contract

Phone No.		
# of years Subcontractor has been in business under current company name:		
Name of Project:		
Location:		
OWNER's Name:		
OWNER's Address:		
OWNER's Contact Person (Print):		
Phone/Fax No.:		
Initial Contract Price:		
Final Contract Price:		
Contract Start Date: <i>(Date of Notice to Proceed)</i>		
Contract Time:	Calendar Days:	Working Days:
Contract Substantial Completion Date:		
Actual Substantial Completion Date:		
If contract time extensions were added to the contract as a result of Bidder's responsibilities, provide a short explanation of each:		
Project Description and why it is comparable to this Contract:		

**ATTACHMENT E
AVAILABLE EQUIPMENT LIST**

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

Name of Bidder:	
Solicitation Number:	CLMC822
CIP ID Number:	5335.016

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

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

Use additional pages, as necessary

**ATTACHMENT F
AVAILABLE WORKFORCE**

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

Name of Bidder:	
Solicitation Number:	CLMC822
CIP ID Number:	5335.016

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

Number of Anticipated Work Crews: _____

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

Use additional pages, as necessary

ATTACHMENT G

CURRENT PROJECT LISTING (INCLUDING ALL CITY OF AUSTIN PROJECTS)

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

Name of Bidder:	
Solicitation Number:	CLMC822
CIP ID Number:	5335.016

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

Name of Project:		
Location:		
Type of Job:		
City of Austin Job?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Project Start Date		
Estimated Completion Date:		
Project Contact:		
Brief Description:		

Name of Project:		
Location:		
Type of Job:		
City of Austin Job?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Project Start Date		
Estimated Completion Date:		
Project Contact:		
Brief Description:		

ATTACHMENT H

COMPLETED PROJECTS (INCLUDING ALL CITY OF AUSTIN PROJECTS)

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

Name of Bidder:	
Solicitation Number:	CLMC822
CIP ID Number:	5335.016

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

Calendar Year of _____

Name of Project:		
Location:		
Type of Job:		
City of Austin Job?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Project Duration:		
Project Contact:		
Brief Description:		

Name of Project:		
Location:		
Type of Job:		
City of Austin Job?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Project Duration:		
Project Contact:		
Brief Description:		

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

**ATTACHMENT I
BIDDERS AUTHENTICATION**

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

Solicitation Number:	CLMC822
CIP ID Number:	5335.016

THE STATE OF TEXAS
COUNTY OF TRAVIS

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

Bidder's full name and entity status:

Company's Name

Signature, Authorized Representative of Bidder

Title

Date

END

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CERTIFICATE OF NON-SUSPENSION OR DEBARMENT

Section 00405

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

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

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

Contractor's full name and entity status:

(Name/Signature of Authorized Official)

Title

Date

END

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REGULATORY NOTICE AND CITATION HISTORY DATA	
<p>Provide bidder's information regarding regulatory OSHA and/ or Environmental Protection Agency Notices and Citations as follows:</p> <p>Describe federal, state, city/municipal or county OSHA notices of noncompliance or citations issued to or received by the bidder within the past three years or any notices from any environmental protection agency, including any notices or citations from any state agency or local government responsible for enforcing environmental protection or other health and safety laws or regulations of any state of the United States, received within the past three years.</p>	<p>Provide a description of each on the OSHA/ EPA form on the following page to include:</p> <ul style="list-style-type: none"> • Date of Citation/Notices • Issuing agency • Standard cited • Level of violation (i.e. serious, willful) • Dates and brief description(s) of the event(s) • Brief description(s) of actions taken to correct the violation(s) • Current status (Open, Closed, Contested) • If Closed, date of Closure • If Open, estimated date of Closure
<p>Bidder may include additional information explaining any related circumstances.</p>	
<p>Evaluation: Information may be verified by referring to respective agency. More than two serious or more than one willful or repeated violation (investigation completed) within the past three years may deem the Bidder non-responsive.</p>	

Bidding Requirements, Contract Forms and Conditions of the Contract

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

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

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

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

ACKNOWLEDGEMENT

THE STATE OF TEXAS

COUNTY OF TRAVIS

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

Contractor's full name and entity status:

(Name/Signature of Authorized Official)

Title

Date

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

State of Texas

County of Travis

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

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

1. **Anti-Collusion Statement.** The Bidder has not and will not in any way directly or indirectly:
 - a. colluded, conspired, or agreed with any other person, firm, corporation, bidder or potential bidder to the amount of this bid or the terms or conditions of this bid.
 - b. paid or agreed to pay any other person, firm, corporation bidder or potential bidder any money or anything of value in return for assistance in procuring or attempting to procure a contract or in return for establishing the prices in the attached bid or the bid of any other bidder.
2. **Preparation of Invitation for Bid and Contract Documents.** The Bidder has not received any compensation or a promise of compensation for participating in the preparation or development of the underlying bid or contract documents., In addition, the Bidder has not otherwise participated in the preparation or development of the underlying bid or contract documents, except to the extent of any comments or questions and responses in the bidding process, which are available to all bidders, so as to have an unfair advantage over other bidders, provided that the Bidder may have provided relevant product or process information to a consultant in the normal course of its business.
3. **Participation in Decision Making Process.** The Bidder has not participated in the evaluation of bids or proposals or other decision making process for this solicitation, and, if Bidder is awarded a contract hereunder, no individual, agent, representative, consultant or sub contractor or consultant associated with Bidder, who may have been involved in the evaluation or other decision making process for this solicitation, will have any direct or indirect financial interest in the Contract, provided that the Bidder may have provided relevant product or process information to a consultant in the normal course of its business.
4. **Present Knowledge.** Bidder is not presently aware of any potential or actual conflicts of interest regarding this solicitation, which either enabled Bidder to obtain an advantage over other bidders or would prevent Bidder from advancing the best interests of OWNER in the course of the performance of the Contract.

5. **City Code.** As provided in Sections 2-7-61 through 2-7-65 of the City Code, no individual with a substantial interest in Bidder is a City official or employee or is related to any City official or employee within the first or second degree of consanguinity or affinity.
6. **Chapter 176 Conflict of Interest Disclosure.** In accordance with Chapter 176 of the Texas Local Government Code, the Bidder:
 - a. does not have an employment or other business relationship with any local government officer of OWNER or a family member of that officer that results in the officer or family member receiving taxable income;
 - b. has not given a local government officer of OWNER one or more gifts, other than gifts of food lodging transportation or entertainment accepted as a guest, that have an aggregate value of more than \$100 in the twelve-month period preceding the date the officer becomes aware of the execution of the Contract or that OWNER is considering doing business with the Bidder; and
 - c. does not have a family relationship with a local government officer of OWNER in the third degree of consanguinity or the second degree of affinity.

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

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

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

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

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

Bidding Requirements, Contract Forms and Conditions of the Contract

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

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

END

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NONRESIDENT BIDDER PROVISIONS

Section 00475

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

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

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

Answer: _____

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

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

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

Answer: ☐ Yes ☐ No Which state? _____

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

Answer: _____

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AGREEMENT SECTION

Section 00500

**STATE OF TEXAS
COUNTY OF TRAVIS**

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

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

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

\$	
(Figures)	(Words)

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

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

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

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

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

This project is subject to the American Iron and Steel (AIS) requirements of federal law, including federal appropriation acts and Section 1452(a)(4) of the Safe Drinking Water Act (42 U.S.C. §300j-12(a)(4)) and the Texas Water Development Board requirements and supplemental conditions (TWDB 0550), as applicable. All iron and steel products for construction, alteration, maintenance, or repairs incorporated in these plans must be produced in the United States.

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

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

PERFORMANCE BOND

Section 00610

STATE OF TEXAS

COUNTY OF _____

Bond No. _____

C.I.P. ID No. _____

Project Name _____

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

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

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

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

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

Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, for a period of one (1) year beyond the date of approval for 100 percent of the contract price by the engineer of the OWNER (Water Code 17.183(2)(B)).

The work described in the Agreement shall be guaranteed without limitation to be completed according to the Drawings and Specifications in accordance with sound construction principles and practices (Water Code 17.183(2)(A)).

In witness whereof, said Principal and Surety have signed and sealed this instrument this

_____ day of _____, _____.

Principal

Surety

By _____
(Signature)

By _____
(Signature)

Title _____

Title _____

Address _____

Address _____

Telephone _____ Fax _____

E-Mail Address _____

Name and address of Resident Agent of Surety:

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

END

Bidding Requirements, Contract Forms and Conditions of the Contract

PAYMENT BOND

Section 00620

STATE OF TEXAS

COUNTY OF _____

Bond No. _____

C.I.P. ID No. _____

Project Name: _____

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

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

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

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

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

Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, for a period of one (1) year beyond the date of approval for 100 percent of the contract price by the engineer of the OWNER (Water Code 17.183(2)(B)).

In witness whereof, said Principal and Surety have signed and sealed this instrument this

_____ day of _____, _____.

Principal

Surety

By _____

By _____

Bidding Requirements, Contract Forms and Conditions of the Contract

(Signature)

(Signature)

Title_____

Title_____

Address_____

Address_____

Telephone_____Fax_____

E-Mail Address _____

Name and address of Resident Agent of Surety:

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

END

NON-DISCRIMINATION AND NON-RETALIATION CERTIFICATE

Section 00630

**City of Austin, Texas
Equal Employment/Fair Housing Office**

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

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

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

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

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

Bidding Requirements, Contract Forms and Conditions of the Contract

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

City of Austin

Minimum Standard Non-Discrimination and Non-Retaliation in Employment Policy

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

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

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

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

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

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

(<http://austintexas.gov/page/bid-docs>).

Sanctions:

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

Term:

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

END

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TITLE VI ASSURANCES APPENDIX A

Section 00631

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

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

1. Compliance with Regulations: The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Nondiscrimination in Federally-assisted programs of the U.S. Department of Transportation, the Federal Highway Administration, as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. Nondiscrimination: The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, or national origin in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate either directly or indirectly in the discrimination prohibited by the Acts and the Regulations, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 C.F.R. part 21.
3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding or negotiation made by the contract for work to be performed under a subcontract, including procurements of materials or leases of equipment, each potential subcontractor or supplier shall be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Nondiscrimination on the grounds of race, color, or national origin.
4. Information and Reports: The contractor shall provide all information and reports required by the Acts, the Regulations, and directives issued pursuant thereto and will permit access to its book, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the Federal Highway Administration to be pertinent to ascertain compliance with such Acts, Regulations, and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish this information the contractor will so certify to the Recipient, or the Federal Highway Administration, as appropriate, and will set forth what efforts it has made to obtain the information.
5. Sanctions for Noncompliance: In the event of the contractor's noncompliance with the Nondiscrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the Federal Highway Administration may determine to be appropriate, including, but not limited to:
 - (a) withholding of payments to the contractor under the contract until the contractor complies, and or
 - (b) cancelling, terminating or suspending a contract, in whole or in part.
6. Incorporation of Provisions: The contractor will include the provisions of paragraphs one through six in every subcontract, including procurements of materials and leases of equipment, unless exempt by the Acts, the Regulations and directives issued pursuant thereto. The contractor will take action with respect to any subcontract or procurement as the Recipient or the Federal Highway Administration may direct as a means of enforcing such provisions including sanctions for non-compliance: Provided, that if a

Bidding Requirements, Contract Forms and Conditions of the Contract

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

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

Contractor's full name and entity status:

(Name/Signature of Authorized Official)

Title

Date

END

TITLE VI ASSURANCES APPENDIX E

Section 00632

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

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

Pertinent Nondiscrimination Authorities:

1. Title VI of the Civil Rights Act of 1964 (42 U.S.C. § 2000d et seq., 78 stat. 252), (prohibits discrimination on the basis of race, color, national origin); and 49 C.F.R. Part 21.
2. The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, (42 U.S.C. § 4601), (prohibits unfair treatment of persons displaced or whose property has been acquired because of Federal or Federal-aid programs and projects);
3. Federal-Aid Highway Act of 1973, (23 U.S.C. § 324 et seq.), (prohibits discrimination on the basis of sex);
4. Section 504 of the Rehabilitation Act of 1973, (29 U.S.C. § 794 et seq.), as amended, (prohibits discrimination on the basis of disability); and 49 C.F.R. Part 27;
5. The Age Discrimination Act of 1975, as amended, (42 U.S.C. § 6101 et seq.), (prohibits discrimination on the basis of age);
6. Airport and Airway Improvement Act of 1982, (49 U.S.C. § 4 71, Section 4 7123), as amended, (prohibits discrimination based on race, creed, color, national origin, or sex);
7. The Civil Rights Restoration Act of 1987, (PL 100-209), (Broadened the scope, coverage and applicability of Title VI of the Civil Rights Act of 1964, The Age Discrimination Act of 1975 and Section 504 of the Rehabilitation Act of 1973, by expanding the definition of the terms "programs or activities" to include all of the programs or activities of the Federal-aid recipients, subrecipients and contractors, whether such programs or activities are Federally funded or not);
8. Titles II and III of the Americans with Disabilities Act, which prohibit discrimination on the basis of disability in the operation of public entities, public and private transportation systems, places of public accommodation, and certain testing entities (42 U.S.C. §§ 12131-12189) as implemented by Department of Transportation regulations at 49 C.F.R. parts 37 and 38;
9. The Federal Aviation Administration's Nondiscrimination statute (49 U.S.C. § 47123) (prohibits discrimination on the basis of race, color, national origin, and sex);
10. Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, which ensures nondiscrimination against minority populations by discouraging programs, policies, and activities with disproportionately high and adverse human health or environmental effects on minority and low-income populations;

Bidding Requirements, Contract Forms and Conditions of the Contract

11. Executive Order 13166, Improving Access to Services for Persons with Limited English Proficiency, and resulting agency guidance, national origin discrimination includes discrimination because of limited English proficiency (LEP).
12. To ensure compliance with Title VI, you must take reasonable steps to ensure that LEP persons have meaningful access to your programs (70 Fed. Reg. at 74087 to 74100);
13. Title IX of the Education Amendments of 1972, as amended, which prohibits you from discriminating because of sex in education programs or activities (20 U.S.C. 1681 et seq).

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

Contractor's full name and entity status:

(Name/Signature of Authorized Official)

Title

Date

END

Bidding Requirements, Contract Forms and Conditions of the Contract
CERTIFICATE OF INSURANCE
Section 00650

This Certificate shall be completed by a licensed insurance agent:

Name and Address of Agency:

Phone: _____ / _____

Name and Address of Insured:

Phone: _____ / _____

Prime or Sub-Contractor?: _____

Name of Prime Contractor, if different from Insured: _____

City of Austin Reference:

Project Name:

C.I.P. No.:

Project Location:

Managing Dept.:

Contract No.:

Project Mgr.:

Insurers Affording Coverages:

Insurer A:

Insurer B:

Insurer C:

Insurer D:

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

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

This form is for informational purposes only and certifies that policies of insurance listed above have been issued to insured named above and are in force at this time. Notwithstanding any requirements, term or condition of any contract or other document with respect to which this certificate may be issued or may pertain, insurance afforded by policies described herein is subject to all terms, exclusions and conditions of such policies.

CERTIFICATE HOLDER:

DATE ISSUED: _____

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

AUTHORIZED REPRESENTATIVE SIGNATURE
Licensed Insurance Agent

END

Bidding Requirements, Contract Forms and Conditions of the Contract
TEXAS SALES AND USE TAX EXEMPTION CERTIFICATE
Section 00670

City of Austin, Texas
P.O. Box 1088
Austin, Texas 78767

CONTRACTOR/ PURCHASER: _____

Street Address: _____

City, State, ZIP Code: _____

PROJECT: _____

Project Manager: _____

FDU No.: _____

CIP ID No.: _____

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

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

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

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

City of Austin, Texas	Title	Date
 ELAINE HART	DEPUTY CITY MANGER/CHIEF FINANCIAL OFFICER	January 11, 2019

CONTRACTOR/ PURCHASER: _____

By: _____

Title: _____

Date: _____

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

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

End

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Bidding Requirements, Contract Forms and Conditions of the Contract
GENERAL CONDITIONS OF THE CONTRACT
Section 00700

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ARTICLE 1 – DEFINITIONS

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

- 1.1 Addendum** - Written instruments issued by the Contract Awarding Authority which clarify, correct or change the bidding requirements or the Contract Documents prior to the Due Date. "Addenda" is the plural form of Addendum.
- 1.2 Agreement** - Prescribed form, Section 00500.
- 1.3 Alternative Dispute Resolution** - The process by which a disputed Claim may be settled if the OWNER and the CONTRACTOR cannot reach an agreement between themselves, as an alternative to litigation.
- 1.4 Bid** - A complete, properly signed response to an Invitation for Bid that, if accepted, would bind the Bidder to perform the resultant Contract.
- 1.5 Bidder** - A person, firm, or entity that submits a Bid in response to a Solicitation. Any Bidder may be represented by an agent after submitting evidence demonstrating the agent's authority. The agent cannot certify as to his own agency status.
- 1.6 Bid Documents** - The advertisement or Invitation for Bids, instructions to Bidders, the Bid form, the Contract Documents and Addenda.
- 1.7 Calendar Day** - Any day of the week; no days being excepted. Work on Saturdays, Sundays, and/or Legal Holidays shall be coordinated with OWNER.
- 1.8 Change Directive** - A written directive to CONTRACTOR, signed by OWNER, ordering a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Amount or Contract Time, or both. A Change Directive may be used in the absence of total agreement on the terms of a Change Order. A Change Directive does not change the Contract Amount or Contract Time, but is evidence that the parties expect that the change directed or documented by a Change Directive will be incorporated in a subsequently issued Change Order.
- 1.9 Change Orders** - Written agreements entered into between CONTRACTOR and OWNER authorizing an addition, deletion, or revision to the Contract, issued on or after the Execution Date of the Agreement.
- 1.10 Claim** - A written demand seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract.
- 1.11 Contract** - The binding legal agreement between the OWNER and the CONTRACTOR. The Contract represents the entire and integrated agreement between OWNER and CONTRACTOR for performance of the Work, as evidenced by the Contract Documents.
- 1.12 Contract Amount** - The moneys payable by OWNER to CONTRACTOR for completion of the Work in accordance with the Contract Documents.
- 1.13 Contract Awarding Authority** - A City department authorized to enter into Contracts on behalf of the City.
- 1.14 Contract Documents** - Project Manual, Drawings, Addenda and Change Orders.
- 1.15 Contract Time** - The number of days allowed for completion of the Work as defined by the Contract. When any period is referred to in days, it will be computed to exclude the first and include the last day of such period. A day of twenty-four hours measured from midnight to the next midnight will constitute a day.

- 1.16 CONTRACTOR** - The individual, firm, corporation, or other business entity with whom OWNER has entered into the Contract for performance of the Work.
- 1.17 Critical Path** - The longest series of tasks that runs consecutively from the beginning to the end of the project, as determined by duration and workflow sequence. This longest path sets the managerial standard for how quickly a project can be completed, given appropriate resources.
- 1.18 Drawings** - Those portions of the Contract Documents which are graphic representations of the scope, extent and character of the Work to be furnished and performed by CONTRACTOR and which have been approved by OWNER. Drawings may include plans, elevations, sections, details, schedules and diagrams. Shop Drawings are not Drawings as so defined.
- 1.19 Due Date** - The date and time specified for receipt of Bids.
- 1.20 Engineer/Architect (E/A)** - The OWNER's design professional identified as such in the Contract. The titles of "Architect/Engineer," "Architect" and "Engineer" used in the Contract Documents shall read the same as Engineer/Architect (E/A). Nothing contained in the Contract Documents shall create any contractual or agency relationship between E/A and CONTRACTOR.
- 1.21 Equal** - The terms "equal" or "approved equal" shall have the same meaning.
- 1.22 Execution Date** - Date of last signature of the parties to the Agreement.
- 1.23 Field Order** - A written order issued by Owner's Representative which orders minor changes in the Work and which does not involve a change in the Contract Amount or the Contract Time.
- 1.24 Final Completion** - The point in time when OWNER determines that all Work has been completed and final payment to CONTRACTOR will be made in accordance with the Contract Documents.
- 1.25 Force Account** - a basis of payment for the direct performance of Work with payment based on the actual cost of the labor, equipment and materials furnished and consideration for overhead and profit as set forth in Section 11.5.
- 1.26 Inspector** - The authorized representative of any regulatory agency that has jurisdiction over any portion of the Work.
- 1.27 Invitation for Bid (IFB)** - a Solicitation requesting pricing for a specified Good or Service which has been advertised for Bid in a newspaper and/or the Internet.

1.28 Legal Holidays

1.28.1 The following are recognized by the OWNER:

<u>Holiday</u>	<u>Date Observed</u>
New Year's Day	January 1
Martin Luther King, Jr.'s Birthday	Third Monday in January
President's Day	Third Monday in February
Memorial Day	Last Monday in May
Independence Day	July 4
Labor Day	First Monday in September
Veteran's Day	November 11
Thanksgiving Day	Fourth Thursday in November
Friday after Thanksgiving	Friday after Thanksgiving
Christmas Eve	December 24
Christmas Day	December 25

- 1.28.2** If a Legal Holiday falls on Saturday, it will be observed on the preceding Friday. If a Legal Holiday falls on Sunday, it will be observed on the following Monday.
- 1.28.3** Christmas Eve is observed only if it falls on a Monday through Thursday. If Christmas Eve falls on a Friday, that day is observed as the Christmas Day holiday.
- 1.29 Milestones** - A significant event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.
- 1.30 Notice to Proceed** - A Written Notice given by OWNER to CONTRACTOR fixing the date on which the Contract Times will commence to run and on which CONTRACTOR shall start to perform CONTRACTOR's obligations under the Contract Documents.
- 1.31 OWNER** - City of Austin, Texas, a municipal corporation, home rule city and political subdivision organized and existing under the laws of the State of Texas, acting through the City Manager or his/her designee, officers, agents or employees to administer design and construction of the Project.
- 1.32 Owner's Representative** - The designated representative of the OWNER. The Owner's Representative will be identified at the pre-construction conference.
- 1.33 Partial Occupancy or Use** - Use by OWNER of a substantially completed part of the Work for the purpose for which it is intended (or a related purpose) prior to Substantial Completion of all the Work, provided OWNER and CONTRACTOR have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, utilities, corrective work, insurance and warranties.
- 1.34 Project** - The subject of the Work and its intended result.
- 1.35 Project Manual** - That portion of the Contract Documents which may include the following: introductory information; bidding requirements, Contract forms and General and Supplemental General Conditions; General Requirements; Specifications; Drawings; MBE/WBE or DBE Procurement Program Package; Project Safety Manual; and Addenda.
- 1.36 Resident Project Representative** - The authorized representative of E/A who may be assigned to the site or any part thereof.
- 1.37 Shop Drawings** - All drawings, diagrams, illustrations, schedules and other data or information which are specifically prepared or assembled by or for CONTRACTOR and submitted by CONTRACTOR as required by the Contract Documents.
- 1.38 Specifications** - Those portions of the Contract Documents consisting of written technical descriptions as applied to the Work, which set forth to CONTRACTOR, in detail, the requirements which must be met by all materials, equipment, construction systems, standards, workmanship, equipment and services in order to render a completed and useful project.
- 1.39 Solicitation** - Solicitation means, as applicable, an Invitation for Bid or a Request for Proposal.
- 1.40 Substantial Completion** - The stage in the progress of the Work when the Work, or designated portion thereof, is sufficiently complete in accordance with the Contract Documents so OWNER can occupy or utilize the Work for its intended use, as evidenced by a Certificate of Substantial Completion approved by OWNER.
- 1.41 Subcontractor** - An individual, firm, corporation, or other business entity having a direct contract with CONTRACTOR for the performance of a portion of the Work under the Contract.

- 1.42 Sub-Subcontractor** - A person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the work.
- 1.43 Superintendent** - The representative of CONTRACTOR authorized in writing to receive and fulfill instructions from the Owner's Representative, and who shall supervise and direct construction of the Work.
- 1.44 Supplemental General Conditions** - The part of the Contract Documents which amends or supplements the General Conditions. All General Conditions which are not so amended or supplemented remain in full force and effect.
- 1.45 Supplier** - An individual or entity having a direct contract with CONTRACTOR or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by CONTRACTOR or any Subcontractor.
- 1.46 Time Extension Request** - An approved request for time extension on a form acceptable to OWNER.
- 1.47 Work** - The entire completed construction, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents.
- 1.48 Working Day** - Any day of the week, not including Saturdays, Sundays, or Legal Holidays in which conditions under the CONTRACTOR's control will permit work for a continuous period of not less than seven (7) hours between 7:00 a.m. and 6:00 p.m. If other contract documents reduce the continuous period available for work to less than seven (7) hours, those reduced hours shall be considered a Working Day. Upon agreement with Owner's Representative, work on Saturdays, Sundays, and/or Legal Holidays may be allowed and will be considered a Working Day.
- 1.49 Working Hours**
- 1.49.1 Working Day Contract:** All Work shall be done between 7:00 a.m. and 6:00 p.m. unless otherwise authorized by Owner's Representative. However, emergency work may be done without prior permission as indicated in paragraph 6.11.5. If night Work is authorized and conditions under CONTRACTOR's control will permit Work for a continuous period of not less than seven (7) hours between 12:00 a.m. and 11:59 p.m. it will be considered a Working Day. Night Work may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for the prosecution and control of the night Work.
- 1.49.2 Calendar Day Contract:** All Work shall be done between 7:00 a.m. and 6:00 p.m. unless authorized by Owner's Representative. However, emergency work may be done without prior permission as indicated in paragraph 6.11.5. Night Work may be revoked at any time by OWNER if CONTRACTOR fails to maintain adequate equipment and supervision for the prosecution and control of the night Work.
- 1.50 Written Notice** - Written communication between OWNER and CONTRACTOR. Written Notice shall be deemed to have been duly served if delivered in person to Owner's Representative or CONTRACTOR's duly authorized representative, or if delivered at or sent by registered or certified mail to the attention of Owner's Representative or CONTRACTOR's duly authorized representative at the last business address known to the party giving notice.

ARTICLE 2 - PRELIMINARY MATTERS

- 2.1 Delivery of Agreement, Bonds, Insurance, etc.:** Within five (5) Working Days after written notification of award of Contract, CONTRACTOR shall deliver to OWNER signed Agreement, Bond(s), Insurance Certificate(s) and other documentation required for execution of Contract.
- 2.2 Copies of Documents:** OWNER shall furnish to CONTRACTOR (1) copy of the executed Project Manual, one (1) set of Drawings and one (1) copy of the Contract Documents in .pdf format. Additional copies will be furnished, upon request, at the cost specified in the Supplemental General Conditions."
- 2.3 Commencement of Contract Times; Notice to Proceed:** The Contract Time(s) will begin to run on the day indicated in the Notice to Proceed. Notice to Proceed will be given at any time within sixty (60) calendar days after the Execution Date of the Agreement, unless extended by written agreement of the parties.
- 2.4 Before Starting Construction:**
- 2.4.1** No Work shall be done at the site prior to the preconstruction conference without OWNER's approval. Before undertaking each part of the Work, CONTRACTOR shall carefully study the Contract Documents to check and verify pertinent figures shown thereon compare accurately to all applicable field measurements. CONTRACTOR shall promptly report in writing to Owner's Representative any conflict, error, ambiguity or discrepancy which CONTRACTOR may discover and shall obtain a written interpretation or clarification from Owner's Representative before proceeding with any Work affected thereby. CONTRACTOR shall be liable to OWNER for failure to report any conflict, error, ambiguity or discrepancy in the Contract Documents of which CONTRACTOR knew or reasonably should have known.
- 2.4.2** It is mutually agreed between CONTRACTOR and OWNER that successful completion of the Work within the Contract completion date is of primary importance. Therefore, the CONTRACTOR hereby agrees to submit to the Owner's Representative for review and approval, or acceptance, as appropriate, all information requested within this section, including a Baseline Schedule, no later than five working days prior to the preconstruction conference. The Owner's Representative will schedule the preconstruction conference upon the timely submittal of the required documents, unless time is extended by written mutual agreement. CONTRACTOR will submit the following:
- .1** A proposed Baseline Schedule developed using Microsoft Project software, unless otherwise approved by Owner's Representative ("Baseline Schedule") to confirm that all Work will be completed within the Contract time. The Baseline Schedule must (i) indicate the times (number of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents, (ii) identify the Critical Path for completing the Work, (iii) identify when all Subcontractors will be utilized, and (iv) take into consideration any limitations on Working Hours, including baseline Rain Days on Calendar Day Contracts, and (v) be prepared accordance with Section 01310, Schedules and Reports, if applicable; otherwise in accordance with Section 01300, Submittals. This Baseline Schedule, a copy of which shall be made available at the job site(s), must contain sufficient detail to indicate that the CONTRACTOR has properly identified required Work elements and tasks, has provided for a sufficient and proper workforce and integration of Subcontractors, has provided sufficient

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

- .2 An organizational chart showing the principals and management personnel who will be involved with the Work, including each one's responsibilities for the Work;
- .3 To the extent not set forth in the Section 00400 Statement of Contractor's Experience, a complete listing of the CONTRACTOR's employees proposed for the Work. List each one by name and job title, and show length of employment with CONTRACTOR;
- .4 To the extent not set forth in the Section 00410 Statement of Bidder's Safety Experience, a discussion and confirmation of the CONTRACTOR's commitment to safety by providing a copy of its employee's safety handbook and the safety records for the past three years of CONTRACTOR's proposed project manager and Superintendent;
- .5 A preliminary schedule of Shop Drawing and sample submittals;
- .6 A preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. Such prices will be deemed to include an appropriate amount of overhead and profit applicable to each item of Work;
- .7 To the extent not set forth in the Section 00400 Statement of Contractor's Experience, a letter designating CONTRACTOR's Superintendent and project manager, and a confirmation of past project experience for the CONTRACTOR's Superintendent and project manager specifically intended for the Work;
- .8 A letter from CONTRACTOR and Subcontractor(s) listing salaried specialists. A salaried specialist is anyone except an hourly worker whose wage rate is governed by Section 00830 of this agreement;
- .9 A letter designating the project's Safety Representative along with a copy of their Department of Labor-issued OSHA card proving completion of the OSHA 30-hour Construction Safety and Health training class in the OSHA Outreach Training Program;
- .10 If applicable, an excavation safety system plan;
- .11 If applicable, a plan illustrating proposed locations of temporary facilities;
- .12 A completed Non-Use of Asbestos Affidavit (Prior to Construction);
- .13 A letter designating the Texas Registered Professional Land Surveyor for layout of the Work, if the Work requires the services of a surveyor; and
- .14 Copies of the Department of Labor-issued OSHA cards proving completion of the OSHA 10-hour Construction Safety and Health training class in the OSHA Outreach Training Program for each worker (defined as a person covered by a prevailing wage determination) that will initially be on site. Note that workers must possess other OSHA-required training as the work dictates in accordance with the OSHA Act; and specifically, the contractor must meet the required provisions in 509S Excavation Safety Systems required prior to commencing excavation;

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

.16 A Construction Equipment Emissions Reduction Plan.

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

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

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

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.1 Intent:

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

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

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

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

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

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

3.3 Modifying and Supplementing Contract Documents:

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

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

- .1 Field Order.
- .2 Review of a Shop Drawing or sample.
- .3 Written interpretation or clarification.

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

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

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

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

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

4.2 Subsurface and Physical Conditions:

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

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

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

4.2.4 CONTRACTOR shall take reasonable precaution to avoid disturbing primitive records and antiquities of archaeological, paleontological or historical significance. No objects of this nature shall be disturbed without written permission of OWNER and Texas Historical Commission. When such objects are uncovered unexpectedly,

CONTRACTOR shall stop all Work in close proximity and notify Owner's Representative and Texas Historical Commission of their presence and shall not disturb them until written permission and permit to do so is granted. All primitive rights and antiquities uncovered on OWNER's property shall remain property of State of Texas, Texas Historical Commission conforming to Texas Natural Resources Code. If it is determined by OWNER, in consultation with Texas Historical Commission, that exploration or excavation of primitive records or antiquities on Project site is necessary to avoid loss, CONTRACTOR shall cooperate in salvage work attendant to preservation. If the Work stoppage or salvage work causes an increase in CONTRACTOR's cost of, or time required for, performance of the Work, the Contract Amount and/or Contract Time will be equitably adjusted.

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

4.4 Hazardous Materials:

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

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

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

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

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

.2 Upon receiving notice of the presence of suspected Hazardous Materials, OWNER shall take the necessary measures required to ensure that the Hazardous Materials are remediated or rendered harmless. Such necessary measures shall include OWNER retaining qualified independent experts to (i)

ascertain whether Hazardous Materials have actually been encountered, and, if they have been encountered, (ii) prescribe the remedial measures that OWNER must take either to remove the Hazardous Materials or render the Hazardous Materials harmless.

- .3 CONTRACTOR shall be obligated to resume Work at the affected area of the Project only after OWNER's Representative provides written certification that (i) the Hazardous Materials have been removed or rendered harmless and (ii) all necessary approvals have been obtained from all government and quasi-government entities having jurisdiction over the Project or site. The CONTRACTOR shall be responsible for continuing the Work in the unaffected portion of the Project and site.
- .4 CONTRACTOR will be entitled, in accordance with these General Conditions, to an adjustment in its Contract Amount and/or Contract Time(s) to the extent CONTRACTOR's cost and/or time of performance have been adversely impacted by the presence of Hazardous Materials.
- .5 Notwithstanding the preceding provisions of this Section 4.1, OWNER is not responsible for Hazardous Materials introduced to the Site by CONTRACTOR, Subcontractors or anyone for whose acts they may be liable. CONTRACTOR shall indemnify, defend and hold harmless OWNER and OWNER's officers, directors, employees and agents from and against all claims, losses, damages, liabilities and expenses, including attorneys' fees and expenses, arising out of or resulting from those hazardous materials introduced to the site by CONTRACTOR, Subcontractors or anyone for whose acts they may be liable.

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

ARTICLE 5 - BONDS AND INSURANCE

5.1 Surety and Insurance Companies: All bonds and insurance required by the Contract Documents shall be obtained from solvent surety or insurance companies that are duly licensed by the State of Texas and authorized to issue bonds or insurance policies for the limits and coverages required by the Contract Documents. The bonds shall be in a form acceptable to OWNER and shall be issued by a surety which complies with the requirements of Texas Insurance Code, Title 12, Chapter 3503. The surety must obtain reinsurance for any portion of the risk that exceeds 10% of the surety's capital and surplus. For bonds exceeding \$100,000, the surety must also hold a certificate of authority from the U.S. Secretary of the Treasury or have obtained reinsurance for any liability in excess of \$1,000,000 from a reinsurer that is authorized as a reinsurer in Texas or holds a certificate of authority from the U.S. Secretary of the Treasury. In the event that the proposed surety for a contract award in excess of \$100,000 does not hold a certificate of authority from the U.S. Secretary of the Treasury and/or its proposed reinsurer does not hold a certificate of authority from the U.S. Secretary of the Treasury, the OWNER may require additional financial solvency information from the Bidder/Contractor and the proposed surety company and/or reinsurer as part of the 00400 Statement of Bidders Experience and determination of bidder responsibility in the award of the Contract.

5.2 Workers' Compensation Insurance Coverage:

5.2.1 Definitions:

- .1 Certificate of coverage ("certificate") - A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (DWC-81, DCW-82, DCW-83, or DCW84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on the Project, for the duration of the Project.
 - .2 Duration of the Project - includes the time from the beginning of the Work on the Project until the CONTRACTOR's/ person's Work on the Project has been completed and accepted by OWNER.
 - .3 Persons providing services on the Project ("subcontractor" in Texas Labor Code, Section 406.096) - includes all persons or entities performing all or part of the services the CONTRACTOR has undertaken to perform on the Project, regardless of whether that person contracted directly with the CONTRACTOR and regardless of whether that person has employees. This includes, without limitation, independent contractors, Subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity which furnishes persons to provide services on the Project. "Services" include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. "Services" does not include activities unrelated to the Project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.
- 5.2.2** CONTRACTOR shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the CONTRACTOR providing services on the Project, for the duration of the Project.
- 5.2.3** CONTRACTOR must provide a certificate of coverage to OWNER prior to being awarded the Contract.
- 5.2.4** If the coverage period shown on the CONTRACTOR's current certificate of coverage ends during the duration of the Project, the CONTRACTOR must, prior to the end of the coverage period, file a new certificate of coverage with OWNER showing that coverage has been extended.
- 5.2.5** CONTRACTOR shall obtain from each person providing services on the Project, and provide to OWNER:
- .1 A certificate of coverage, prior to that person beginning Work on the Project, so OWNER will have on file certificates of coverage showing coverage for all persons providing services on the Project; and
 - .2 No later than seven (7) days after receipt by CONTRACTOR, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project.
- 5.2.6** CONTRACTOR shall retain all required certificates of coverage for the duration of the Project and for one (1) year thereafter.
- 5.2.7** CONTRACTOR shall notify OWNER in writing by certified mail or personal delivery, within ten (10) days after CONTRACTOR knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project.

- 5.2.8** CONTRACTOR shall post on each Project site a notice, in the text, form and manner prescribed by the Texas Workers' Compensation Commission, informing all persons providing services on the Project that they are required to be covered, and stating how a person may verify coverage and report lack of coverage.
- 5.2.9** CONTRACTOR shall contractually require each person with whom it contracts to provide services on a Project, to:
- .1** Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all of its employees providing services on the Project, for the duration of the Project;
 - .2** Provide to CONTRACTOR, prior to that person beginning Work on the Project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the Project, for the duration of the Project;
 - .3** Provide CONTRACTOR, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;
 - .4** Obtain from each other person with whom it contracts, and provide to CONTRACTOR: a) a certificate of coverage, prior to the other person beginning Work on the Project; and b) a new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;
 - .5** Retain all required certificates of coverage on file for the duration of the Project and for one (1) year thereafter;
 - .6** Notify OWNER in writing by certified mail or personal delivery, within ten (10) days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the Project; and
 - .7** Contractually require each person with whom it contracts, to perform as required by paragraphs 5.2.9.1 - 5.2.9.7, with the certificates of coverage to be provided to the person for whom they are providing services.
- 5.2.10** By signing this Contract or providing or causing to be provided a certificate of coverage, CONTRACTOR is representing to OWNER that all employees of the CONTRACTOR who will provide services on the Project will be covered by workers' compensation coverage for the duration of the Project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the Texas Worker's Compensation Commission's Division of Self- Insurance Regulation. Providing false or misleading information may subject CONTRACTOR to administrative penalties, criminal penalties, civil penalties, or other civil actions.
- 5.2.11** CONTRACTOR's failure to comply with any of these provisions is a breach of Contract by CONTRACTOR which entitles OWNER to declare the Contract void if CONTRACTOR does not remedy the breach within ten (10) days after receipt of notice of breach from OWNER.

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

5.4 Bonds:

5.4.1 General.

- .1 Bonds, when required, shall be executed on forms furnished by or acceptable to OWNER. All bonds signed by an agent must be accompanied by a certified copy of such agent's authority to act.
- .2 If the surety on any bond furnished by CONTRACTOR is declared bankrupt or becomes insolvent or its right to do business is terminated in the State of Texas or it ceases to meet the requirements of the preceding paragraph, CONTRACTOR shall within ten (10) days thereafter substitute another bond and surety, both of which must be acceptable to OWNER.
- .3 When Performance Bonds and/or Payment Bonds are required, each shall be issued in an amount of one hundred percent (100%) of the Contract Amount as security for the faithful performance and/or payment of all CONTRACTOR's obligations under the Contract Documents. Performance Bonds and Payment Bonds shall be issued by a solvent surety company authorized to do business in the State of Texas, and shall meet any other requirements established by law or by OWNER pursuant to applicable law. Any surety duly authorized to do business in Texas may write Performance and Payment Bonds on a project without reinsurance to the limit of ten percent (10%) of its capital and surplus. Such a surety must reinsure any obligations over ten percent (10%).

5.4.2 Performance Bond.

- .1 If the Contract Amount exceeds \$100,000, CONTRACTOR shall furnish OWNER with a Performance Bond in the form set out in Section 00610.
- .2 If the Contract Amount exceeds \$25,000 but is less than or equal to \$100,000, CONTRACTOR shall furnish OWNER with a Performance Bond in the form set out in Section 00610, unless the original Contract Time is 60 Calendar Days/40 Working Days or less, in which case CONTRACTOR can agree to the following terms and conditions for payment in lieu of providing a Performance Bond: no moneys will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER; CONTRACTOR shall be entitled to receive 95% of the Contract Amount following Final Completion, and the remaining 5% of the Contract Amount following the one (1) year warranty period.
- .3 If the Contract Amount is less than or equal to \$25,000, CONTRACTOR will not be required to furnish a Performance Bond; provided that no moneys will be paid to CONTRACTOR until completion and acceptance of the Work by OWNER under the following terms and conditions: CONTRACTOR shall be entitled to receive 95% of the Contract Amount following Final Completion, and the remaining 5% of the Contract Amount following the one (1) year warranty period.
- .4 If a Performance Bond is required to be furnished, it shall extend for the one (1) year warranty period.

5.4.3 Payment Bond.

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

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

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

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.1 Supervision and Superintendence:

- 6.1.1** CONTRACTOR shall supervise, inspect and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. CONTRACTOR shall be responsible to see that the completed Work complies accurately with the Contract Documents.
 - 6.1.2** CONTRACTOR shall have a competent, qualified Superintendent on the Work at all times that work is in progress. To be qualified, at a minimum, the Superintendent must be effective at (a) communicating both verbally and in writing with the OWNER's representative; (b) receiving and fulfilling instructions from the Owner's Representative; (c) supervising and directing the construction of the Work; (d) reading and interpreting the plans and specifications; (e) writing, preparing and submitting necessary paperwork; and (f) understanding work sequencing and scheduling. The Superintendent will be CONTRACTOR's representative on the Work and shall have the authority to act on the behalf of CONTRACTOR. All communications given to the Superintendent shall be as binding as if given to CONTRACTOR. Either CONTRACTOR or the Superintendent shall provide a cellular telephone number and an emergency and home telephone number at which one or the other may be reached if necessary when work is not in progress. The Superintendent must be an employee of the CONTRACTOR, unless such requirement is waived in writing by the Owner's Representative. If the CONTRACTOR proposes a management structure with a Project Manager supervising, directing, and managing construction of the work in addition to or in substitution of a Superintendent, the requirements of these Construction Documents with respect to the Superintendent shall likewise apply to any such Project Manager.
- .1 CONTRACTOR shall present the resume of the proposed Superintendent to the Owner's Representative showing evidence of experience and successful superintendence and direction of work of a similar scale and complexity. If, in the opinion of the Owner's Representative, the proposed Superintendent does not indicate sufficient experience in line with the Work, he/she will not be allowed to be the designated Superintendent for the Work.
 - .2 The Superintendent shall not be replaced without Written Notice to Owner's Representative. If CONTRACTOR deems it necessary to replace the Superintendent, CONTRACTOR shall provide the necessary information for approval, as stated above, on the proposed new Superintendent.

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

6.2 Labor, Materials and Equipment:

- 6.2.1** CONTRACTOR shall maintain a work force adequate to accomplish the Work within the Contract Time. CONTRACTOR agrees to employ only orderly and competent workers, skillful in performance of the type of Work required under this Contract. CONTRACTOR, Subcontractors, Sub-subcontractors, and their employees may not use or possess any alcoholic or other intoxicating beverages, illegal drugs or controlled substances while on the job or on OWNER's property, nor may such workers be intoxicated, or under the influence of alcohol or drugs, on the job. Subject to the applicable provisions of Texas law, CONTRACTOR, Subcontractors, Sub-subcontractors, and their employees may not use or possess any firearms or other weapons while on the job or on OWNER'S property. If OWNER or Owner's Representative notifies CONTRACTOR that any worker or representative of Contractor is incompetent, disorderly, abusive, or disobedient, has knowingly or repeatedly violated safety regulations, has possessed any firearms in contravention of the applicable provisions of Texas law, or has possessed or was under the influence of alcohol or drugs on the job, CONTRACTOR shall immediately remove such worker or representative, including an officer or owner of CONTRACTOR, from performing Contract Work, and may not employ such worker or representative again on Contract Work without OWNER's prior written consent. CONTRACTOR shall at all times maintain good discipline and order on or off the site in all matters pertaining to the Project. Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) for Building Construction and Heavy and Highway Trades "AS APPLICABLE" and/or the minimum wage required by City of Austin Ordinance No. 20160324-015, whichever is higher. The Total Minimum Wage required can be met using any combination of cash and non-cash qualified fringe benefits provided the cash component meets or exceeds the minimum wage required.
- 6.2.2** Unless otherwise specified in Division 1, CONTRACTOR shall provide and pay for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.
- 6.2.3** All materials and equipment shall be of good quality and new (including new products made of recycled materials, pursuant to Section 361.426 of the Texas Health & Safety Code), except as otherwise provided in the Contract Documents. If required by Owner's Representative, CONTRACTOR shall furnish satisfactory evidence (reports of required tests, manufacturer's certificates of compliance with material requirements, mill reports, etc.) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with instructions of the applicable Supplier, except as otherwise provided in the Contract Documents.
- 6.2.4** Substitutes and "Approved Equal" Items:
 - .1 Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the

type, function and quality required. Unless the specification or description contains words reading that no like, equivalent or "approved equal" item or no substitution is permitted, other items of material or equipment of other Suppliers may be submitted by CONTRACTOR, at CONTRACTOR'S sole risk, including disruptions to the Critical Path of the Progress Schedule, to E/A through Owner's Representative under the following circumstances:

- .1.1 "Approved Equal": If in E/A's sole discretion an item of material or equipment proposed by CONTRACTOR is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by E/A as an "approved equal" item, in which case review of the proposed item may, in E/A's sole discretion, be accomplished without compliance with some or all of the requirements for evaluation of proposed substitute items. CONTRACTOR shall provide E/A with the documentation required for E/A to make its determination.
- .1.2 Substitute Items: If in E/A's sole discretion an item of material or equipment proposed by CONTRACTOR does not qualify as an "approved equal" item under subparagraph 6.2.4.1.1, it will be considered a proposed substitute item. CONTRACTOR shall submit sufficient information as provided in Division 1 to allow E/A to determine that the item of material or equipment proposed is essentially equivalent to that named and a substitute therefor.
- .2 Substitute Construction Methods and Procedures: If a specific means, method, technique, sequence or procedure of construction is shown or indicated in and expressly required by the Contract Documents, CONTRACTOR may, at CONTRACTOR'S sole risk, including disruptions to the Critical Path of the Progress Schedule, with prior approval of E/A furnish or utilize a substitute means, method, technique, sequence, or procedure of construction. CONTRACTOR shall submit sufficient information to Owner's Representative to allow E/A, in E/A's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The procedure for review by E/A will be same as that provided for substitute items in Division 1.
- .3 E/A's Evaluation: E/A will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to subparagraphs 6.2.4.1.1 and 6.2.4.1.2. E/A will be the sole judge of acceptability. No "approved equal" or substitute shall be ordered, installed, or utilized until E/A's review is complete, which will be evidenced by either a Change Order or completion of the Shop Drawing review procedure. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety bond with respect to any "approved equal" or substitute or for any other delay or disruption to the Critical Path of the Project Schedule attributable to any such substitution. OWNER shall not be responsible for any delay due to review time for any "approved equal" or substitute.
- .4 CONTRACTOR's Expense: All data and documentation to be provided by CONTRACTOR in support of any proposed "approved equal" or substitute item will be at CONTRACTOR's expense.
- .5 The approval of the E/A will not relieve the CONTRACTOR from primary responsibility and liability for the suitability and performance of any proposed substitute item, method or procedure and will not relieve CONTRACTOR from

its primary responsibility and liability for curing defective Work and performing warranty work, which the CONTRACTOR shall cure and perform, regardless of any claim the CONTRACTOR may choose to advance against the E/A or manufacturer.

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

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

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

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

6.4 Concerning Subcontractors, Suppliers and Others:

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

- 6.4.2** Award of Subcontracts for Portions of the Work: CONTRACTOR shall not employ any Subcontractor, Supplier or other person or organization, whether initially or as a substitute, against whom OWNER may have reasonable objection. OWNER will communicate such objections by Written Notice. If OWNER requires a change without good cause of any Subcontractor, person or organization previously accepted by OWNER, the Contract Amount shall be increased or decreased by the difference in the cost occasioned by any such change, and appropriate Change Order shall be issued. CONTRACTOR shall not substitute any Subcontractor, person or organization that has been accepted by OWNER, unless the substitute has been accepted in writing by OWNER. No acceptance by OWNER of any Subcontractor, Supplier or other person or organization shall constitute a waiver of any right of OWNER to reject defective Work.

- 6.4.3** CONTRACTOR shall enter into written agreements with all Subcontractors and Suppliers which specifically binds the Subcontractors or Suppliers to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and E/A.

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

- 6.4.4** CONTRACTOR shall be fully responsible to OWNER for all acts and omissions of the Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR just as CONTRACTOR is responsible for CONTRACTOR's own acts and omissions. Nothing in the Contract Documents shall create for the benefit of any such Subcontractor, Supplier or other person or organization any contractual relationship between OWNER and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of OWNER or E/A to pay or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization except as may otherwise be required by laws and regulations.
- 6.4.5** CONTRACTOR shall be solely responsible for efficiently scheduling and coordinating the Work of Subcontractors, Suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect contract with CONTRACTOR in order to avoid any delays or inefficiencies in the prosecution of the Work. CONTRACTOR shall require all Subcontractors, Suppliers and such other persons and organizations performing or furnishing any of the Work to communicate with Owner's Representative through CONTRACTOR.
- 6.4.6** The divisions and sections of the Specifications and the identifications of any Drawings shall not control CONTRACTOR in dividing or delineating the Work to be performed by any specific trade.
- 6.4.7** CONTRACTOR shall pay each Subcontractor and Supplier their appropriate share of payments made to CONTRACTOR not later than ten (10) Calendar Days of CONTRACTOR's receipt of payment from OWNER. Upon request from Owner, the CONTRACTOR has two (2) Working Days to provide documentation verifying Payment to Subcontractor(s). The CONTRACTOR is required to notify the Subcontractor(s) in writing of rejection of Application for Payment within two (2) Working Days following notification by Owner. Failure of CONTRACTOR to make payments to Subcontractors or for labor, materials or equipment in accordance to this contract, may be cause to reject future Bids by the CONTRACTOR in accordance with Section 00100 9.B.4 and may be cause to reject payment in accordance with 00700 14.4.1.3.
- 6.4.8** To the extent allowed by Texas law, the OWNER shall be deemed to be a third party beneficiary to each subcontract and may, if OWNER elects, following a termination of the CONTRACTOR, require that the Subcontractor(s) perform all or a portion of unperformed duties and obligations under its subcontract(s) for the benefit of the OWNER, rather than the CONTRACTOR; however, if the OWNER requires any such performance by a Subcontractor for the OWNER's direct benefit, then the OWNER

shall be bound and obligated to pay such Subcontractor the reasonable value for all Work performed by such Subcontractor to the date of the termination of the CONTRACTOR, less previous payments, and for all Work performed thereafter. In the event that the OWNER elects to invoke its right under this section, OWNER will provide notice of such election to the CONTRACTOR and the affected Subcontractor(s).

6.5 Patent Fees and Royalties:

- 6.5.1** CONTRACTOR shall be responsible at all times for compliance with applicable patents or copyrights encompassing, in whole or in part, any design, device, material, or process utilized, directly or indirectly, in the performance of the Work or the formulation or presentation of its Bid.
- 6.5.2** CONTRACTOR shall pay all royalties and license fees and shall provide, prior to commencement of Work hereunder and at all times during the performance of same, for lawful use of any design, device, material or process covered by letters, patent or copyright by suitable legal agreement with the patentee, copyright holder, or their duly authorized representative whether or not a particular design, device, material, or process is specified by OWNER.
- 6.5.3** CONTRACTOR shall defend all suits or claims for infringement of any patent or copyright and shall save OWNER harmless from any loss or liability, direct or indirect, arising with respect to CONTRACTOR's process in the formulation of its Bid or the performance of the Work or otherwise arising in connection therewith. OWNER reserves the right to provide its own defense to any suit or claim of infringement of any patent or copyright in which event CONTRACTOR shall indemnify and save harmless OWNER from all costs and expenses of such defense as well as satisfaction of all judgments entered against OWNER.
- 6.5.4** OWNER shall have the right to stop the Work and/or terminate this Agreement at any time in the event CONTRACTOR fails to disclose to OWNER that CONTRACTOR's work methodology includes the use of any infringing design, device, material or process.

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

6.7 Laws and Regulations:

- 6.7.1** CONTRACTOR shall give all notices and comply with all laws and regulations applicable to furnishing and performing the Work, including arranging for and obtaining any required inspections, tests, approvals or certifications from any public body having jurisdiction over the Work or any part thereof. Except where otherwise expressly required by applicable laws and regulations, neither OWNER nor E/A shall be responsible for monitoring CONTRACTOR's compliance with any laws and regulations.
- 6.7.2** Maintaining clean water, air and earth or improving thereon shall be regarded as of prime importance. CONTRACTOR shall plan and execute its operations in compliance with all applicable Federal, State and local laws and regulations concerning control and abatement of water pollution and prevention and control of air pollution.
- 6.7.3** If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to laws or regulations, CONTRACTOR shall bear all claims, costs, losses and damages arising therefrom; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Drawings are in accordance

with laws and regulations, but this does not relieve CONTRACTOR of CONTRACTOR's obligations under Article 3.

6.8 Taxes:

- 6.8.1** CONTRACTOR shall pay only those sales, consumer, use and other similar taxes required to be paid by CONTRACTOR in accordance with the laws and regulations of the State of Texas in the performance of this public works contract.
- 6.8.2** OWNER is an exempt organization as defined by Chapter 11 of the Property Tax Code of Texas and is thereby exempt from payment of Sales Tax under Chapter 151, Limited Use Sales, Excise and Use Tax, Texas Tax Code, and Article 1066 (C), Local Sales and Use Tax Act, Revised Civil Statutes of Texas.

6.9 Use of Premises:

- 6.9.1** CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by laws and regulations, right-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof or of any adjacent land or areas, resulting from the performance of the Work. Should any claim be made by any such owner or occupant because of or in connection with the performance of the Work, CONTRACTOR shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law. CONTRACTOR shall indemnify, defend and hold harmless OWNER, E/A, E/A'S Consultants and anyone directly or indirectly employed by any of them from and against all claims, costs, losses and damages (including court costs and reasonable attorney's fees) arising out of or resulting from any claim or action, legal or equitable, brought by any such owner or occupant against OWNER, E/A or any other party indemnified hereunder to the extent caused by or based upon performance of the work or failure to perform the Work.
- 6.9.2** During the progress of the Work and on a daily basis, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work, CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials. CONTRACTOR shall leave the site clean and ready for occupancy by OWNER at Substantial Completion of the Work. CONTRACTOR shall, at a minimum, restore to original condition all property not designated for alteration by the Contract Documents. If the CONTRACTOR fails to clean up at the completion of the Work, OWNER may do so and the cost thereof will be charged against the CONTRACTOR.
- 6.9.3** CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

- 6.10 Record Documents:** CONTRACTOR shall maintain in a safe place at the site, or other location acceptable to OWNER, one (1) record copy of all Drawings, Specifications, Addenda, Change Orders, Change Directives, Field Orders and written interpretations and clarifications (issued pursuant to paragraph 9.5) in good order and annotated to show all changes made during construction. These record documents together with all final samples and all final Shop Drawings will be available to OWNER and E/A for reference during performance of the

Work. Upon Substantial Completion of the Work, these record documents, samples and Shop Drawings shall be promptly delivered to Owner's Representative.

6.11 Safety and Protection:

6.11.1 CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Upon request, and prior to installation of measures, CONTRACTOR shall submit a site security plan for approval by OWNER. By reviewing the plan or making recommendations or comments, OWNER will not assume liability nor will CONTRACTOR be relieved of liability for damage, injury or loss. CONTRACTOR shall take all necessary precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

- .1 all persons on the Work site or who may be affected by the Work;
- .2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and
- .3 other property at the site or adjacent thereto, including, but not limited to, trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement in the course of construction.

6.11.2 CONTRACTOR shall comply with all applicable laws and regulations of any public body having jurisdiction for safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and of underground facilities, and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph 6.11.1.2 and 6.11.1.3 caused, directly or indirectly, in whole or in part, by CONTRACTOR, Subcontractor, Supplier or any person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by CONTRACTOR (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of OWNER, or E/A, or E/A's consultant or anyone employed by any of them or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the faults or negligence of CONTRACTOR or any Subcontractor, Supplier or other person or organization directly or indirectly employed by any of them). CONTRACTOR's duties and responsibilities for safety and protection of the Work shall continue until such time as all the Work is completed and Owner's Representative has issued a notice to OWNER and CONTRACTOR in accordance with Article 14 that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion). Without limitation, CONTRACTOR shall comply with the following specific provisions:

It shall be the duty and responsibility of CONTRACTOR and all of its subcontractors to be familiar with and comply with 29 USC Section 651, et seq., the Occupational Safety and Health Act of 1970, as amended ("OSHA") and to enforce and comply with all provisions of this Act.

The CONTRACTOR and all of its subcontractors shall comply with all applicable requirements of Subpart P of Part 1926 of 29 C.F.R, OSHA Safety and Health Standards, Texas Health and Safety Code Section 756.023, as amended, and shall submit a unit price for the particular excavation safety systems to be utilized by the Contractor for all excavations which exceed a depth of five feet (5').

Before commencing any excavation which will exceed a depth of five feet (5'), the CONTRACTOR shall provide the Owner with detailed plans and specifications regarding the safety systems to be utilized. Said plans and specifications shall include a certification from a Texas licensed professional engineer indicating full compliance with the OSHA provisions cited above.

6.11.3 Safety Representative: CONTRACTOR shall designate in writing a qualified and experienced safety representative (the "Safety Representative") at the site whose duties and responsibilities shall include safety training; identifying and mitigating hazardous conditions and unsafe work practices; and developing, maintaining and supervising the implementation of safe work practices and safety programs as deemed necessary and appropriate for the Project. The term "Safety Representative" includes any designated Safety Supervisor, Superintendent or Safety Manager. The Safety Representative shall exercise due diligence in the execution of all Project related safety duties. Upon request of OWNER, CONTRACTOR shall provide certifications or other acceptable documentation of the Safety Representative's qualifications. The following requirements will be effective as of September 1, 2010:

- .1 The Safety Representative shall present certification of completion of the OSHA 30-hour Construction Industry Training Outreach Program described at: http://www.osha.gov/dte/outreach/construction_generalindustry/construction.html
- .2 The Safety Representative shall verify that all construction workers (defined as persons covered by a prevailing wage determination) on the job site, whether employed by the CONTRACTOR or subcontractors, have completed the OSHA 10-hour Construction Industry Training Outreach Program described at: http://www.osha.gov/dte/outreach/construction_generalindustry/construction.html. The Safety Representative must receive a certificate of training completion before allowing a worker on site and shall have all such certificates available for inspection by the OWNER.
- .3 The Safety Representative shall ensure that workers, including designated competent persons, have completed all applicable OSHA specific or other training needed to perform their job assignments. Training topics applicable to the scope of the current Project may include, but are not limited to, scaffolds, fall protection, cranes, excavations, electrical safety, tools, concrete and masonry construction, steel erection, operation of motor vehicles and mechanized equipment.
- .4 The Safety Representative shall post notice on the site of the Work stating that all workers shall have completed OSHA Construction Industry Training. The Owner may require, and the Safety Representative should consider providing a means of readily identifying workers who have completed the required training to monitor compliance with these requirements.
- .5 The Safety Representative shall ensure that all required OSHA and Workers Compensation notices to workers are posted in English and Spanish at one or more conspicuous locations on the work site.

6.11.4 Hazard Communication Programs: CONTRACTOR shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the site in accordance with laws and regulations.

6.11.5 Emergencies:

- .1 In emergencies affecting the safety or protection of persons or the Work at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from OWNER or E/A, is obligated to act reasonably to prevent threatened damage, injury or loss and to mitigate damage or loss to the Work. CONTRACTOR shall give Owner's Representative telephone notification as soon as reasonably practical and a prompt written notice if CONTRACTOR believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Owner's Representative determines that a change in the Contract Documents is required because of the action taken by CONTRACTOR in response to such an emergency, a Change Directive or Change Order will be issued to document the consequences of such action; otherwise OWNER will not be responsible for CONTRACTOR's emergency action.
- .2 Authorized agents of CONTRACTOR shall respond immediately to call-out at any time of any day or night when circumstances warrant the presence on Project site of CONTRACTOR or his agent to protect the Work or adjacent property from damage, restriction or limitation or to take such action or measures pertaining to the Work as may be necessary to provide for the safety of the public. Should CONTRACTOR and/or their agent fail to respond and take action to alleviate such an emergency situation, OWNER may direct other forces to take action as necessary to remedy the emergency condition, and OWNER will deduct any cost of such remedial action from the funds due CONTRACTOR under this Contract.
- .3 In the event there is an accident involving injury to any individual or damage to any property on or near the Work, CONTRACTOR shall provide to Owner's Representative verbal notification within one (1) hour and written notification within twenty-four (24) hours of the event and shall be responsible for recording the location of the event and the circumstances surrounding the event through photographs, interviewing witnesses, obtaining medical reports, police accident reports and other documentation that describes the event. Copies of such documentation shall be provided to Owner's Representative, for OWNER's and E/A's records, within forty-eight (48) hours of the event. Contractor shall cooperate with OWNER on any OWNER investigation of any such incident.

6.11.6 Rest Breaks:

- .1 Except as provided in subsection 6.11.6.2 below, an employee performing construction activity at a construction site is entitled to a rest break of not less than ten (10) minutes for every four (4) hours worked. No employee may be required to work more than 3.5 hours without a rest break. A rest break means a break from work within working hours, excluding meal breaks, during which an employee may not work. A rest break shall be scheduled as near as possible to the midpoint of the work period.
- .2 An employee is not entitled to a rest break under subsection 6.11.6.1 on any day the employee works less than 3.5 hours or spends more than half of his or her work time engaged in non-strenuous labor in a climate controlled environment.
- .3 A sign describing the requirements of this Section 6.11.6 in English and Spanish shall be posted by the employer in each establishment subject to the requirement of a rest break in a conspicuous place or places where notices to

employees are customarily posted, in accordance with the OWNER's then current rules for size, content, and location of such signage.

- .4 The violation of Ordinance No. 20100729-047, enacted July 29, 2010, which establishes the rest break requirements set forth above, may be enforced with criminal penalties and civil remedies, as set forth in the Ordinance.

6.11.7 If the Contractor fails to carry out the Work in accordance with the Contract Documents so that a safety violation has occurred, the Owner may order the Contractor to stop the Work or any portion thereof, until the cause for such order has been eliminated. However, the right of the Owner to stop the Work under this paragraph shall not give rise to a duty on the part of the Owner to supervise the Contractor's Work or to control the Contractor's means and methods or to exercise this right for the benefit of the Contractor or any other person or entity. All time lost due to Project shut down will be the Contractor's sole responsibility, will be charged against the Contract Time, and the Contractor will be responsible for any and all expenses incurred. This provision is in addition to and supplemental to the applicable provisions of the Project's ROCIP Safety Manual.

6.11.8 Confined Space Program

- .1 Contractor acknowledges and agrees that the Owner is temporarily transferring management and control of the site of the Work to the Contractor for the purpose of constructing the Project. The Contractor's responsibilities to manage the Work includes the responsibility to manage the property for purposes of compliance with 29 CFR 1926 subpart AA. To the best of Owner's knowledge and belief, Owner has provided the following information in the plans and specifications and other Contract Documents: (i) the location of each known permit space, (ii) the hazards or potential hazards in each space or the reason it is a permit space; and (iii) any precautions that the Owner or any previous contractor has implemented for the protection of employees in the permit space. This transfer will result in the Contractor being both the host employer and the controlling contractor for this portion of the Work.

6.12 Continuing the Work: CONTRACTOR shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as OWNER and CONTRACTOR may otherwise agree in writing.

6.13 CONTRACTOR's General Warranty and Guarantee:

6.13.1 CONTRACTOR warrants and guarantees to OWNER that all Work will conform to the plans and specifications, be performed in a good and workmanlike manner in accordance with the Contract Documents and will not be defective. This warranty will survive the termination or expiration of the Contract. CONTRACTOR's warranty and guarantee hereunder excludes defects or damage caused by:

- .1 abuse, modification or improper maintenance or operation by persons other than CONTRACTOR, Subcontractors or Suppliers; or
- .2 normal wear and tear under normal usage.

6.13.2 CONTRACTOR's obligation to perform and complete the Work in a good and workmanlike manner in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance

with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents:

- .1 observations by Owner's Representative and/or E/A;
- .2 recommendation of any progress or final payment by Owner's Representative;
- .3 the issuance of a certificate of Substantial Completion or any payment by OWNER to CONTRACTOR under the Contract Documents;
- .4 use or occupancy of the Work or any part thereof by OWNER;
- .5 any acceptance by OWNER or any failure to do so;
- .6 any review of a Shop Drawing or sample submittal;
- .7 any inspection, test or approval by others; or
- .8 any correction of defective Work by OWNER.

6.14 INDEMNIFICATION:

6.14.1 CONTRACTOR shall defend, indemnify and hold harmless OWNER, E/A, E/A'S Consultants and Sub consultants and their respective officers, directors, partners, employees, agents and other Consultants and any of them (the "INDEMNIFIED PARTIES") from and against all claims, costs, losses and damages (including but not limited to all fees and charges of engineers, architects, attorneys and other professionals and all court or arbitration or other dispute resolution costs) arising out of or resulting from the performance of the Work, provided that any such claim, cost, loss or damage:

- .1 Is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the work itself), including the loss of use resulting therefrom, and
- .2 Is caused in whole or in part by any negligent act or omission of CONTRACTOR, any Subcontractor, any Supplier, any person or organization directly or indirectly employed by any of them to perform or furnish any of the work or anyone for whose acts any of them may be liable, regardless of whether or not caused in part by any negligence or omission of the INDEMNIFIED PARTIES hereunder or whether liability is imposed upon such INDEMNIFIED PARTY by laws and regulations regardless of the negligence of any such person or entity.

In the event that indemnification of the INDEMNIFIED PARTIES is prohibited by law, CONTRACTOR shall nonetheless be solely responsible for any liability arising out of or resulting from the performance of the Work, subject to the limitations set forth above, and shall indemnify and hold harmless the remaining INDEMNIFIED PARTIES, who may be legally indemnified, from such liability of the CONTRACTOR and the associated costs described above.

6.14.2 The indemnification obligation under paragraph 6.14.1 shall not be limited in any way by any limitation on the amount or type of damages, or compensation or benefits payable by or for CONTRACTOR or any such Subcontractor, Supplier or other person or organization under workers' compensation acts, disability benefit acts or other employee benefit acts.

6.14.3 The obligations of CONTRACTOR under paragraph 6.14.1 shall not extend to the liability of OWNER, E/A, E/A's consultants, and their officers, directors, partners, employees or agents caused primarily by negligent preparation of maps, drawings,

surveys, designs or specifications upon which is placed the applicable state-authorized design professional seal of OWNER's, E/A's or E/A's consultant's officers, directors, partners, employees or agents.

6.14.4 In the event CONTRACTOR fails to follow OWNER's directives concerning use of the site, scheduling or course of construction, or engages in other conduct which proximately causes damage to property based on inverse condemnation or otherwise, then and in that event, CONTRACTOR shall indemnify OWNER against all costs resulting from such claims.

6.14.5 In the event CONTRACTOR unreasonably delays progress of the work being done by others on the site so as to cause loss for which OWNER becomes liable, then CONTRACTOR shall indemnify OWNER from and reimburse OWNER for such loss.

6.15 Survival of Obligations: All representations, indemnifications, warranties and guarantees made in, required by or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion and acceptance of the Work and termination or completion of the Agreement.

6.16 Losses from Natural Causes: Unless otherwise specified, all loss or damage to CONTRACTOR arising out of the nature of the Work to be done or from action of the elements, floods or from unforeseeable circumstances in prosecution of the Work or from unusual obstructions or difficulties which may be encountered in prosecution of the Work, shall be sustained and borne by CONTRACTOR at its own cost and expense.

6.17 Notice of Claim: Should CONTRACTOR suffer injury or damage to person or property because of any error, omission or act of OWNER or of any of OWNER's employees or agents or others for whose acts OWNER is liable, a Claim must be made to the other party within thirty (30) calendar days of the event giving rise to such injury or damage. The provisions of this paragraph 6.17 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

6.18 Liquidated Damages: CONTRACTOR or its Surety shall be liable for liquidated damages for the failure of the CONTRACTOR to timely complete the Work or any portion thereof within the Contract Time.

ARTICLE 7 - OTHER WORK

7.1 OWNER may perform other work related to the Project at the site by OWNER's own forces, or let other contracts therefor, or have other work performed by utility owners. CONTRACTOR and OWNER agree to and shall use best efforts to cooperate and coordinate the Work with others performing work and other work related to the Project in order to avoid conflicts and delays in the Work. If CONTRACTOR believes that delay or additional cost is involved because of such action by OWNER, CONTRACTOR may make a Claim as provided in Article 11 or 12.

7.2 CONTRACTOR shall afford other contractors who are in a contract with OWNER and each utility owner (and OWNER, if OWNER is performing the additional work with OWNER's employees) proper and safe access to the site and a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work and shall properly connect and coordinate the Work with theirs. Unless otherwise provided in the Contract Documents, CONTRACTOR shall do all cutting, fitting and patching of the Work that may be required to make its several parts come together properly and integrate

with such other work. CONTRACTOR shall not endanger any work of others by cutting, excavating or otherwise altering their work and will only cut or alter their work with the written consent of Owner's Representative and the other contractors whose work will be affected. CONTRACTOR shall promptly remedy damage wrongfully caused by CONTRACTOR to completed or partially completed construction or to property of the OWNER or separate contractors.

- 7.3** If the proper execution or results of any part of CONTRACTOR's Work depends upon work performed by others under this Article 7, CONTRACTOR shall inspect such other work and promptly report to Owner's Representative in writing any delays, defects or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of CONTRACTOR's Work. CONTRACTOR's failure to report will constitute an acceptance of such other work as fit and proper for integration with CONTRACTOR's Work except for latent or non-apparent defects and deficiencies in such other work.
- 7.4** OWNER shall provide for coordination of the activities of the OWNER's own forces and of each separate contractor with the Work of CONTRACTOR, who shall cooperate with them. CONTRACTOR shall participate with other separate contractors and Owner's Representative in reviewing their construction Progress Schedules when directed to do so. On the basis of such review, CONTRACTOR shall make any revisions to the construction Progress Schedule deemed necessary after a joint review and mutual agreement. The agreed upon construction Progress Schedules shall then constitute the Progress Schedules to be used by CONTRACTOR, separate contractors and OWNER until subsequently revised.
- 7.5** Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

- 8.1** Prior to the start of construction, OWNER will designate in writing a person or entity to act as Owner's Representative during construction. Except as otherwise provided in these General Conditions, OWNER shall issue all communications to CONTRACTOR through Owner's Representative.
- 8.2** OWNER will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction or the safety precautions and programs incident thereto. OWNER is not responsible for any failure of CONTRACTOR to comply with laws and regulations applicable to furnishing or performing the Work. OWNER is not responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of OWNER to discover, or object to or condemn any defective Work or material shall not release CONTRACTOR from the obligation to properly and fully perform the Contract.
- 8.3** OWNER is not responsible for the acts or omissions of CONTRACTOR, or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work. CONTRACTOR acknowledges and agrees that OWNER'S direction to perform Work in accordance with the approved Progress Schedule is not a demand for acceleration or a dictation of CONTRACTOR'S means or methods.
- 8.4** Information or services under the OWNER's control shall be furnished by the OWNER with reasonable promptness to avoid delay in orderly progress of the Work. The OWNER shall have a reasonable amount of time to investigate site conditions, review submittals, analyze requests for changes, and to make other decisions in the orderly administration of the Contract. CONTRACTOR must notify the OWNER in writing, if the time for the investigation,

review, analysis of any submittals, required for changes or otherwise required for OWNER'S decision, impacts in any way the Critical Path of the approved Progress Schedule.

- 8.5** The foregoing are in addition to other duties and responsibilities of the OWNER enumerated herein and especially those in respect to Article 4 (Availability of Lands; Subsurface and Physical Conditions; Reference Points), Article 7 (Other Work) and Article 14 (Payments to CONTRACTOR and Completion).
- 8.6 Notice of Claim:** Should OWNER suffer injury or damage to person or property because of any error, omission or act of CONTRACTOR or of any of CONTRACTOR's employees or agents or others for whose acts CONTRACTOR is liable, a Claim will be made to the other party within thirty (30) calendar days of receipt of actual or constructive notice of the event giving rise to such injury or damage. The provisions of this paragraph 8.6 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or statute of repose.

ARTICLE 9 - ENGINEER/ARCHITECT'S STATUS DURING CONSTRUCTION

9.1 E/A's Authority and Responsibilities:

- 9.1.1** The duties and responsibilities and the limitations of authority of E/A during construction, as set forth in the Contract Documents, may be assigned or assumed by the OWNER, but shall not be extended without written consent of OWNER and/or E/A. The assignment of any authority, duties or responsibilities to E/A under the Contract Documents, or under any agreement between OWNER and E/A, or any undertaking, exercise or performance thereof by E/A, is intended to be for the sole and exclusive benefit of OWNER and not for the benefit of CONTRACTOR, Subcontractor, Supplier, or any other person or organization, or for any surety or employee or agent of any of them.
- 9.1.2** E/A will not supervise, direct, control or have authority over or be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto. E/A is not responsible for any failure of CONTRACTOR to comply with laws and regulations applicable to the furnishing or performing the Work. E/A is not responsible for CONTRACTOR's failure to perform or furnish the Work in accordance with the Contract Documents. Failure or omission of E/A to discover, or object to or condemn any defective Work or material shall not release CONTRACTOR from the obligation to properly and fully perform the Contract.
- 9.1.3** E/A is not responsible for the acts or omissions of CONTRACTOR, or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.
- 9.1.4** If OWNER and E/A agree, E/A will review the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds and certificates of inspection, tests and approvals and other documentation required to be delivered by Article 14, but only to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests and approvals that the results certified indicate compliance with, the Contract Documents.
- 9.1.5** The limitations upon authority and responsibility set forth in this paragraph 9.1 shall also apply to E/A's Consultants, Resident Project Representative and assistants.

- 9.2 E/A as Owner's Representative:** E/A may be designated as the Owner's Representative under paragraph 8.1.
- 9.3 Visits to Site:** If OWNER and E/A agree, E/A will make visits to the site at intervals appropriate to the various stages of construction as E/A deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of CONTRACTOR's executed Work. Based on information obtained during such visits and observations, E/A will endeavor for the benefit of OWNER to determine, in general, if the Work is proceeding in accordance with the Contract Documents. E/A will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. E/A's efforts will be directed toward providing for OWNER a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and on-site observations, E/A will keep OWNER informed of the progress of the Work and will endeavor to guard OWNER against defective Work. E/A's visits and on-site observations are subject to all the limitations on E/A's authority and responsibility set forth in paragraph 9.1.
- 9.4 Resident Project Representative:** If OWNER and E/A agree, E/A will furnish a Resident Project Representative to assist E/A in providing more continuous observation of the Work. The responsibilities and authority and limitations of any such Resident Project Representative and assistants will be as provided in paragraph 9.1 and in the Supplemental General Conditions. OWNER may designate another representative or agent to represent OWNER at the site who is not E/A, E/A's consultant, agent or employee.
- 9.5 Clarifications and Interpretations:** E/A may determine that written clarifications or interpretations of the requirements of the Contract Documents (in the form of drawings or otherwise) are necessary. Such written clarifications or interpretations will be consistent with the intent of and reasonably inferable from the Contract Documents, will be issued with reasonable promptness by Owner's Representative and will be binding on OWNER and CONTRACTOR. If OWNER or CONTRACTOR believes that a written clarification or interpretation justifies an adjustment in the Contract Amount or the Contract Times, OWNER or CONTRACTOR may make a Claim therefor as provided in Article 11 or 12.
- 9.6 Rejecting Defective Work:** E/A will recommend that OWNER disapprove or reject Work which E/A believes to be defective, or believes will not produce a completed Project that conforms to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
- 9.7 Shop Drawings:** Refer to Division 1 for E/A's authority concerning Shop Drawings.

ARTICLE 10 - CHANGES IN THE WORK

10.1 Changes:

- 10.1.1** Without invalidating the Contract and without notice to any surety, OWNER may, at any time or from time to time, order additions, deletions or revisions in the Work. Such changes in the Work will be authorized by Change Order, Change Directive or Field Order. In the event that the OWNER and the CONTRACTOR are unable to negotiate the terms of a Change Order for the performance of additional Work, the OWNER may, at its election, perform such additional Work with its own forces or with another contractor and such work will be considered "Other Work" in accordance with Article 7.
- 10.1.2** Changes in the Work shall be performed under applicable provisions of the Contract Documents, and CONTRACTOR shall proceed promptly, unless otherwise

provided in the Change Order, Change Directive or Field Order. CONTRACTOR's proposals for changes in the Contract Amount and/or Contract Time shall be submitted within ten (10) Calendar Days of request by Owner's Representative, including impacts to the approved Progress Schedule, unless Owner's Representative grants an extension. OWNER will review each proposal and respond to CONTRACTOR within ten (10) Calendar Days. After review by OWNER, CONTRACTOR shall provide any supporting data requested by Owner's Representative within seven (7) Calendar Days, unless Owner's Representative grants an extension. OWNER will determine within seven (7) Calendar Days whether to pursue the change in Work.

- 10.1.3** CONTRACTOR shall not be entitled to an increase in the Contract Amount or an extension of the Contract Times with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented as provided in paragraphs 3.3.1 and 3.3.2, except in the case of an emergency as provided in paragraph 6.11.5 or in the case of uncovering Work as provided in paragraph 13.4.
- 10.1.4** Except in the case of an emergency as provided in paragraph 6.11.5, a Change Order or Change Directive is required before CONTRACTOR commences any activities associated with a change in the Work which, in CONTRACTOR's opinion, will result in a change in the Contract Amount and/or Contract Times.
- 10.1.5** If notice of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Amount or Contract Times) is required by the provisions of any Bond to be given to a surety, the giving of any such notice will be CONTRACTOR's responsibility, and the amount of each applicable Bond will be adjusted accordingly.

10.2 Change Orders:

- 10.2.1** OWNER and CONTRACTOR shall execute appropriate written Change Orders covering:
 - .1** a change in the Work;
 - .2** the amount of the adjustment in the Contract Amount, if any; and
 - .3** the extent of the adjustment in the Contract Time, if any.
- 10.2.2** An executed Change Order shall represent the complete, equitable, and final amount of adjustment in the Contract Amount and/or Contract Time owed to CONTRACTOR or OWNER as a result of the occurrence or event causing the change in the Work encompassed by the Change Order.

10.3 Change Directives:

- 10.3.1** Without invalidating the Contract, OWNER may, by written Change Directive, using the Force Account method, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Amount and Contract Time being adjusted as necessary. "Force Account" means a basis of payment for the direct performance of Work with payment based on the actual cost of the labor, equipment and materials furnished and consideration for overhead and profit as set forth in Section 11.5, below. A Change Directive shall be used in the absence of complete and prompt agreement on the terms of a Change Order. Where practicable, any items of Work that may be agreed upon, prior to the performance of Work under this Section, will be included in a separate

Change Order. For example, the cost of the installation of additional asphalt may be agreed upon based on the unit prices in the Bid.

- 10.3.2** If the Change Directive provides for an adjustment to the Contract Amount, the adjustment shall be based on the method provided in paragraph 11.5.
- 10.3.3** A Change Directive shall be effective immediately and shall be recorded later by preparation and execution of an appropriate Change Order.
- 10.3.4** Upon receipt of a Change Directive, CONTRACTOR shall promptly proceed with the change in the Work involved, provided, prior to the commencement of any Work under this section, the CONTRACTOR must submit its proposed Work plan, anticipated schedule, and a list of its work force and equipment proposed to be used in the Work for OWNER'S approval. Upon such approval, CONTRACTOR must promptly commence and make continuous progress in the Work. The OWNER reserves the right to withhold payment for low production or lack of progress.

10.4 Field Order:

- 10.4.1** Owner's Representative may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Amount or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These shall be accomplished by written Field Order and shall be binding on OWNER and on CONTRACTOR who shall perform the Work involved promptly.
- 10.4.2** If CONTRACTOR believes that a Field Order would require an adjustment in the Contract Amount and/or Contract Times, CONTRACTOR shall make a prompt written request to Owner's Representative for a Change Order. Any request by CONTRACTOR for an adjustment in Contract Amount and/or Contract Times must be made in writing prior to beginning the work covered by the Field Order.

- 10.5 No Damages for Delay:** CONTRACTOR shall receive no compensation for delays or hindrances to the Work, except when direct and unavoidable extra cost to CONTRACTOR is caused by failure of OWNER to provide information or material, if any, which is to be furnished by OWNER or access to the Work and only to the extent that such acts continue after the CONTRACTOR furnishes OWNER with written notice of such failure. When such extra compensation is claimed a written statement thereof shall be presented by CONTRACTOR to OWNER and if by OWNER found correct shall be approved. If delay is caused by specific orders given by OWNER to stop work or by performance of extra Work or by failure of OWNER to provide material or necessary instructions for carrying on the Work, then such delay will entitle CONTRACTOR to an equivalent extension of time, CONTRACTOR's application for which shall, however, be subject to approval of OWNER. No such extension of time shall release CONTRACTOR or surety on its performance bond from all CONTRACTOR's obligations hereunder which shall remain in full force until discharge of the Contract. In no event shall the CONTRACTOR be entitled to any compensation or recovery of any special damages in connection with any delays, including without limitation: consequential damages, lost opportunity costs, impact damages, or other similar damages. The OWNER'S exercise of any of its rights or remedies under the Contract Documents (including without limitation ordering changes in the Work, or directing suspension, rescheduling, or correction of the Work), regardless of the extent or frequency of the OWNER'S exercise of such rights or remedies, shall not be construed as active interference in the CONTRACTOR'S performance of the Work. Except as otherwise provided herein, an extension of Contract Time, to the extent permitted under Article 12, shall be the sole remedy of the CONTRACTOR for any acknowledged delays.

ARTICLE 11 - CHANGE OF CONTRACT AMOUNT

- 11.1** The Contract Amount is stated in the Agreement and, including authorized adjustments, is the total amount payable by OWNER to CONTRACTOR for performance of the Work under the Contract Documents.
- 11.2** The original Contract Amount may not be increased by more than twenty-five percent (25%) and it may not be decreased more than twenty-five percent (25%) without the consent of the CONTRACTOR to such decrease, except in the event of a termination for convenience under paragraph 15.2 or the failure of the City Council to appropriate sufficient funding for the Project, in which events it is agreed that the consent of the CONTRACTOR will not be required.
- 11.3** The Contract Amount shall only be changed by a Change Order. Any claim for an adjustment in the Contract Amount shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than thirty (30) calendar days) after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant, and shall represent that the adjustment claimed covers all known amounts to which claimant is entitled as a result of said occurrence or event. If OWNER and CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Amount shall be determined as set out in Article 16.
- 11.4** Determination of Value of Work:
- 11.4.1** The value of any Work covered by a Change Order for an adjustment in the Contract Amount will be determined by one or more of the following methods:
- .1 by application of unit prices contained in the Contract Documents to the quantities of the items involved.
 - .2 by a mutually agreed unit price, or lump sum properly itemized and supported by sufficient substantiating data, including documentation by subcontractors performing the work, to permit evaluation.
 - .3 by cost of Work plus CONTRACTOR's fee for all overhead costs and profit (determined as provided in paragraph 11.5).
 - .4 No cost will be included in the change order for time spent preparing the change order, nor will costs be included for an estimate of time to negotiate the change order costs for machinery, tools, or equipment as described in subparagraph 11.5.3
- 11.4.2** Before using the method described in paragraph 11.4.1.3, OWNER and CONTRACTOR agree to negotiate a Change Order using the methods identified in paragraphs 11.4.1.1 and 11.4.1.2, as appropriate, to determine the adjustment in the Contract Amount.
- 11.5 Cost of Work:** If neither of the methods defined in paragraphs 11.4.1.1 nor 11.4.1.2 can be agreed upon before a change in the Work is commenced which will result in an adjustment in the Contract Amount, then the change in the Work will be performed by Change Directive, using the Force Account method, and payment will be made as follows:
- 11.5.1** For all personnel, CONTRACTOR will receive actual field cost wage rates for each hour that said personnel are actually engaged in such Work, as substantiated by its certified payroll, to which will be added an amount equal to twenty-five percent

(25%) of the sum thereof as compensation for CONTRACTOR's total overhead, profit, and small tools. No separate charge will be made by CONTRACTOR or its Subcontractor(s) for organization or overhead expenses. In no case will the rate of wage be less than the minimum shown in the Contract for a particular category. CONTRACTOR will also receive an amount equal to 55% of the wages paid personnel, excluding the 25% compensation provided above, for CONTRACTOR's and any effected Subcontractor's cost of premiums on public liability insurance, workers' compensation insurance, social security and unemployment insurance. No charge for superintendence will be made unless considered necessary and ordered by OWNER.

- 11.5.2** CONTRACTOR will receive the actual cost, including freight charges, of the materials used and installed on such Work, to which costs will be added a sum equal to twenty-five percent (25%) thereof as compensation for CONTRACTOR's and any affected Subcontractor's total overhead and profit. In case material invoices indicate a discount may be taken, the actual cost will be the invoice price minus the discount.
- 11.5.3** For machinery, trucks, power tools, or other similar equipment (the "equipment") agreed to be necessary by OWNER and CONTRACTOR, OWNER will allow CONTRACTOR the Regional and Model Year adjusted Monthly Ownership Cost divided by 176 plus the Hourly Estimated Operating Costs as given in the latest edition of the "Rental Rate Blue Book" as published by EquipmentWatch (1-800-669-3282) for each hour that said equipment is in use on such work. The established equipment rates will be paid for each hour that the equipment is utilized in the Work. In the event that the equipment is used intermittently during the Work, full payment for an eight-hour day will be made if the equipment is not idle more than four (4) hours of the day. If the equipment is idle more than four (4) hours in a day, then payment will be made only for the actual hours worked. No additional compensation will be allowed on the equipment for CONTRACTOR's or any affected Subcontractor's overhead and profit. OWNER may accept an actual rental invoice in lieu of the method of calculation set forth in paragraph 11.5.3 for equipment rented exclusively for Force Account Work or for equipment not included in the Rental Rate Blue Book.
- 11.5.4** For Subcontractors, CONTRACTOR will receive the approved actual invoice cost plus 5% as compensation for CONTRACTOR's total overhead and profit.
- 11.5.5** CONTRACTOR will receive an additional 1% of the total of 11.5.1, 11.5.2, 11.5.3, and 11.5.4 as compensation for increased bond costs.
- 11.5.6** The compensation, as herein provided for, shall be received by CONTRACTOR and any affected Subcontractor as payment in full for work done by Change Directive and will include use of small tools, and total overhead expense and profit. CONTRACTOR and Owner's Representative shall compare records of work done by Change Directive at the end of each day. Copies of these records will be made upon forms provided for this purpose by OWNER and signed by both Owner's Representative and CONTRACTOR, with one copy being retained by OWNER and one by CONTRACTOR. Refusal by CONTRACTOR to sign these records within two (2) working days of presentation does not invalidate the accuracy of the record.

11.6 Unit Price Work:

- 11.6.1** Where the Contract Documents provide that all or part of the Work is to be unit price Work, initially the Contract Amount will be deemed to include for all unit price work an amount equal to the sum of the established unit price for each separately

identified item of unit price work times the estimated quantity of each item as indicated in the Bid. The estimated quantities of items of unit price work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Amount. Determinations of the actual quantities and classifications of unit price work performed by CONTRACTOR will be made by Owner's Representative. Owner's Representative will review with CONTRACTOR the preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise).

- 11.6.2** When "plan quantity" is indicated for a Bid item, CONTRACTOR shall be paid amount specified in the Contract Documents without any measurements.
- 11.6.3** Each unit price will be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR's overhead and profit for each separately identified item.
- 11.6.4** A Major Item is any individual Bid item in the Bid that has a total cost equal to or greater than five percent (5%) of the original Contract Amount or \$50,000, whichever is greater, computed on the basis of Bid quantities and Contract unit prices.
- 11.6.5** OWNER or CONTRACTOR may make a Claim for an adjustment in the Contract Amount in accordance with Article 11 if:
 - .1** the actual quantity of any Major Item should become as much as twenty percent (20%) more than or twenty percent (20%) less than that in the Bid; or
 - .2** CONTRACTOR presents documentation contesting accuracy of "plan quantity" and Owner's Representative verifies quantity and determines original value is in error by five percent (5%) or more;

Provided, however, in the event a Major Item is reduced by twenty percent (20%) or more of the amount in the Bid, no additional Article 11 profit or overhead will be added, if, due to other additions in the Work, the net value of the Contract Amount is not reduced.

ARTICLE 12 - CHANGE OF CONTRACT TIMES

12.1 Working Day and Calendar Day Contracts:

- 12.1.1** The Contract Times (or Milestones) may only be changed by Change Order or Time Extension Request duly executed by both CONTRACTOR and Owner's Representative. Any claim for an adjustment of the Contract Times (or Milestones) shall be made by Written Notice delivered by the party making the Claim to the other party promptly (but in no event later than thirty (30) calendar days after the start of the occurrence or event giving rise to the delay) and stating the general nature of the delay. Notice of the extent of the delay with supporting data shall be delivered within thirty (30) calendar days after Written Notice of Claim is delivered by claimant, and shall represent that the adjustment claimed is the entire adjustment to which claimant is entitled as a result of said occurrence or event. If OWNER and CONTRACTOR cannot otherwise agree, all Claims for adjustment in the Contract Times (or Milestones) shall be determined as set out in Article 16. No Claim for an adjustment in the Contract Times (or Milestones) will be valid if not submitted in accordance with the requirements of this paragraph.

- 12.1.2** When CONTRACTOR is at fault and OWNER stops the Work, so that corrections in the Work can be made by CONTRACTOR, no extension in time will be allowed.
- 12.1.3** When CONTRACTOR is prevented from completing any part of the Work within the Contract Times (or Milestones) due to delay beyond the control of both OWNER and CONTRACTOR, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be CONTRACTOR's sole and exclusive remedy for such delay. If performance by the CONTRACTOR or OWNER is interrupted by any occurrence not occasioned by its own conduct, whether such occurrence be an act of god or the result of war, riot, civil commotion, sovereign conduct, or the conduct of a third party, then such performance will be excused for a period of time necessary to remedy its effects, provided, however, in such an event, a conference will be held within three (3) business days to establish a proposed new Progress Schedule for the Project.
- 12.1.4** OWNER will consider time extension requests and may grant CONTRACTOR an extension of time because of:
- .1** Changes ordered in the work which justify additional time.
 - .2** Failure of materials or products being at the Project site due to delays in transportation or failures of Suppliers, which are not the result of CONTRACTOR's, Subcontractor's or Supplier's negligence. The request for an extension of time shall be supported by a citation of acts demonstrating that the delays are beyond CONTRACTOR's control, including, but not limited to, CONTRACTOR's efforts to overcome such delays documented as follows:
 - a)** Copy of purchase order for delayed item(s) indicating date ordered by CONTRACTOR/ Subcontractor and date purchase order received by Supplier.
 - b)** If item(s) require Shop Drawings or other submittal information in accordance with the Contract Documents, provide record of date submittal(s) forwarded to Owner's Representative, date submittal(s) returned to CONTRACTOR, and date submittal(s) forwarded to Supplier.
 - c)** Copy of document(s) from Supplier, on Supplier's letterhead, indicating date(s) item(s) would be ready for shipment and/or actual shipment date(s).
 - d)** Copies of all correspondence between CONTRACTOR / Subcontractor and Supplier indicating CONTRACTOR / Subcontractor's efforts to expedite item(s).
 - e)** If item(s) are being purchased by a Subcontractor, provide correspondence, meeting notes, etc., that reflect CONTRACTOR's efforts with the Subcontractor to expedite delivery of the item(s).
 - .3** When acts of OWNER, E/A, utility owners or other contractors employed by OWNER delay progress of work through no fault of CONTRACTOR. The CONTRACTOR will only be entitled to an extension of time for delays that affect the Critical Path of the Work and that are not caused by the CONTRACTOR.
 - .4** When CONTRACTOR is delayed by strikes, lockouts, fires, losses from natural causes, or other unavoidable cause or causes beyond CONTRACTOR's control.

12.2 Calendar Day Contracts:

12.2.1 Under a Calendar Day Contract, CONTRACTOR may be granted an extension of time because of unusual inclement weather, including but not limited to unusual rainfall events, which are beyond the normal rainfall recorded and expected for Austin, Texas. However, the CONTRACTOR will not be granted an extension of time for "normal rainfall", as described below.

12.2.2 "Unusual Inclement Weather" is defined as a rain event or other weather related event which occurs at the site and is of sufficient magnitude to prevent CONTRACTOR from performing units of Work critical to maintaining the Progress Schedule.

12.2.3 Baseline Rain Day Determination. "Normal rainfall" compiled by the State climatologist, based on U.S. Weather Bureau Records for Austin, Texas, is considered a part of the Calendar Day Contract, and is not a justification for an extension of time. Listed below are the number of days in each month for which no compensatory days for rainfall events ("Rain Days") in such months may be claimed:

January.....	8 days
February.....	8 days
March.....	7 days
April.....	7 days
May.....	9 days
June.....	6 days
July.....	5 days
August.....	5 days
September.....	7 days
October.....	7 days
November.....	7 days
December.....	7 days

Rain Days in addition to the baseline Rain Day determination described above will be measured with the Owner's Representative's approval at the nearest operational public weather data collection facility to the site, including but not limited to the OWNER's early warning flood gauge system.

12.2.4 CONTRACTOR may receive credit in any month for Unusual Inclement Weather, and specifically for any Rain Days in that month which exceed the number of Rain Days allocated to that month, if a Claim is made in accordance with paragraph 12.1.1 and the weather event meets the definition for "Unusual Inclement Weather", and as applicable, "Rain Day" and such claimed day is a day on which Work critical to maintaining the Progress Schedule is scheduled to be performed and is otherwise capable of being performed.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

- 13.1 Notice of Defects:** Prompt notice of all defective Work of which OWNER or E/A has actual knowledge will be given to CONTRACTOR. All defective Work may be rejected, corrected or accepted as provided in Article 13. CONTRACTOR must give OWNER and E/A prompt notice of any defective Work of which CONTRACTOR has actual knowledge.
- 13.2 Access to Work:** OWNER, E/A, E/A's Consultants, other representatives and personnel of OWNER, independent testing laboratories and governmental agencies having jurisdiction will have access to the Work at reasonable times for observing, inspecting and testing. CONTRACTOR shall provide them proper and safe conditions for such access, and advise them of CONTRACTOR's site safety procedures and programs so that they may comply therewith as applicable.
- 13.3 Tests and Inspections:**
- 13.3.1** CONTRACTOR shall give timely notice of readiness of the Work for all required inspections, tests or approvals, and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- 13.3.2** OWNER shall employ and pay for services of an independent testing laboratory to perform all inspections, tests or approvals required by the Contract Documents except:
- .1 for inspections, tests or approvals covered by paragraphs 13.3.3 and 13.3.4 below;
 - .2 that costs incurred for tests or inspections conducted pursuant to paragraph 13.4.3 shall be paid as provided in paragraph 13.4.3;
 - .3 for reinspecting or retesting defective Work, including any associated costs incurred by the testing laboratory for cancelled tests or standby time; and
 - .4 as otherwise specifically provided in the Contract Documents.
- 13.3.3** If laws or regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested or approved by an employee or other representative of such public body, CONTRACTOR shall assume full responsibility for arranging and obtaining such inspections, tests or approvals, pay all costs in connection therewith and furnish Owner's Representative the required certificates of inspection or approval.
- 13.3.4** CONTRACTOR shall also be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests or approvals required for OWNER's and E/A's review of submittals covering materials, equipment, and mix designs to be incorporated in the Work.
- 13.3.5** All testing laboratories shall meet the requirements of ASTM E-329.
- 13.4 Uncovering Work:**
- 13.4.1** If any Work (or the work of others) that is to be inspected, tested or approved is covered by CONTRACTOR without written concurrence of Owner's Representative, or if any Work is covered contrary to the written request of Owner's Representative, it must, if requested by Owner's Representative, be uncovered and recovered at CONTRACTOR's expense.

13.4.2 Uncovering Work as provided in paragraph 13.4.1 shall be at CONTRACTOR's expense unless CONTRACTOR has given Owner's Representative timely notice of CONTRACTOR's intention to cover the same and Owner's Representative has not acted within five (5) working days to such notice.

13.4.3 If Owner's Representative considers it necessary or advisable that covered Work be observed, inspected or tested, CONTRACTOR shall uncover, expose or otherwise make available for observation, inspection or testing that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is defective, CONTRACTOR shall pay all claims, costs, losses and damages caused by, arising out of or resulting from such uncovering, exposure, observation, inspection and testing and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and OWNER shall be entitled to an appropriate decrease in the Contract Amount, and may make a Claim therefor as provided in Article 11. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Amount or an extension of the Contract Times (or Milestones), or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement and reconstruction; and CONTRACTOR may make a Claim therefor as provided in Articles 11 and 12.

13.5 OWNER May Stop the Work:

13.5.1 If the Work is defective, or CONTRACTOR fails to supply sufficient skilled workers, suitable materials, and/or equipment; or fails to furnish or perform the Work in such a way that the Work in progress or the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any surety or other party.

13.5.2 If CONTRACTOR fails to correct defective Work or submit a satisfactory plan to take corrective action, with procedure and time schedule, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until cause for such order has been eliminated, or take any other action permitted by this Contract. A notice to stop the Work, based on defects, shall not stop calendar or working days charged to the Project.

13.6 Correction or Removal of Defective Work: If required by OWNER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Owner's Representative, remove it from the site and replace it with Work that is not defective. CONTRACTOR shall correct or remove and replace defective Work, or submit a plan of action detailing how the deficiency will be corrected, within the time frame identified in the notice of defective Work. CONTRACTOR shall pay all claims, costs, losses and damages caused by or resulting from such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.7 Warranty period:

13.7.1 If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by laws or regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents (e.g. paragraph 14.11.2), any Work, including work performed after the Substantial Completion date, is found to be defective,

CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instructions:

- (i) correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with Work that is not defective, and
- (ii) satisfactorily correct or remove and replace any damage to other Work or the work of others resulting therefrom.

If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all claims, costs, losses and damages caused by or resulting from such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by CONTRACTOR. The warranty period will be deemed to be renewed and recommenced in connection with the completed items of Work requiring correction.

13.7.2 In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the warranty period for that item may start to run from an earlier date if so provided in the Contract Documents.

13.7.3 If correction of defective Work will affect the function or use of the facility CONTRACTOR shall not proceed with correction of defective Work without prior coordination and approval of OWNER.

13.7.4 The obligations of the CONTRACTOR to perform warranty work will survive the acceptance of the Work and any termination of the Contract.

13.8 Acceptance of Defective Work: If, instead of requiring correction or removal and replacement of defective Work, OWNER decides to accept it, OWNER may do so. CONTRACTOR shall pay all claims, costs, losses and damages attributable to OWNER's evaluation of and determination to accept such defective Work. If any such acceptance occurs prior to recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents and compensating OWNER for the diminished value of the defective Work. If the acceptance occurs after such recommendation, an appropriate amount will be paid by CONTRACTOR to OWNER after a calculation by OWNER of the diminution in value of the defective Work.

13.9 OWNER May Correct Defective Work: If CONTRACTOR fails within a reasonable time after Written Notice of OWNER to correct defective Work, or to remove and replace rejected Work, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents, or if CONTRACTOR fails to comply with any other provision of the Contract Documents, OWNER may, after seven (7) calendar days' Written Notice to CONTRACTOR, correct and remedy any such deficiency. If, in the opinion of the Owner's Representative, significant progress has not been made during this seven (7) calendar day period to correct the deficiency, the OWNER may exercise any actions necessary to remedy the deficiency. In exercising the rights and remedies under this paragraph, OWNER shall proceed expeditiously. In connection with such corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, and incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, its agents and employees, OWNER's other contractors, E/A and E/A's consultants access to the site to enable OWNER to exercise the rights and remedies under this paragraph. All claims, costs, losses and damages incurred or sustained by OWNER in exercising such rights and remedies will be charged

against CONTRACTOR and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work. Such claims, costs, losses and damages will include but not be limited to all costs of repair or replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's defective Work. CONTRACTOR shall not be allowed an extension of the Contract Times (or Milestones), or claims of damage because of any delay in the performance of the Work attributable to the exercise by OWNER of OWNER's rights and remedies hereunder.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 Application for Progress Payment:

- 14.1.1** Within 45 days from when the work was performed by the Contractor and Subcontractors, but not more often than once a month, CONTRACTOR shall submit to Owner's Representative for review an Application for Payment, in a form acceptable to OWNER, filled out and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.
- 14.1.2** Such applications shall not include requests for payment on account of changes in the Work which have been properly authorized by Change Directives but not yet included in Change Orders.
- 14.1.3** Such applications shall not include requests for payment of amounts the CONTRACTOR does not intend to pay to a Subcontractor or Supplier because of a dispute or other reason.
- 14.1.4** If payment is requested on the basis of materials or equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall be accompanied by such bills of sale, data and other procedures satisfactory to OWNER substantiating OWNER's title to such materials or equipment or otherwise protecting OWNER's interest. Payment on account of such materials or equipment will not include any amount for CONTRACTOR's overhead or profit or relieve CONTRACTOR of its obligation to protect and install such materials or equipment in accordance with the requirements of the Contract and to restore damaged or defective Work. If materials or equipment are stored at another location, at the direction of the OWNER they shall be stored in a bonded and insured facility, accessible to E/A and OWNER, and shall be clearly marked as property of OWNER. Title to materials delivered to the site of the Work or a staging area will pass to OWNER upon payment by OWNER without the necessity for further documentation. Risk of loss will not pass to OWNER until acceptance.
- 14.1.5** Where the original Contract Amount is less than \$400,000, OWNER will pay CONTRACTOR total amount of approved Application for Payment, less ten percent (10%) of amount thereof, which ten percent (10%) will be retained until final payment, less all previous payments and less all other sums that may be retained by OWNER under the terms of this Agreement. Where the original Contract Amount is \$400,000 or more, OWNER will pay CONTRACTOR total amount of approved Application for Payment, less five percent (5%) of amount thereof, which five percent (5%) will be retained until final payment, less all previous payments and less all other sums that may be retained by OWNER under the terms of this Agreement. In either case, if the Work is near completion and delay occurs due to no fault or neglect of CONTRACTOR, OWNER may pay a portion of the retained

amount to CONTRACTOR. CONTRACTOR, at OWNER's option, may be relieved of the obligation to complete the Work and, thereupon, CONTRACTOR shall receive payment of the balance due under the Contract subject to the conditions stated under paragraph 15.2. A Subcontractor may submit a written request to the CONTRACTOR and Project Manager requesting release of retainage for work by the Subcontractor that has been completed and approved. The Project Manager will evaluate the request and if it is approved, the Project Manager will request the CONTRACTOR to include the request for release of an appropriate amount of retainage in the next Pay Application.

14.1.6 Applications for Payment shall include the following documentation:

- .1 updated Progress Schedule;
- .2 monthly subcontractor report;
- .3 any other documentation required under the Supplemental General Conditions.

14.2 CONTRACTOR's Warranty of Title: CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER free and clear of all Liens no later than the time of payment to CONTRACTOR.

14.3 Review of Applications for Progress Payment:

14.3.1 Owner's Representative will, within seven (7) calendar days after receipt of each Application for Payment, either indicate a recommendation for payment and forward the Application for processing by OWNER, or return the Application to CONTRACTOR indicating Owner's Representative's reasons for refusing to recommend payment. In the latter case, CONTRACTOR shall make the necessary corrections and resubmit the Application.

14.3.2 Owner's Representative's recommendation of any payment requested in an Application for Payment will constitute a representation by Owner's Representative, based upon Owner's Representative's on-site observations of the executed Work and on Owner's Representative's review of the Application for Payment and the accompanying data and schedules, that to the best of Owner's Representative's knowledge, information and belief:

- .1 the Work has progressed to the point indicated; and
- .2 the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for unit price Work, and to any other qualifications stated in the recommendation).

14.3.3 By recommending any such payment, Owner's Representative will not thereby be deemed to have represented that:

- .1 exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work;
- .2 examination has been made to ascertain how or for what purpose CONTRACTOR has used money previously paid on account of the Contract Amount;
- .3 CONTRACTOR's construction means, methods, techniques, sequences or procedures have been reviewed; or

- .4 that there may not be other matters or issues between the parties that might entitle CONTRACTOR to be paid additionally by OWNER or entitle OWNER to withhold payment to CONTRACTOR.

14.4 Decisions to Withhold Payment:

14.4.1 OWNER may withhold or nullify the whole or part of any payment to such extent as may be necessary on account of:

- .1 defective Work not remedied;
- .2 third party Claims filed or reasonable evidence indicating probable filing of such Claims;
- .3 failure of CONTRACTOR to make payments properly to Subcontractors for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Amount;
- .5 damage to OWNER or another contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- .7 failure of CONTRACTOR to submit a schedule of values in accordance with the Contract Documents;
- .8 failure of CONTRACTOR to submit a submittal schedule in accordance with the Contract Documents;
- .9 failure of CONTRACTOR to submit and update a construction Progress Schedule in accordance with the Contract Documents;
- .10 failure of CONTRACTOR to maintain a record of changes on drawings and documents;
- .11 failure of CONTRACTOR to maintain weekly payroll reports and, as applicable, provide copies of reports in a timely manner upon request of OWNER;
- .12 failure of CONTRACTOR to submit monthly subcontractor reports;
- .13 CONTRACTOR's neglect or unsatisfactory prosecution of the Work, including failure to clean up;
- .14 failure of CONTRACTOR to comply with the Austin City Code, Chapter 2-9-A, as amended, "Minority-Owned and Women-Owned Business Enterprise Procurement Program;" or
- .15 failure of CONTRACTOR to comply with any provision of the Contract Documents.

14.4.2 When the above reasons for withholding payment are removed, CONTRACTOR shall resubmit a statement for the value of Work performed. Payment will be made within thirty (30) calendar days of receipt of approved Application for Payment.

14.4.3 Subcontractors may request Partial Payment when the OWNER withholds payment of an invoice to the CONTRACTOR for any reason listed in Section 14.4.1. If payment is withheld by the OWNER, the CONTRACTOR shall notify all affected Subcontractors within two (2) working days of notice that payment is being withheld. Upon notification, Subcontractors may submit a formal written request

for Partial Payment to the CONTRACTOR and OWNER. If directed by the OWNER, the CONTRACTOR shall within three (3) working days resubmit to the OWNER an invoice for the same period that includes only the work performed by the requesting Subcontractors during this period. The OWNER will review this resubmitted invoice in accordance with Section 14.3.1. Upon receipt of payment for the resubmitted invoice, CONTRACTOR shall pay the subcontractor within ten (10) Calendar Days in accordance with Section 6.4.7.

14.5 Delayed Payments: Should OWNER fail to make payment to CONTRACTOR of sum named in any Application for Payment within thirty (30) calendar days after the day on which OWNER received the mutually acceptable Application for Payment, then OWNER will pay to CONTRACTOR, in addition to sum shown as due by such Application for Payment, interest thereon at the rate specified in Government Code, Section 2251.025(b) from date due until fully paid, which shall fully liquidate any injury to CONTRACTOR growing out of such delay in payment.

14.6 Arrears: No money shall be paid by OWNER upon any claim, debt, demand or account whatsoever, to any person, firm or corporation who is in arrears to City for taxes; and City shall be entitled to counterclaim and automatically offset against any such debt, claim, demand or account in the amount of taxes so in arrears and no assignment or transfer of such debt, claim, demand or account after said taxes are due, shall affect the right of OWNER to so offset said taxes, and associated penalties and interest if applicable, against the same.

14.7 Substantial Completion:

14.7.1 When the CONTRACTOR considers that the Work, or a portion thereof which the OWNER agrees to accept separately, is substantially complete, the CONTRACTOR shall notify Owner's Representative and request a determination as to whether the Work or designated portion thereof is substantially complete. If Owner's Representative does not consider the Work substantially complete, Owner's Representative will notify CONTRACTOR giving reasons therefor. After performing any required Work, CONTRACTOR shall then submit another request for Owner's Representative to determine Substantial Completion. If Owner's Representative considers the Work substantially complete, Owner's Representative will prepare and deliver a certificate of Substantial Completion which shall establish the date of Substantial Completion, shall include a punch list of items to be completed or corrected before final payment, shall establish the time within which CONTRACTOR shall finish the punch list, and shall establish responsibilities of the OWNER and CONTRACTOR for security, maintenance, heat, utilities, damage to the Work, warranty and insurance. Failure to include an item on the punch list does not alter the responsibility of CONTRACTOR to complete all Work in accordance with the Contract Documents. If a Certificate of Occupancy is required by public authorities having jurisdiction over the Work, said certificate shall be issued before the Work or any portion thereof is considered substantially complete. The certificate of Substantial Completion shall be signed by OWNER and CONTRACTOR to evidence acceptance of the responsibilities assigned to them in such certificate.

14.7.2 OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER will allow CONTRACTOR reasonable access to complete or correct items on the punch list and complete warranty work.

14.8 Partial Utilization: Use by OWNER, at OWNER's option, of any substantially completed part of the Work which: (i) has specifically been identified in the Contract Documents, or (ii) OWNER and CONTRACTOR agree constitutes a separately functioning and usable part of the Work that can be used by OWNER for its intended purpose without significant interference

with CONTRACTOR's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work in accordance with the following:

14.8.1 OWNER at any time may request CONTRACTOR to permit OWNER to use any such part of the Work which OWNER believes to be ready for its intended use and substantially complete. If CONTRACTOR agrees that such part of the Work is substantially complete, CONTRACTOR shall certify to Owner's Representative that such part of the Work is substantially complete and request Owner's Representative to issue a certificate of substantial Completion for that part of the Work. CONTRACTOR at any time may notify Owner's Representative that CONTRACTOR considers any such part of the Work ready for its intended use and substantially complete and request Owner's Representative to issue a certificate of Substantial Completion for that part of the Work. The provisions of paragraphs 14.7.1 and 14.7.2 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.8.2 Such partial utilization is authorized by public authorities having jurisdiction over the Work.

14.9 Final Inspection: Upon Written Notice from CONTRACTOR that the entire Work or an agreed portion thereof is complete, Owner's Representative will make a final inspection with CONTRACTOR and provide Written Notice of all particulars in which this inspection reveals that the Work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.10 Final Application for Payment: CONTRACTOR may make application for final payment following the procedure for progress payments after CONTRACTOR has completed all such corrections to the satisfaction of Owner's Representative and delivered the following documents:

14.10.1 Affidavit by CONTRACTOR certifying the payment of all debts and claims;

14.10.2 Three (3) complete operating and maintenance manuals, each containing maintenance and operating instructions, schedules, guarantees, and other documentation required by the Contract Documents;

14.10.3 Record documents (as provided in paragraph 6.10);

14.10.4 Consent of surety, if any, to final payment. If surety is not provided, complete and legally effective releases or waivers (satisfactory to OWNER) of all claims arising out of or filed in connection with the Work;

14.10.5 Certificate evidencing that insurance required by the Supplemental General Conditions will remain in force after final payment and through the warranty period;

14.10.6 Non-Use of Asbestos Affidavit (After Construction);

14.10.7 Subcontractor report and all other documentation necessary for evaluation of CONTRACTOR's fulfillment of the Contract MBE/WBE or DBE goals;

14.10.8 Documentation of notice to claimants, to the extent applicable and subject to subparagraph 14.11.4;

14.10.9 Proof of performance Bond extension through warranty period, if a performance Bond was required; and

14.10.10 Any other documentation called for in the Contract Documents.

14.11 Final Payment and Acceptance:

- 14.11.1** If, on the basis of observation of the Work during construction, final inspection, and review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Owner's Representative is satisfied that the Work has been completed and CONTRACTOR's other obligations under the Contract Documents have been fulfilled and there are no outstanding claims, Owner's Representative will recommend the final Application for Payment and thereby notify the OWNER, who will pay to CONTRACTOR the balance due CONTRACTOR under the terms of the Contract. If the sole remaining unfinished item to complete the Work is the reestablishment of vegetation, CONTRACTOR may execute a revegetation letter with fiscal posted (letter of credit) to ensure completion of this item. This Work must be accomplished within one hundred twenty (120) Calendar Days of the date of Final Completion of the Work. When the permanent erosion control has been established, OWNER will initiate an inspection for final acceptance of the erosion controls. If the revegetation is not completed within the one hundred twenty (120) Calendar Days, OWNER, at its option, may complete the Work using the posted fiscal.
- 14.11.2** If the Contract measures Contract Time to Final Completion, rather than Substantial Completion, Owner's Representative will issue a letter of final acceptance to CONTRACTOR which establishes the Final Completion date and initiates the one-year warranty period. If the sole remaining unfinished item to complete the Work is the reestablishment of vegetation and CONTRACTOR has executed a revegetation letter with fiscal posted (letter of credit) to ensure completion of this item, the Owner's Representative will issue a letter of conditional acceptance to CONTRACTOR which established the Final Completion date and initiates the one-year warranty period.
- 14.11.3** Final payment is considered to have taken place when CONTRACTOR or any of its representatives negotiates OWNER's final payment check, whether labeled final or not, for cash or deposits check in any financial institution for its monetary return.
- 14.11.4** The OWNER will withhold funds sufficient to cover the amount of any unresolved contract claims from final payment for six months under the following limited conditions:
- .1** CONTRACTOR must provide written notice to the claimant (via certified mail or hand delivery) that (i) OWNER will hold funds in the amount of the disputed claim for six (6) months from the date of the receipt of the notice and (ii) CONTRACTOR and the claimant have certain alternative dispute resolution rights; and
 - .2** CONTRACTOR must provide OWNER with a copy of the receipted notice.

Provided the claimant has received notice under this section, OWNER will release the withheld funds, if the CONTRACTOR provides a bond in substantial compliance with the provisions of Section 52.231 of the Texas Property Code; when the OWNER receives a settlement or release of the claim with accompanying instructions regarding payment; upon resolution of the claim in litigation, if suit is filed within such six (6) month period and the OWNER receives written notice of such filing; or when such six (6) month period has passed, if no such bond, settlement, release, or notice of filing of suit have been received. The above provisions notwithstanding, if efforts to timely resolve a disputed claim are not being made to OWNER'S reasonable satisfaction, OWNER may, in its complete discretion, file an interpleader action and deposit the withheld funds in the registry

of a court of competent jurisdiction. In addition, CONTRACTOR must include a provision in each of its subcontracts that the prevailing party in any litigation arising thereunder will be entitled to recover its costs of court and reasonable attorney's fees.

14.12 Waiver of Claims: The making and acceptance of final payment will constitute:

- 14.12.1** a waiver of claims by OWNER against CONTRACTOR, except claims arising from unsettled claims, from defective Work appearing after final inspection, from failure to comply with the Contract Documents or the terms of any warranty specified therein, or from CONTRACTOR's continuing obligations under the Contract Documents; and
- 14.12.2** a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.1 OWNER May Suspend Work Without Cause: At any time and without cause, OWNER may suspend the Work or any portion thereof for a period of not more than ninety (90) calendar days by Written Notice to CONTRACTOR which will fix the date on which the Work will be resumed. CONTRACTOR shall resume the Work on the date so fixed. CONTRACTOR shall be allowed an adjustment in the Contract Amount or an extension of the Contract Times, or both, directly attributable to any such suspension if CONTRACTOR makes an approved Claim therefor as provided in Articles 11 and 12.

15.2 OWNER May Terminate Without Cause: Upon seven (7) calendar days' Written Notice to CONTRACTOR, OWNER may, without cause and without prejudice to any right or remedy of OWNER, elect to terminate the Agreement. In such case, CONTRACTOR shall be paid (without duplication of any items):

- 15.2.1** for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination;
- 15.2.2** for reasonable demobilization costs; and
- 15.2.3** for anticipated profits on completed and accepted Work not previously paid and not included in separate pay items calculated to date of termination but not for anticipated profit on the entire Contract not previously paid, unabsorbed overhead, or lost opportunity.

15.3 OWNER May Terminate With Cause:

15.3.1 Upon the occurrence of any one or more of the following events:

- .1** if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents;
- .2** if CONTRACTOR disregards laws or regulations of any public body having jurisdiction;
- .3** if CONTRACTOR disregards the authority of Owner's Representative;
- .4** if CONTRACTOR makes fraudulent statements;
- .5** if CONTRACTOR fails to maintain a work force adequate to accomplish the Work within the Contract Time;

- .6 if CONTRACTOR fails to make adequate progress and endangers successful completion of the Contract; or
- .7 if CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents;

OWNER may, after giving CONTRACTOR (and the surety, if any) seven (7) calendar days Written Notice terminate the services of CONTRACTOR. OWNER, at its option, may proceed with negotiation with surety for completion of the Work. Alternatively, OWNER may under these circumstances exclude CONTRACTOR from the site and take possession of the Work (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Amount exceeds all claims, costs, losses and damages sustained by OWNER arising out of or resulting from completing the Work, such excess will be paid to CONTRACTOR. If such claims, costs, losses and damage exceed such unpaid balance, CONTRACTOR or surety shall pay the difference to OWNER. In the event that a termination for cause is found to be wrongful, the termination shall be converted to a termination without cause as set forth in Section 15.2 and CONTRACTOR'S remedy for wrongful termination is limited to the recovery of the payments permitted for termination without cause as set forth in Section 15.2.

- 15.3.2** Where CONTRACTOR's services have been so terminated by OWNER, the termination will not affect any rights or remedies of OWNER against CONTRACTOR and surety then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability. In the event OWNER terminates Contract with cause, OWNER may reject any and all Bids submitted by CONTRACTOR for up to three (3) years after the date of such termination. These sanctions will be administered in accordance with the City of Austin Purchasing Office Probation, Suspension, and Debarment Procedures for Vendors, which include notice and an opportunity for a hearing.

- 15.4 CONTRACTOR May Stop Work or Terminate:** If through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety (90) calendar days by OWNER or under an order of court or other public authority, or (except during disputes) Owner's Representative fails to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) OWNER fails for sixty (60) calendar days after it is submitted to pay CONTRACTOR any sum finally determined by OWNER to be due, then CONTRACTOR may, upon seven (7) calendar days' Written Notice to OWNER, and provided OWNER does not remedy such suspension or failure within that time, terminate the Agreement and recover from OWNER payment on the same terms as provided in paragraph 15.2. In lieu of terminating the Agreement and without prejudice to any other right or remedy, if (except during disputes) Owner's Representative has failed to forward for processing any mutually acceptable Application for Payment within thirty (30) calendar days after it is submitted, or (except during disputes) OWNER has failed for sixty (60) calendar days after it is submitted to pay CONTRACTOR any sum finally determined by OWNER to be due, CONTRACTOR may upon seven (7) calendar days' Written Notice to OWNER stop the Work until payment of all such amounts due CONTRACTOR, including interest thereon. The provisions of this paragraph 15.4 are not intended to preclude CONTRACTOR from making a Claim under Articles 11 and 12 for an increase in Contract Amount or Contract Times or otherwise for expenses or damage directly attributable to CONTRACTOR's stopping Work as permitted by this paragraph.

- 15.5 Discretionary Notice to Cure:** In its complete discretion, OWNER may, but is not required to, provide a Notice to Cure to CONTRACTOR and its surety to cure an event of default described above and/or an anticipatory breach of contract and, if required by OWNER, to attend a meeting with OWNER, regarding the Notice to Cure, the event of default, and/or the anticipatory breach of contract. The Notice to Cure will set forth the time limit in which the cure is to be completed or commenced and diligently prosecuted. Upon receipt of any Notice to Cure, CONTRACTOR shall prepare a report describing its program and measures to affect the cure of the event of default and/or anticipatory breach of contract within the time required by the Notice to Cure. The CONTRACTOR'S report must be delivered to OWNER at least three (3) days prior to any requested meeting with the OWNER and surety.
- 15.6 Bankruptcy:** If CONTRACTOR declares bankruptcy or is adjudged bankrupt or makes an assignment for the benefit of creditors or if a receiver is appointed for the benefit of creditors or if a receiver is appointed by reason of CONTRACTOR'S insolvency, CONTRACTOR may be unable to perform this Contract in accordance with the Contract requirements. In such an event, OWNER may demand CONTRACTOR or its successor in interest provide OWNER with adequate assurance of CONTRACTOR'S future performance in accordance with the terms and conditions of the Contract. If CONTRACTOR fails to provide adequate assurance of future performance to OWNER'S reasonable satisfaction within ten (10) days of such a request, OWNER may terminate the CONTRACTOR'S services for cause or without cause, as set forth above. If CONTRACTOR fails to provide timely adequate assurance of its performance and actual performance, OWNER may prosecute the Work with its own forces or with other contractors on a time and material or other appropriate basis and the cost of which will be charged against the Contract balance.
- 15.7 Duty to Mitigate:** In the event of any termination or suspension under this Contract, the CONTRACTOR agrees to and shall take all reasonable actions to mitigate its damages and any and all claims which may be asserted against the OWNER.
- 15.8 Responsibility during Demobilization:** While demobilizing, the CONTRACTOR will take all necessary and reasonable actions to preserve and protect the Work, the site and other property of the OWNER or others at the site.

ARTICLE 16 - DISPUTE RESOLUTION

16.1 Filing of Claims:

- 16.1.1** Claims arising from the circumstances identified in paragraphs 3.2, 4.1, 4.2.2, 4.2.4, 6.4.2, 6.11.5.2, 6.17, 7.5, 8.6, 9.5, 10.4.2, 13.4.3, 13.8, 13.9, 15.1, 15.2, 15.3, or 15.4, or other occurrences or events, shall be made by Written Notice delivered by the party making the Claim to the other party within thirty (30) calendar days after the start of the occurrence or event giving rise to the Claim and stating the general nature of the Claim. Notice of the amount of the Claim with supporting data shall be delivered in writing within thirty (30) calendar days after Written Notice of Claim is delivered by claimant and shall represent that the adjustment claimed covers all known amounts and/or extensions of time to which claimant is entitled.
- 16.1.2** Within thirty (30) calendar days of receipt of notice of the amount of the Claim with supporting data, Owner's Representative and CONTRACTOR shall meet to discuss the Claim, after which an offer of settlement or notification of no settlement offer will be made to claimant. If claimant is not satisfied with the proposal presented, claimant shall have thirty (30) calendar days in which to: (i)

submit additional supporting data requested by the other party; (ii) modify the initial Claim; or (iii) request Alternative Dispute Resolution.

16.2 Alternative Dispute Resolution:

16.2.1 If a dispute exists concerning a Claim, the parties agree to use the following procedure prior to pursuing any other available remedies. OWNER reserves the right to include the E/A as a party.

16.2.2 Negotiating with Previously Uninvolved Personnel: Either party may make a written request for a meeting to be held between representatives of each party within fourteen (14) Calendar Days of the request or such later period that the parties may agree to. Each party shall endeavor to include, at a minimum, one (1) previously uninvolved senior level decision maker (an owner, officer, or employee of each organization) empowered to negotiate on behalf of their organization. If a previously uninvolved senior level decision maker is unavailable due to the size of the CONTRACTOR'S organization or any other reason, the CONTRACTOR shall nonetheless provide an appropriate senior level decision maker for the meeting. The purpose of this and any subsequent meetings will be good faith negotiations of the matters constituting the dispute. Negotiations shall be concluded within thirty (30) Calendar Days of the first meeting, unless mutually agreed otherwise. This step may be waived by a written agreement signed by both parties, in which event the parties may proceed directly to mediation as described below.

16.2.3 Mediation:

.1 If the procedure described in 16.2.2 proves unsuccessful or is waived pursuant to its terms, the parties shall initiate the mediation process. OWNER and CONTRACTOR agree to select within thirty (30) calendar days a mediator trained in mediation skills, to assist with resolution of the dispute. OWNER and CONTRACTOR agree to act in good faith in the selection of the mediator and to give consideration to qualified individuals nominated to act as mediator. Nothing in this agreement prevents the parties from relying on the skills of a person who also is trained in the subject matter of the dispute and/or a contract interpretation expert. Should the parties fail to agree on a mediator within thirty (30) calendar days of initiation of the mediation process, the parties agree to ask the Travis County Dispute Resolution Center to select a qualified individual, which selection shall be binding on the parties.

.2 Mediation is a forum in which an impartial person, the mediator, facilitates communication between parties to promote reconciliation, settlement, or understanding among them. The parties hereby agree that mediation, at a minimum, shall provide for (i) conducting an on-site investigation, if appropriate, by the mediator for fact gathering purposes, (ii) a meeting of all parties for the exchange of points of view and (iii) separate meetings between the mediator and each party to the dispute for the formulation of resolution alternatives. The parties agree to participate in mediation in good faith for up to thirty (30) calendar days from the date of the first mediation session, unless mutually agreed otherwise. Should the parties fail to reach a resolution of the dispute through mediation, then each party is released to pursue other remedies available to them.

16.3 Resolution of Disputes between Contractor and Subcontractor or Supplier: If a dispute exists concerning a claim between a CONTRACTOR and a Subcontractor or Supplier, the CONTRACTOR agrees to participate with such Subcontractor and/or Supplier in a

process substantially paralleling the steps set out in paragraphs 16.1 and 16.2 above, including the delivery of written notices, submission of supporting data, negotiation with previously uninvolved personnel, and, if such alternative dispute resolution process is unsuccessful, mediation between the parties to the claim. If the CONTRACTOR and Subcontractor or Supplier agreement provides an alternative dispute resolution process, which provides substantially equivalent rights to those set forth herein, it may be followed, unless the CONTRACTOR and affected Subcontractor or Supplier agree to follow the process outlined above. The OWNER is not a party to the alternative dispute resolution process between the CONTRACTOR and Subcontractor or Supplier and will not pay any costs incurred in the process. Each party will be responsible for its own expenses incurred in the process, which will include an equal share of the mediation expenses, unless otherwise determined by the mediator. NOTICE: THE PROCESS SET FORTH HEREIN IS NOT A SUBSTITUTE FOR THE STATUTORY PAYMENT BOND CLAIM PROCESS.

16.4 Claim Calculation:

16.4.1 Delay Claims: The intent of paying for delay damages is to reimburse the CONTRACTOR for actual expense arising out of a compensable delay. No profit or force account markups, other than labor burden, will be allowed for delay claims by the CONTRACTOR seeking reimbursement for expenses arising out of an alleged event of delay. No consequential damages will be allowed to the CONTRACTOR in connection with any claimed delays. If the CONTRACTOR requests compensation for delay damages and the delay is determined to be compensable, then standby equipment costs and project overhead compensation will be based on the duration of the compensable delay and the following:

- .1** Standby equipment costs will not be allowed during periods when the equipment would have otherwise been idle. Standby equipment time will not exceed more than eight (8) hours per twenty-four (24) hour day, forty (40) hours per week, and one hundred seventy-six (176) hours per month. Standby equipment costs will be paid at 50 percent (50%) of the applicable Rental Rate Blue Book rates and calculated by dividing the monthly rate by one hundred seventy-six (176), multiplying the result by the number of standby hours and multiplying that number by the regional adjustment factor and the rate adjustment factor contained in the Blue Book. Operating costs will not be allowed.
- .2** Project overhead will be determined from actual costs that the CONTRACTOR will be required to document. Project overhead is defined as the administrative and supervisory expenses incurred at the work site and will not include home office overhead.

16.4.2 General: Except as limited with respect to delay claims, as set forth above, the criteria set forth in Section 11.4.1 may be used as a basis to calculate an adjustment in the Contract Amount in the resolution of a claim, provided that there will be no compensation for home office overhead.

16.5 MBE/WBE Program Progressive Sanctions: CONTRACTOR is subject to progressive sanctions for failure of CONTRACTOR to comply with Austin City Code, Chapter 2-9A, as amended: "Minority-owned and Women-owned Business Enterprise Procurement Program." Available sanctions for Program violations are set forth in Program rules adopted by the Small and Minority Business Resources Department (SMBR), as amended, and may include the following progressive sanctions for Program violations within a rolling 24-month period: (i) a period of probation for up to six (6) months for the first violation (ii) a period of suspension from bidding for up to 24 months for the second violation, and (iii) a period of debarment for up to five (5) years for the third violation. If the CONTRACTOR engages in

more than one of the violations listed below at any given time, OWNER has the discretion to determine whether such actions should be counted as multiple violations of the MBE/WBE Ordinance. Program violations include:

- .1 providing false or misleading information to the OWNER in connection with the submission of a Bid, responses to request for qualifications or Proposals, Good Faith Efforts documentation, post award compliance or other Program operations;
- .2 substituting M/WBE Subcontractors without first receiving approval for such substitutions;
- .3 failure to comply with the approved Compliance Plan without an approved request for a change, an approved Change Order or other approved change to the Contract;
- .4 violation of any other provision of the "Minority-owned and Women-owned Business Enterprise Procurement Program";
- .5 providing false or misleading information to the OWNER in connection with an application for or challenge to certification, recertification or decertification as a MBE/WBE; and
- .6 bid shopping.

The Progressive Sanctions will be administered in accordance with the City of Austin Purchasing Office Probation, Suspension, and Debarment Procedures for Vendors, which includes notice and an opportunity for a hearing.

ARTICLE 17 – MISCELLANEOUS

- 17.1 Venue:** In the event of any suit at law or in equity involving the Contract, venue shall be exclusively in Travis County, Texas and the laws of the State of Texas shall apply to the interpretation and enforcement of the Contract.
- 17.2 Extent of Agreement:** This Contract represents the entire and integrated agreement between the OWNER and CONTRACTOR with respect to the subject matter hereof and supersedes all prior negotiations, representations or agreements, either written or oral.
- 17.3 Cumulative Remedies:** The rights and remedies available to the parties are not to be construed in any way as a limitation of any rights and remedies available to any or all of them which are otherwise imposed or available by laws or regulations, by special warranty or guarantees or by other provisions of the Contract Documents, and the provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. Specifically, the OWNER is not required to only assess liquidated damages, and OWNER may elect to pursue its actual damages resulting from the failure of the CONTRACTOR to complete the Work in accordance with the requirements of the Contract Documents.
- 17.4 Severability:** If any word, phrase, clause, sentence or provision of the Contract, or the application of same to any person or set of circumstances is for any reason held to be unconstitutional, invalid or unenforceable, that finding shall only effect such word, phrase, clause, sentence or provision, and such finding shall not affect the remaining portions of this

Contract; this being the intent of the parties in entering into the Contract; and all provisions of the Contract are declared to be severable for this purpose.

17.5 Independent Contractor: The Contract shall not be construed as creating an employer/employee relationship, a partnership, or a joint venture. CONTRACTOR is an independent contractor and CONTRACTOR's services shall be those of an independent contractor. CONTRACTOR agrees and understands that the Contract does not grant any rights or privileges established for employees of OWNER.

17.6 Prohibition of Gratuities: OWNER may, by Written Notice to CONTRACTOR, terminate the Contract without liability if it is determined by OWNER that gratuities were offered or given by CONTRACTOR or any agent or representative of CONTRACTOR to any officer or employee of OWNER with a view toward securing the Contract or securing favorable treatment with respect to the awarding or amending or the making of any determinations with respect to the performing of such Contract. In the event the Contract is terminated by OWNER pursuant to this provision, OWNER shall be entitled, in addition to any other rights and remedies, to recover or withhold the amount of the cost incurred by CONTRACTOR in providing such gratuities.

17.7 Prohibition Against Personal Interest in Contracts: No officer, employee, independent consultant, or elected official of OWNER who is involved in the development, evaluation, or decision-making process of the performance of any solicitation shall have a financial interest, direct or indirect, in the Contract resulting from that solicitation. Any violation of this provision, with the knowledge, expressed or implied, of CONTRACTOR shall render the Contract voidable by OWNER.

17.8 OWNER'S Right to Audit:

17.8.1 Records means all records generated by or on behalf of CONTRACTOR and each Subcontractor and Supplier of CONTRACTOR, whether paper, electronic, or other media, which are in any way related to performance of or compliance with this Contract, including, without limitation:

- .1 accounting records;
- .2 written policies and procedures;
- .3 subcontract files (including proposals of successful and unsuccessful Bidders, Bid recaps, etc.);
- .4 original estimates and estimating work sheets;
- .5 correspondence;
- .6 Change Order files (including documentation covering negotiated settlements);
- .7 back charge logs and supporting documentation;
- .8 general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends;
- .9 lump sum agreements between CONTRACTOR and any Subcontractor or Supplier;
- .10 records necessary to evaluate: Contract compliance, Change Order pricing, and any Claim submitted by CONTRACTOR or any of its payees; and
- .11 any other CONTRACTOR record that may substantiate any charge related to this Contract.

- 17.8.2** CONTRACTOR shall allow OWNER'S agent or its authorized representative to inspect, audit, and/or reproduce, or all three, all Records generated by or on behalf of CONTRACTOR and each Subcontractor and Supplier, upon OWNER'S written request. Further, CONTRACTOR shall allow OWNER'S agent or authorized representative to interview any of CONTRACTOR'S employees, all Subcontractors and all Suppliers, and all their respective employees.
- 17.8.3** CONTRACTOR shall retain all its Records, and require all its Subcontractors and Suppliers to retain their respective Records, during this Contract and for three (3) years after final payment, until all audit and litigation matters that OWNER has brought to the attention of CONTRACTOR are resolved, or as otherwise required by law, whichever is longer. OWNER'S right to inspect, audit, or reproduce Records, or interview employees of CONTRACTOR or its respective Subcontractors or Suppliers exists during this Contract, and for three (3) years after final payment, until all audit and litigation matters that OWNER has brought to CONTRACTOR'S attention are resolved, or as otherwise required by law, whichever is longer, and at no cost to OWNER, either from CONTRACTOR or any of its Subcontractors or Suppliers that may furnish Records or make employees available for interviewing.
- 17.8.4** CONTRACTOR must provide sufficient and accessible facilities during its normal business hours for OWNER to inspect, audit, or reproduce Records, or all three, and to interview any person about the Records.
- 17.8.5** CONTRACTOR shall insert these requirements in each written contract between CONTRACTOR and any Subcontractor or Supplier and require each Subcontractor and Supplier to comply with these provisions.
- 17.9 Survival:** The terms and conditions of this Contract, which contemplate a period of time beyond completion or termination will survive such completion or termination and not be merged therein or otherwise terminated.
- 17.10 No Waiver:** The waiver of any provision of this Contract will not be deemed to be a waiver of any other provision of this Contract. No waiver of any provision of this Contract will be deemed to constitute a continuing waiver unless expressly provided in writing, nor will a waiver of any default be deemed a waiver of any subsequent defaults of the same type. The failure at any time to enforce this Contract, whether the default is known or not, shall not constitute a waiver or estoppel of the right to do so.
- 17.11 Conditions Precedent to Right to Sue:** Notwithstanding anything herein to the contrary, the CONTRACTOR will have at least 90 days to give notice of a claim for damages as a condition precedent to the right to sue on the Contract, subject to the contractual claim and alternative dispute resolution processes set forth herein.
- 17.12 Waiver of Trial by Jury:** OWNER and CONTRACTOR agree that they have knowingly waived the right to trial by jury and have instead agreed that, in the event of any litigation arising out of or connected to this Contract, to proceed with a trial before the court, unless both parties subsequently agree otherwise in writing.
- 17.13 Contractor Evaluation:** The Owner will review and evaluate the Contractor's Work and performance on the Project and provide the Contractor with a written Contractor Evaluation Report in accordance with City of Austin Administrative Rule R161-13.37. Rule R161-13.37 provides an appeal process.

<http://www.austintexas.gov/department/contract-management>

End

SUPPLEMENTAL GENERAL CONDITIONS

Section 00810

The Supplemental General Conditions contained herein amend or supplement the General Conditions, Section 00700.

ARTICLE 1 – DEFINITIONS

Add to the following definition:

1.20 Engineer/Architect (E/A): The OWNER's design professional for this contract is:

Name: William Wehner, HDR Inc.

Address: 4401 West Gate Blvd. Suite #400, Austin, Texas 78745

Add the following definition:

1.51 Commissioning Authority or Agent - A consultant retained by the OWNER charged with supporting E/A in monitoring the Work for conformance with the Contract Documents, and with assisting in the facility's start-up and testing as a member of the commissioning team.

Add the following definition:

1.52 Allowance - Allowance is defined as "a not-to-be-exceeded amount", either individually or in the aggregate, which is established between the Owner and the Contractor as part of its Bid Proposal when the precise scope of a particular line item(s) has not been defined to a level which is adequate for the Contractor to provide a definitive line item pricing for that particular scope of Work. The use of any Allowances by the Contractor will be subject to the Owner's sole approval and it is the Owner's intent to minimize the use of Allowances to the fullest extent possible. For any Allowances which the Owner allows the Contractor to use, the following rules shall apply: (i) Allowances shall cover the cost to the Contractor of the Cost of Work; (ii) Contractor's overhead and profit associated with the stated Allowance shall be included in the Allowance; and (iii) upon completion of the portion of the Work subject to an Allowance, the Contract Amount for that portion of the Work will be adjusted based upon the approved actual cost of the Work, which will not exceed the approved aggregate amount of the Allowances.

Add the following definition:

1.53 Mobilization Prompt Payment Program - The Owner's Mobilization Prompt Payment Program, will allow bimonthly payments during "critical mobilization stages" as specified in the Contract Documents by the Prime Contractor. The Mobilization Prompt Payment Program will only apply to projects with a construction cost greater than \$2,000,000.

ARTICLE 2 - PRELIMINARY MATTERS

Add the following modification to the end of 2.4.2.1:

.1 The Baseline Schedule and schedule submittals for Projects in the Mobilization Prompt Payment Program must identify periods of 'critical mobilization.' The periods of critical mobilization will include the first two months of the Contract Time and additional

Bidding Requirements, Contract Forms and Conditions of the Contract

periods identified by the Contractor and approved by Owner when peak Subcontractor mobilization will occur.

2.4 Before Starting Construction:

Delete 2.4.2.6 and replace with the following (changes to the original text are identified by underlining):

.6 A preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. At a minimum, the schedule of values shall be broken out by trade and split between materials and labor. Prices will include an appropriate amount of overhead and profit applicable to each item of Work;

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.1 Intent: Add the following:

3.1.3 Federal Aid - Assurances: To the extent that federal funding has been provided for this Contract, the federal contracting provisions set forth in Section 00810A are made a part of the Contract Documents for all purposes. The provisions of Section 00810A are intended to supplement and will supersede and be controlling over the City's standard 00700 General Conditions and other Contract Document provisions to the extent of any conflict with Section 00810A. The Contractor/Bidder acknowledges and agrees that Contractor/Bidder has the obligation to comply with the attached federal-aid assurances and contract provisions. This Section 3.1.3 will constitute the Contractor's/Bidder's accepted proposal and agreement with respect to the attached federal-aid assurances and contract provisions.

In the event of any ambiguity or inconsistency between the Section 00810A federal aid assurances and the Contract Documents, the federal provision will control to the extent consistent with the overall intent of the Project. If the Contractor/Bidder has any question as to the applicability of a Section 00700 or Section 00810A provision, the Contractor/Bidder shall submit a request for information to the Owner. The Owner will have three (3) business days in which to respond.

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

4.1 Availability of Lands: Add the following to the end of the paragraph:

CONTRACTOR shall contact OWNER's Transportation Department to obtain a Temporary Use of Right-of-Way Permit prior to beginning construction on any sidewalk/driveway or occupying any parking area/meters within the public right-of-ways.

ARTICLE 5 - BONDS AND INSURANCE

5.3 Other Bond and Insurance Requirements:

5.3.1 CONTRACTOR Provided Insurance

5.3.1.1 General Requirements.

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.1 CONTRACTOR shall carry insurance in the types and amounts indicated below for the duration of the Contract, which shall include items owned by OWNER in the care, custody and control of CONTRACTOR prior to and during construction and warranty period.

.2 CONTRACTOR must complete and forward the Certificate of Insurance, Section 00650, to OWNER before the Contract is executed as verification of coverage required below. CONTRACTOR shall not commence Work until the required insurance is obtained and until such insurance has been reviewed by OWNER. Approval of insurance by OWNER shall not relieve or decrease the liability of CONTRACTOR hereunder and shall not be construed to be a limitation of liability on the part of CONTRACTOR. CONTRACTOR must also complete and forward the Certificate of Insurance, Section 00650, to OWNER whenever a previously identified policy period has expired as verification of continuing coverage.

.3 CONTRACTOR's insurance coverage is to be written by companies authorized to do business in the State of Texas at the time the policies are issued and shall be written by companies with A.M. Best ratings of B+VII or better, except for hazardous material insurance which shall be written by companies with A.M. Best ratings of A- or better.

.4 All endorsements naming the OWNER as additional insured, waivers, and notices of cancellation endorsements as well as the Certificate of Insurance shall indicate: City of Austin, Capital Contracting Office, P.O. Box 1088, Austin, Texas 78767.

.5 The "other" insurance clause shall not apply to the OWNER where the OWNER is an additional insured shown on any policy. It is intended that policies required in the Contract, covering both OWNER and CONTRACTOR, shall be considered primary coverage as applicable.

.6 If insurance policies are not written for amounts specified below, CONTRACTOR shall carry Umbrella or Excess Liability Insurance for any differences in amounts specified. If Excess Liability Insurance is provided, it shall follow the form of the primary coverage.

.7 OWNER shall be entitled, upon request and without expense, to receive certified copies of policies and endorsements thereto and may make any reasonable requests for deletion or revision or modification of particular policy terms, conditions, limitations, or exclusions except where policy provisions are established by law or regulations binding upon either of the parties hereto or the underwriter on any such policies.

.8 OWNER reserves the right to review the insurance requirements set forth during the effective period of this Contract and to make reasonable adjustments to insurance coverage, limits, and exclusions when deemed necessary and prudent by OWNER based upon changes in statutory law, court decisions, the claims history of the industry or financial condition of the insurance company as well as CONTRACTOR.

.9 CONTRACTOR shall not cause any insurance to be canceled nor permit any insurance to lapse during the term of the Contract or as required in the Contract.

.10 CONTRACTOR shall be responsible for premiums, deductibles and self-insured retentions, if any, stated in policies. All deductibles or self-insured retentions shall be disclosed on the Certificate of Insurance.

.11 CONTRACTOR shall provide OWNER thirty (30) days written notice of erosion of the aggregate limits below occurrence limits for all applicable coverages indicated within the Contract.

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.12 If OWNER owned property is being transported or stored off-site by CONTRACTOR, then the appropriate property policy will be endorsed for transit and storage in an amount sufficient to protect OWNER's property.

.13 The insurance coverages required under this contract are required minimums and are not intended to limit the responsibility or liability of CONTRACTOR.

5.3.1.2 Business Automobile Liability Insurance. Provide coverage for all owned, non-owned and hired vehicles. The policy shall contain the following endorsements in favor of OWNER:

- a) Waiver of Subrogation endorsement CA 0444;
- b) 30 day Notice of Cancellation endorsement CA 0244; and
- c) Additional Insured endorsement CA 2048.

Provide coverage in the following types and amounts:

.1 A minimum combined single limit of \$1,000,000 minimum per occurrence for bodily injury and property damage.

5.3.1.3 Workers' Compensation And Employers' Liability Insurance. Coverage shall be consistent with statutory benefits outlined in the Texas Workers' Compensation Act (Section 401). CONTRACTOR shall assure compliance with this Statute by submitting two (2) copies of a standard certificate of coverage (e.g. ACCORD form) to Owner's Representative for every person providing services on the Project as acceptable proof of coverage. The Certificate of Insurance, Section 00650, must be presented as evidence of coverage for CONTRACTOR. CONTRACTOR's policy shall apply to the State of Texas and include these endorsements in favor of OWNER:

- a) Waiver of Subrogation, form WC 420304; and
- b) 30 day Notice of Cancellation, form WC 420601.

The minimum policy limits for Employers' Liability Insurance coverage shall be as follows:

.1 \$100,000 bodily injury per accident, \$500,000 bodily injury by disease policy limit and \$100,000 bodily injury by disease each employee.

5.3.1.4 Commercial General Liability Insurance. The Policy shall contain the following provisions:

- a) Contractual liability coverage for liability assumed under the Contract and all contracts relative to this Project.
- b) Completed Operations/Products Liability for the duration of the warranty period.
- c) Explosion, Collapse and Underground (X, C & U) coverage.
- d) Independent Contractors coverage (Contractors/ Subcontractors work).
- e) Aggregate limits of insurance per project, endorsement CG 2503.
- f) OWNER listed as an additional insured, endorsements CG 2010 and CG 2037 or equivalent.
- g) 30 day notice of cancellation in favor of OWNER, endorsement CG 0205.
- h) Waiver of Transfer of Recovery Against Others in favor of OWNER, endorsement CG 2404.

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Provide coverages A&B with minimum limits as follows:

.1 A combined bodily injury and property damage limit of \$1,000,000 minimum per occurrence.

5.3.1.5 Builders' Risk Insurance. CONTRACTOR shall maintain Builders' Risk Insurance or Installation Insurance on an all risk physical loss form in the Contract Amount. Coverage shall continue until the Work is accepted by OWNER. OWNER shall be a loss payee on the policy. If off-site storage is permitted, coverage shall include transit and storage in an amount sufficient to protect property being transported or stored.

5.3.1.6 Hazardous Materials Insurance.

For Work which involves asbestos or any hazardous materials or pollution defined as lead, CONTRACTOR or Subcontractor responsible for the Work shall comply with the following insurance requirements in addition to those specified above:

.1 Provide an asbestos abatement endorsement to the Commercial General Liability policy with minimum bodily injury and property damage limits of \$1,000,000 per occurrence for coverages A&B and products/completed operations coverage with a separate aggregate of \$1,000,000. This policy shall not exclude lead or any hazardous materials or pollution defined as lead, and shall provide "occurrence" coverage without a sunset clause. The policy shall provide 30 day Notice of Cancellation and Waiver of Subrogation endorsements in favor of OWNER.

.2 CONTRACTOR or Subcontractor responsible for transporting asbestos or any hazardous materials defined as lead shall provide pollution coverage. Federal law requires interstate or intrastate transporters of lead to provide an MCS 90 endorsement with a \$5,000,000 limit when transporting lead in bulk in conveyances of gross vehicle weight rating of 10,000 pounds or more. Interstate transporters of lead in non-bulk in conveyances of gross vehicle weight rating of 10,000 pounds or more must provide an MCS 90 endorsement with a \$1,000,000 limit. The terms "conveyance" and "bulk" are defined by Title 49 CFR 171.8. All other transporters of asbestos shall provide either an MCS 90 endorsement with minimum limits of \$1,000,000 or an endorsement to their Commercial General Liability Insurance policy which provides coverage for bodily injury and property damage arising out of the transportation of lead. The endorsement shall, at a minimum, provide a \$1,000,000 limit of liability and cover events caused by the hazardous properties of airborne lead arising from fire, wind, hail, lightning, overturn of conveyance, collision with other vehicles or objects, and loading and unloading of conveyances.

.3 CONTRACTOR shall submit complete copies of the policy providing pollution liability coverage to OWNER.

5.3.1.7 Professional Liability Insurance. For Work which requires professional engineering or professional survey services to meet the requirements of the Contract, including but not limited to excavation safety systems, traffic control plans, and construction surveying, the CONTRACTOR or Subcontractors, responsible for performing the professional services shall provide Professional Liability Insurance with a minimum limit of \$500,000 per claim and in the aggregate to pay on behalf of the assured all sums which the assured shall become legally obligated to pay as damages by reason of any negligent act, error, or omission committed with respect to all professional services provided in due course of the Work of this Contract. CONTRACTOR's policy shall include the following endorsement in favor of the OWNER:

a) 30 day Notice of Cancellation endorsement CA 0244

ARTICLE 6 - CONTRACTOR'S RESPONSIBILITIES

6.4 Concerning Subcontractors, Suppliers and Others: *Delete 6.4.7 and replace with the following:*

6.4.7 CONTRACTOR shall pay each Subcontractor under this Contract for satisfactory performance of its contract no later than ten (10) Calendar Days from the CONTRACTOR's receipt of payment from OWNER. CONTRACTOR shall not withhold retainage payments from any Subcontractor. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval from OWNER. This clause applies to both DBE and non-DBE Subcontractors.

6.4.9 The Texas Water Development Board's (TWDB) Clean Water and Drinking Water State Revolving Fund programs receive federal funds from the U.S. Environmental Protection Agency (EPA). As a condition of federal grant awards, EPA regulations require that loan recipients make a "good faith effort" to award a fair share of work to DBE's who are Minority Business Enterprises (MBE's), and Women-owned Business Enterprises (WBE's) whenever procuring construction, supplies, services and equipment.

The current fair share goals for the State of Texas are as follows:

CATEGORY	MBE	WBE
Construction	19.44%	9.17%
Equipment	16.28%	11.45%
Services	20.41%	13.66%
Supplies	25.34%	8.82%

After loan commitment, but prior to closing, Owners (Applicants) must provide forms TWDB-0216 and TWDB-0373. The project's Prime Engineer, Financial Advisor, and Bond Counsel must complete a TWDB-0217 form and indicate if any subcontracting opportunities will be available or if the Contractor will be performing the contract. Regardless of the procurement's outcome, all entities must submit a TWDB-0373 and list the Contractors selected by the Owner for the project. Failure to include a Contractor and contract amount will result in denial of payment until the proper documentation has been reviewed and approved.

For each construction contract, Owners are required to submit a TWDB-0216 and TWDB-0373 for the procurement of the project's Prime Contractor. If the Prime Contractor is utilizing Subcontractors for the project, then additional TWDB-0216 and TWDB00373 forms will be required for submittal prior to request for payment.

The following forms are required for each contract:

Form	Prime Contractor	Submit Form To:
TWDB-0216	Required	TWDB
TWDB-0217	Required	TWDB
TWDB-0373	Required	TWDB

6.6 Permits, Fees: *Add the following:*

OWNER will obtain and pay for the following permits, licenses and/or fees:

6.6.1 Site Development Permit.

6.6.2 Building Permit(s). OWNER's responsibility for obtaining and paying for the Building Permit(s) shall be limited to the following where applicable: the required Electrical Service (Aid of Construction) Fee, Water and Wastewater Tap Fees, Water and Wastewater Capital Recovery Fees, and Septic Permit Fee. The OWNER's responsibility for obtaining and paying for the Building Permit(s) excludes securing and paying for the following where applicable: Driveway Permit (Concrete) Fee, Electrical Permit, Mechanical Permit, Plumbing Permit, Water Engineering Inspection Fee, Temporary Use of Right-of Way Permit, the gas company's Gas Yard Line Contribution Fee, and any other permits/fees not listed above.

6.7 Laws and Regulations: Add the following:

6.7.4 This Work is subject to the Texas Pollution Discharge Elimination System (TPDES) permitting requirements for the installation and maintenance of temporary and permanent erosion and sediment controls and storm water pollution prevention measures throughout the construction period.

OWNER has prepared a Storm Water Pollution Prevention Plan (SWPPP). Reference Section 01096 for this SWPPP.

CONTRACTOR's responsibilities are as follows:

.1 Obtain a signed certification statement from all Subcontractors responsible for implementing the erosion / sedimentation controls and other best management practices that are part of the SWPPP. This statement shall indicate that the Subcontractor understands the permit requirements. The certified statement forms shall be attached to and become part of the SWPPP.

.2 Fill out the TCEQ's "Construction Site Notice" form, which is Attachment 2 to the TPDES General Permit TXR150000 (form available from OWNER or on the Internet at <http://www.tceq.state.tx.us/assets/public/permitting/waterquality/attachments/stormwater/txr152d2.pdf> and post it near the main entrance of the Work, or at multiple postings if the Work is linear. Mail a copy of the completed Construction Site Notice form to the local Municipal Separate Storm Sewer Systems (MS4) representative:

TPDES Program Coordinator
City of Austin – WPD – ERM
P.O. Box 1088
Austin, TX 78767

.3 Maintain all erosion/sedimentation controls and other protective measures identified in the SWPPP in effective operating condition.

.4 Perform inspections every five (5) working days and after every ½ inch rainfall event, noting the following observations on an inspection form provided by OWNER:

- a) Locations of discharges of sediment or other pollutants from the site.
- b) Locations of storm water / erosion / sedimentation controls that are in need of maintenance.
- c) Locations of storm water / erosion / sedimentation controls that are not performing, failing to operate, or are inadequate.
- d) Locations where additional storm water / erosion / sedimentation controls are needed.

Bidding Requirements, Contract Forms and Conditions of the Contract

.5 Maintain at Work site at all times a copy of the SWPPP (with all updates, as described below) and inspection reports.

.6 Update the SWPPP as necessary to comply with TPDES permitting requirements, which includes noting changes in erosion / sedimentation controls and other best management practices that are part of the SWPPP and which may be necessary due to the results of inspection reports. Any SWPPP revisions or updates must be signed and certified by a Certified Professional in Erosion and Sedimentation Control (CPESC) or a Registered Professional Engineer. If the SWPPP includes engineering calculations, then SWPPP must be sealed and signed by a Registered Professional Engineer.

.7 Upon completion of the Work, provide TPDES records to OWNER.

Article 6.19 Add the following paragraphs

6.19 Equal Employment Opportunity and Affirmative Action (TWDB Requirements): This provision applies to Clean Water State Revolving Fund Program and Drinking Water State Revolving Fund project where the contract agreement is for more than \$10,000. During the performance of this contract, the Contractor agrees as follows:

6.19.1 The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age (40 or older), disability, or genetic information. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

6.19.2 The Contractor will, in all solicitations or advancements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or nation origin

6.19.3 The Contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the Contractor's legal duty.

6.19.4 The Contractor will send to each labor union or representative of workers with which the Contractor has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor

Bidding Requirements, Contract Forms and Conditions of the Contract

union or workers' representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, and shall not post copies of the notice in conspicuous places available to employees and applicants for employment.

6.19.5 The Contactor will comply with all provisions of Executive Order No. 11246 of Sept. 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

6.19.6 The Contactor will furnish all information and reports required by Executive Order No. 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

6.19.7 In the event of the Contractor's noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be cancelled, terminated, or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246 of Sept. 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

6.19.8 The Contactor will include the provisions of paragraphs 6.19.1 through 6.19.8 in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the Contractor becomes involved in or is threatened with litigation with a Subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of \$10,000 the provisions of these specifications and the notice which contains the applicable goals set for minority and female participation and which is set forth in the solicitations from which this contract resulted.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

Add the following paragraph 8.7:

8.7 Project Signage (TWDB Requirements): The Owner must implement one of the signage options below as described in TWDB Guidance TWDB-1109:

8.7.1 Online signage placed on community website or social media outlet;

8.7.2 Press release; Online signage placed on community website or social media outlet;

8.7.3 Posters or wall signage in a public building or location; Online signage placed on community website or social media outlet;

8.7.4 Newspaper or periodical advertisement for project construction, groundbreaking ceremony, or operation of the new or improved facility; or Online signage placed on community website or social media outlet;

8.7.5 Standard on-site signage erected in a prominent location at the construction project site or along a major thoroughfare within the community as directed by the Owner. Online signage placed on community website or social media outlet;

If a recipient decides on a public or media event to publicize the accomplishment of significant events related to construction of the project, the U.S Environmental Protection Administration, Region 6, must be provided with at least a ten working day notice of the event and provided the opportunity to attend and participate. Please contact Associate Director Claudia Hosch, who can be reached at (214) 665-6464 or Hosch.Claudia@epa.gov.

ARTICLE 9 - ENGINEER/ARCHITECT'S STATUS DURING CONSTRUCTION

9.4 Project Representative: Add the following:

PROJECT REPRESENTATIVE shall be the Engineer's on-site representative to provide frequent observations of the Work as it pertains to the design intent and to facilitate communications between the Owner's Construction Manager and the Engineer.

ARTICLE 11 - CHANGE OF CONTRACT AMOUNT

11.4 Determination of Value of Work: Add the following to paragraph 11.4.1.2:

In the case of a Change Order determined by a mutually agreed lump sum or unit price properly itemized and supported by sufficient substantiating data, including documentation by subcontractors performing the work, to permit evaluation, the following method may be used:

COMPONENT ONE - The R.S. Means Co., Inc. 'Building Construction Cost Data' - latest edition - will be used as a basis for evaluating:

- 1a - the cost of labor (base rate, including fringe benefits),
- 1b - the cost of material and equipment to be incorporated in the Work, and
- 1c - the cost of tools, equipment and facilities necessary to accomplish the Work described in the change.

COMPONENT TWO - The costs of payroll taxes and insurance, Liability and Builder's Risk Insurance, shall be calculated as follows:

- 2a - Payroll taxes and Workers' Compensation Insurance 25% of payroll (Item 1a)
- 2b - Liability and Builder's Risk Insurance 2% of "total costs" (Items 1a, 1b, 1c, and 2a)

COMPONENT THREE - Overhead and profit shall be calculated as follows:

3a - For Subcontractors and for those portions of the Work performed by CONTRACTOR's own forces:

15% of the first \$10,000.00 of costs and 10% of the balance over \$10,000.00.

Bidding Requirements, Contract Forms and Conditions of the Contract

("costs" = Items 1a, 1b, and 1c, above, broken down into Contractor and Subcontractor costs).

3b - For the CONTRACTOR for that portion of the Work performed by Subcontractors:

10% of the first \$10,000.00 of the Subcontractor costs and 7.5% of the balance over \$10,000.00.

("costs" = Items 1a, 1b, and 1c, above, broken down into Subcontractor costs)

COMPONENT FOUR - Bonds

Performance and Payment Bond according to the following table ("TOTAL COST" = Items 1a, 1b, 1c, 2a, 2b, 3a, and 3b):

DOLLAR VALUE OF CONTRACT				% OF TOTAL COST OF CHANGE ORDER ADDED FOR BOND EXPENSE
\$100,000	OR	LESS		2.5
\$100,001	THRU	\$500,000		1.5
\$500,001	THRU	\$2,500,000		1.0
\$2,500,001	THRU	\$5,000,000		0.75
\$5,000,001	THRU	\$7,500,000		0.70
OVER \$7,500,000				0.65

a) The total costs for the change, whether additive or deductive, shall be the sum total of COMPONENTS ONE - FOUR.

11.5 Cost of Work: Delete 11.5.1 and replace with the following:

11.5.1 For all personnel, CONTRACTOR will receive actual field cost wage rates for each hour that said personnel are actually engaged in such Work, as substantiated by its certified payroll, to which will be added an amount equal to twenty-five percent (25%) of the sum thereof as compensation for CONTRACTOR's total overhead, profit, and small tools. No separate charge will be made by CONTRACTOR or its Subcontractor(s) for organization or overhead expenses. In no case will the rate of wage be less than the minimum shown in the Contract for a particular category. CONTRACTOR will also receive an amount equal to 55% of the wages paid personnel, excluding the 25% compensation provided above, for CONTRACTOR's and any effected Subcontractor's cost of premiums on public liability insurance, workers' compensation insurance, social security and unemployment insurance. The cost for superintendence, project management, and other salaried employees are considered as included in the twenty five percent (25%) total overhead, profit, and small tools mark-up unless considered necessary and ordered by OWNER.

ARTICLE 13 - TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.7 Warranty Period: Add the following:

13.7.5 OWNER will utilize a "Warranty Item Form" (attached at the end of this Section) for the purpose of providing Written Notice of warranty defects to CONTRACTOR. CONTRACTOR shall date, sign, complete and return the form to OWNER when the defect is corrected, including such information on or attached to the form to describe the nature of the repairs or corrections that were made. If the defect cannot be corrected in seven (7)

Bidding Requirements, Contract Forms and Conditions of the Contract

Calendar Days, CONTRACTOR shall provide a written explanation to the Owner's Representative describing the repairs needed and the time required to complete the repairs.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.1 Application for Progress Payment: *Delete 14.1.1 and replace with the following (changes to the original text are identified by underlining):*

14.1.1 No more often than once a month, unless authorized as part of the Mobilization Prompt Payment Program, CONTRACTOR shall submit to Owner's Representative for review a completed and executed Application for Payment, in a form acceptable to OWNER, covering the Work completed as of the date of the Application and not previously paid and accompanied by such supporting documentation as required by the Contract Documents.

Add the following paragraph to 14.1.1:

.1 Mobilization Prompt Payment Program. During critical mobilization periods, as identified by the CONTRACTOR and as approved by OWNER in accordance with 00700 2.4.2.1 of this Contract, CONTRACTOR shall submit bi-monthly Applications for Payment. The additional Pay Applications will include any costs accrued during the periods of critical mobilization. The Program will allow the CONTRACTOR and Subcontractors to invoice for costs as they are accrued during periods of critical mobilization. The CONTRACTOR shall submit bimonthly invoices to the OWNER for such costs. The CONTRACTOR shall pay Subcontractors for costs within 10 days of receipt of payment from OWNER.

14.1 Application for Progress Payment: *Delete 14.1.5 and replace with the following:*

14.1.5 Retainage will not be withheld on federally funded projects.

14.1 Application for Progress Payment: *Delete 14.1.6.3 and replace with the following:*

.3 Contract time statement form signed by CONTRACTOR and Owner's Representative. If CONTRACTOR does not agree with the number of accumulated days charged, CONTRACTOR shall file a Claim in accordance with Article 16.1, Filing of Claims.

ARTICLE 17 - MISCELLANEOUS

17.1 Notice of Building Project Defect and Right to Cure. *Add the following paragraph to 17.1*

- .1** Pursuant to Texas Government Code Chapter 2272, before the OWNER brings a court proceeding with respect to alleged defective Work, the OWNER shall: (a) provide each party with whom the OWNER has a contract for the construction of a building a written report by certified mail, return receipt requested, describing with reasonable clarity: (i) the defective Work or related condition; (ii) the present physical condition of the building; and (iii) any modification, maintenance, or repairs to the building made by the OWNER or others since the building was initially occupied or used (the "Report"); b) allow each party against whom the OWNER has claimed and any known subcontractor or

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supplier, who is subject to the claim: (i) a reasonable opportunity to inspect the alleged defective Work or related condition identified in the Report for a period of 30 days after OWNER sends the Report; and (ii) at least 120 days after the inspection to: (A) correct the defective Work or related condition identified in the Report; or (B) enter into a separate agreement with the OWNER to correct the defective Work or related condition.

- .2 The CONTRACTOR must provide bonds and insurance in accordance with Contract requirements to cover the correction of the defective Work or related condition.
- .3 The right to correct the defective Work or related condition is unavailable, if the CONTRACTOR has been previously terminated for cause by the OWNER; or has been convicted of a felony.
- .4 In addition, the right to correct defective Work or related condition terminates, if OWNER complies with the Report, inspection, and cure period process and a) the defective Work or condition was not corrected within 120 days or as otherwise agreed; or b) the attempt to correct the defective Work or condition resulted in new defective Work or condition.
- .5 The CONTRACTOR shall provide a copy of the Report to its insurers and sureties and each subcontractor and supplier whose Work is subject to the claim not later than the fifth day after its receipt. The insurer shall treat the received Report as the filing of a suit asserting a claim against its insured for purposes of the relevant policy terms, but only with respect to an insurance policy delivered, issued, or renewed on or after January 1, 2020.
- .6 This section does not prohibit or limit the OWNER from making emergency repairs to the property in question as necessary to protect the health, safety, and welfare of the public or building occupants.
- .7 This section does not apply to an action for personal injury, survival or wrongful death, residential construction, a project with TxDOT or federal highway funding, or a "civil works" project as defined by Texas Government Code Section 2269.351.

17.14 American Iron and Steel (TWDB Requirements): The following statement must be completed by the Contractor and made a part of the agreement between the Owner and the Contractor:

The Contractor acknowledges to and for the benefit of the Owner ("Purchases") and the Texas Water Development Board (TWDB) that it understands the goods and services under this Agreement are being funded the monies made available by the Clean Water State Revolving Fund and/or Drinking Water State Revolving Fund that have statutory requirements commonly known as "American Iron and Steel" that requires all of the iron and steel products used in the project to be produced in the United State ("American Iron and Steel Requirement") including iron and steel products provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the TWDB that (a) the Contractor has reviewed and understands the American Iron and Steel Requirement, (b) all of the iron and steel products used in the project will be and/or have been produced in the United States in a manner that complies with the American Iron and Steel Requirement, unless a waiver

Bidding Requirements, Contract Forms and Conditions of the Contract

*of the requirement is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the American Iron and Steel Requirement, may be requested by the Owner or the TWDB. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the contractor shall permit the Owner to enforce this Agreement and recover as damages against the Contractor any loss, expense, or cost *including without limitation attorney's fees) incurred by the Owner resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole in part, from the TWDB or any damages owed to the TWDB by the Owner).*

Bidding Requirement, Contract Forms and Conditions of the Contract

While the Contractor has not direct contractual privity with the TWDB, as a lender to the Owner for the funding of its project, the Owner and the Contractor agree that the TWDB is a third-part beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the TWDB.

Additional information on the American Iron and Steel (AIS) and its applicability to this contract can be found in the TWDB011-6 guidance. It is recommended the Owner receive and maintain files documenting the Contractor's use of AIS. Monthly compliance with AIS will be verified by the Owner through the submittal of the TWDB form TWDB-1106-!.

Add the following paragraph 17.15:

17.15. Performance and Payment Bonds: Please include a specific comment on each of the bonds that 100% of the contract price is to remain in effect for one year beyond the date of approval by the engineer of the political subdivision)Water Code 17.183(2)(B)).

Add the following paragraph 17.16

17.16. Additional Forms and Information: The following forms and guidance documents, mentioned throughout this Section and the Contract Documents, are available on the TWDB site at: <http://www.twdb.texas.gov/financial/instructions/index.asp>
Forms: Contractor's Act of Assurance (ED-103) Contractor's Resolution on Authorized Representative (ED-104) Debarment / Suspension Certification (SRF-404) Bidder's Certifications- EEO (WRD - 255) DBE Affirmative Steps solicitation Report (TWDB 0216) DBE Prime Contractor Affirmative Steps Certification & Goals (TWDB 0217) DBE Loan/Grant Participation Summary (TWDB 0373) Monthly American Iron and Steel Certificate (TWDB-1106-A) American Iron and Steel (AIS) De Minimis Log (TWDB-1106-B)

Monthly Davis Bacon Wage Rate Certificate of Compliance Submittal by Owner (SubRecipient) (DB-0154)

Guidance Documents: TWDB-0210 Disadvantaged Business Enterprise Guidance

Requirements for American Iron and Steel (AIS) Guidance (TWDB-1106) Guidance on Davis-Bacon Wage Rate Requirements for State Revolving Fund Projects (DB0156)

In addition, Volume I includes the entire TWDB-0550 TWDB Supplemental Contract Conditions. This document outlines all TWDB requirements.

WARRANTY ITEM NO. _____ (PROJECT NAME)

The General Conditions of the Contract require that Warranty Defects be corrected within 7 days after written notice is received.

TO: _____
contractor name address / telephone / fax / email

ATTENTION OF: _____

FROM: _____
project manager name / address / telephone / fax / email

PROJECT: _____
name / location / CIP ID number

END OF ONE YEAR WARRANTY: _____

SUBJECT: _____

[] If checked, the damage requires immediate attention. The Contractor has been called.
[] If checked, the Consultant has been asked to consult with the Contractor on the problem.

PLEASE CORRECT OR REPAIR THE FOLLOWING ITEM(S):

DATE OF REQUEST _____ SIGNATURE _____
Project Manager

XC:
[] _____ Phone No. _____
[] _____ Phone No. _____
[] _____ Phone No. _____
[] _____ Phone No. _____

RESPONSE FROM CONTRACTOR: DATE CORRECTION WAS MADE: _____

The Contractor must endeavor to correct the defect within 7 calendar days after written notice is given. If the defect cannot be corrected in that time, Contractor shall provide a written explanation to the Owner's Representative describing the repairs needed and the time required to complete the repairs.

Description of corrections made:

DATE OF REPLY _____ SIGNATURE _____

When the repair is complete, the contractor should return a copy to each of the following:

[] _____ Phone No. _____
[] _____ Phone No. _____
[] _____ Phone No. _____
[] _____ Phone No. _____

END

TWDB-0216
TEXAS WATER DEVELOPMENT BOARD
AFFIRMATIVE STEPS SOLICITATION REPORT

I. PROJECT INFORMATION

TWDB Project Number	Applicant/Entity Name	Total TWDB Funding Request	Program Type (insert "X" for all that apply)	
			<input type="checkbox"/>	Drinking Water SRF (DWSRF)
			<input type="checkbox"/>	Clean Water SRF (CWSRF)

Project Name: _____

Solicitation By: ☐ Applicant/Entity OR ☐ Prime Contracted Business: _____

Project Phase: ☐ Prior to Closing ☐ Release of funding for PADs ☐ Construction Contract # _____

II. SOLICITATION METHOD(S) UTILIZED

At least two methods of solicitation are required. Select the method(s) utilized for the solicitation. Copies of the actual postings, direct contact email/phone log, etc. must be attached to this form as support documentation for each method used. Failure to adequately follow these steps will result in the requirement to complete additional steps in order to become compliant.

- ☐ Newspaper Advertisements
 ☐ Meetings or Conferences
 ☐ Trade Association Publications
☐ Minority Media
 ☐ Internet & Web Postings
 ☐ Other Government Publications
☐ Direct Contact by Phone, Fax, USPS Mail, or Email*

If using direct contact, entities must solicit to a **minimum of 3 businesses/firms (at least one being a DBE) for each category of contract sought (i.e., construction, supplies, equipment, or services) to demonstrate a Good Faith Effort.*

III. PROJECT BIDDERS LIST:

List on the following table, or provide on a separate list, each business entity directly solicited for procurement or that submitted a bid for consideration.

Instructions for Columns 1 - 4	1 - Full business name (line one) & point of contact (line two) 2 - Business address 3 - Telephone number 4 - Email address for the business
Instructions for Column 5	Enter one of the following procurement or contract categories: CONSTRUCTION – SUPPLIES – EQUIPMENT – SERVICES <i>For detailed definitions, review guidance document, TWDB-0210.</i>
Instructions for Column 6	Enter the type of business: MBE - Minority Business Enterprise, WBE - Women-owned Business Enterprise, or OTHER - Company or firm is Non-MBE or WBE

Notice: Entities receiving State Revolving Fund financial assistance must create and maintain a Bidders List if the entity is subject to, or chooses to follow, competitive bidding. The Bidders List must include all firms that bid or quoted on contracts under EPA assisted projects, including both MBE/WBEs and non-MBE/WBEs. Entities must keep all Bidders Lists until project completion or the recipient is no longer receiving EPA funding under the loan, whichever is later. Entities with loans totaling less than \$250,000 during a state fiscal year are exempt from the Bidders List requirement, but must still meet DBE program requirements. The Bidders List requirement also applies to all Prime Contracted Businesses/Firms that make subcontracting.

Column 1 Business Name & Point of Contact	Column 2 Business Address	Column 3 Telephone Number	Column 4 E-Mail Address	Column 5 Procurement Category	Column 6 MBE/WBE Status
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					

Use additional sheets if necessary

Signature – Authorized Representative	Title (print legibly)	Date

IV. TWDB APPROVAL SIGNATURE

Signature indicates the form meets DBE requirements.

DBE Coordinator	Approval Date

TWDB-0217
TEXAS WATER DEVELOPMENT BOARD (TWDB)
PRIME CONSULTANT/CONTRACTOR CERTIFICATION

I. PROJECT INFORMATION

TWDB Project Number	Applicant/Entity Name	Total of TWDB Funding	Program Type (insert "X" for all that apply)	
			<input type="checkbox"/>	Drinking Water SRF (DWSRF)
			<input type="checkbox"/>	Clean Water SRF (CWSRF)

Prime Consultant/Contractor: _____

Contract Number: _____ **Contract Amount:** _____

II. GOOD FAITH EFFORT (Applicable to all subcontracts awarded by the prime contractor/consultant)

I understand that it is my responsibility to comply with all state and federal regulations and guidance in the utilization of Minority and Women-owned Businesses in procurement. I certify that I will make a "good faith effort" to afford opportunities for Minority Business Enterprise (MBE), and Women-owned Business Enterprise (WBE) by:

1. Including qualified MBEs and WBEs on procurement solicitation lists
 2. Soliciting potential MBEs and WBEs
 3. Reducing contract size/quantities when economically feasible to permit maximum participation by MBEs and WBEs
 4. Establishing delivery schedules to encourage participation by MBEs and WBEs
 5. Using the services and assistance of the Small Business Administration, Minority Business Development Agency, U.S. Department of Commerce, and Texas Marketplace
 6. Submitting documentation to the Applicant/Entity to verify good faith effort, steps 1-5.
- ☐ **EXCEPTION:** As the Prime Consultant/Contractor, I certify that I have reviewed the contract requirements and found no available subcontracting opportunities. I also certify that I will fulfill 100 percent of the contract requirements with my own employees and resources. (Check if applicable)

Signature – Prime Consultant/Contractor	Title (print legibly)	Certification Date

III. PROJECT PARTICIPATION ESTIMATES

The Cost Categories mentioned below are goals. These goals are neither standards nor quotas. Recipients of financial assistance are not required to meet the fair share objectives. They must, however, acknowledge that they are aware of and are actively pursuing the fair share objectives with their procurements.

	Potential MBE Participation	Potential WBE Participation
Cost Category	Goal	Goal
Construction	19.44%	9.17%
Supplies	25.34%	8.82%
Equipment	16.28%	11.45%
Services	20.41%	13.66%

The fair share goals listed above are required by 40 CFR Part 33 Subpart D and are directly negotiated with EPA Region 6. Entities receiving federal financial assistance are subject to the TWDB's goals and may not be substituted with other agency or program goals.

IV. TWDB APPROVAL SIGNATURE

Signature indicates the form meets DBE Requirements.

DBE Coordinator	Approval Date

TWDB-0373
TEXAS WATER DEVELOPMENT BOARD
PARTICIPATION SUMMARY

I. PROJECT INFORMATION

TWDB Project Number	Applicant/Entity Name	Total TWDB Funding Request	Program Type (insert "X" for all that apply)	
			<input type="checkbox"/>	Drinking Water SRF (DWSRF)
			<input type="checkbox"/>	Clean Water SRF (CWSRF)

Project Name: _____

Solicitation By: ☐ Applicant/Entity OR ☐ Prime Contracted Business: _____

Project Phase: ☐ Prior to Closing ☐ Release of funding for PADs ☐ Construction Contract # _____

Instructions

Column 1	Enter the full name, street address, city/state/zip for each firm awarded a contract for the project.
Column 2	Enter one of the following procurement or contract categories: CONSTRUCTION – SUPPLIES – EQUIPMENT – SERVICES
Column 3	Enter the type of business: MBE (Minority Business Enterprise), WBE (Women-owned Business Enterprise), or OTHER (NOTE: OTHER = Company or firm is Non-MBE or WBE)
Column 4	Enter the exact amount of the awarded contract.
Column 5	Enter the exact date the contract was executed or the proposed date of contract execution.

If valid MBE/WBE firms are awarded contracts, a copy of their certification is required to be attached with this form for each MBE/WBE business listed.

Notice: Brokers may not be listed below as an MBE or WBE. A broker is a firm that does not perform, manage, or supervise the work of its sub/contract in a manner consistent with the normal business practices for sub/contractors in its line of business. For more specifics, review guidance document, TWDB-0210.

II. LIST OF ACTUAL CONTRACTS/PROCUREMENTS

	Column 1 Name & Address of Contracted Firm/Vendor	Column 2 Procurement Category	Column 3 MBE/WBE Status	Column 4 Contract Amount (\$)	Column 5 Contract Execution Date
1.					
2.					
3.					
4.					
5.					
6.					

(Table continues on the next page)

	Column 1	Column 2	Column 3	Column 4	Column 5
	Name & Address of Contracted Firm/Vendor	Procurement Category	MBE/WBE Status	Contract Amount (\$)	Contract Execution Date
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					

Use additional sheets if necessary

Signature – Authorized Representative	Title (print legibly)	Date

III. TWDB APPROVAL SIGNATURE

Signature indicates the form meets DBE requirements.

DBE Coordinator	Approval Date

PART 1 – GENERAL

1.1 SECURITY POLICY

Paramount to Austin Water are 1) the production and delivery of an adequate supply of safe drinking water to all customers, 2) uninterrupted collection of wastewater, without spills, and 3) and adequate processing of wastewater to safely return to the environment . The Utility shall provide high quality physical security at all its facilities and shall initiate, implement, enforce, and update as needed, specific rules and procedures to protect property, personnel, facilities, and material against unauthorized entry, trespass, damage, sabotage, or other acts that might threaten the security of these facilities, the quality of the drinking water, or the quality of treated wastewater.

1.2 RELATED DOCUMENTS

The most current version of the Austin Water’s “Facility Security Procedures for Contractors, SP-1070” shall be considered a part of this Specification Section.

1.3 SECURITY PROCEDURE

The CONTRACTOR shall become familiar with this Specification Section and the most current version of the Austin Water’s “Facility Security Procedure for Contractors, SP-1070”, and shall assure that all SUBCONTRACTORS do likewise. The CONTRACTOR and each SUBCONTRACTOR shall sign an affidavit attesting to the fact that they have read, understood, and will abide by this procedure. The CONTRACTOR’s signed affidavit shall be delivered to the Utility no later than the Pre-construction Conference and before any access is allowed to the work site.

1.4 SUBMITTALS

The CONTRACTOR shall submit a “Contractor’s Acknowledgement” form (Appendix A of “Facility Security Procedure for Contractors, SP-1070”) signed by the Contractor’s Project Manager and Site Superintendent no later than the Pre-Construction Conference. This submittal shall be an original document, with original signatures. Copies or facsimiles will not be accepted.

The CONTRACTOR shall submit a “Contractor’s Acknowledgement” form (Appendix A of “Facility Security Procedure for Contractors, SP-1070”) signed by each Subcontractor’s Project Manager and Site Supervisor no later than two weeks prior to the date the Subcontractor wishes to enter the secured area. Each submittal shall be an original document, with original signatures. Copies or facsimiles will not be accepted.

The CONTRACTOR shall submit an “Application for Authorization to Enter Secured Austin Water Utility Facilities” form (Appendix B of “Facility Security Procedure for Contractors, SP-1070”) for every Contractor’s and Subcontractors’ employee that will need to enter the secured area. Each application shall be accompanied by a complete “Criminal History Records Check Disqualifying Criminal Offenses” (Appendix C) and a “Background Security Check”, performed by a governmental law enforcement agency, as described in the “Facility Security

Procedure for Contractors, SP-1070". These submittals shall each be an original document, with original signatures. Copies or facsimiles will not be accepted.

The CONTRACTOR shall submit a sample of their company's Security Identification Badge, sized and formatted as described in the "Facility Security Procedure for Contractors, SP-1070".

PART 2 – EXECUTION

2.0 WORK SCHEDULE

Normal work schedule is between the hours of 7.A.M thru 3.30 P.M. Contractor will be allowed to work from Monday thru Friday from the hours of 7:00 A.M. to 6: P .M. with permission from the project Engineer. Contractor intending to work night and weekends should get special clearance from the Project Engineer, Project Manager and the plant superintendent or manager.

2.1 SITE SECURITY

The CONTRACTOR shall be responsible for maintaining absolute site security and for following all provisions of the UTILITY's "Facility Security Procedures for Contractors, SP-1070" in good faith. Failure to follow any of the provisions of this procedure shall be considered a breach of this CONTRACT.

2.1.1 FENCES AND GATES

All existing fences and gates shall be maintained secure. If existing fences or gates must be moved or removed, equally secure temporary fencing shall be erected to maintain site security before any removal is initiated. If there is no existing fencing, temporary fencing and gates, as identified in another section of these specifications, shall be erected before any other work is performed. Gates shall be maintained closed and locked at all times. If necessary for convenient access, a guard, fluent in speaking and reading English, may be stationed at the gate to open and close it. In addition, the guard shall notify the Contractor's Site Superintendent of the arrival of all deliveries and shall examine the Identification Badges of all personnel seeking to enter the site, to assure that only persons with proper Security Identification Badges are allowed to enter.

2.1.2 BUILDINGS

All existing buildings shall be maintained secure. If access to an existing building is controlled by an existing security system, the CONTRACTOR, all SUBCONTRACTORS, and their respective employees shall follow the procedures for access as described in the "Facility Security Procedures for Contractors, SP-1070"

2.2 PERSONNEL

Personnel access to the construction site shall be limited to those identified in the "Facility Security Procedures for Contractors, SP-1070", and access will be controlled by the use of Security Identification Badges. The CONTRACTOR shall be responsible for assuring that all personnel allowed to enter the work site have proper Security Identification Badges. A proper Security Identification Badge is a picture badge, as described in SP-1070, either issued by the CONTRACTOR or SUBCONTRACTOR with the proper Utility-applied authorization decal, or

a badge issued by the UTILITY. The CONTRACTOR shall deny access to any person lacking a proper Security Identification Badge. Any person discovered on the work site without a proper identification badge will be escorted off the site and may be subject to arrest by law enforcement authorities.

2.2.1 ACCESS AUTHORIZATION

The CONTRACTOR shall provide an original “Application for Authorization to Enter Secured Austin Water Utility Facilities” (including Background Security Check) for each person who will be working on the site at least **five (5) working days** prior to the date that person is scheduled to begin work on the site. The UTILITY shall determine whether or not to grant each person access to the work site based upon the results of the Background Security Check. Random audits shall be performed by the UTILITY on the results of the Background Security Checks.

The original “Application for Authorization to Enter Secured Austin Water Utility Facilities” shall be kept on file by the Utility’s Security Manager or Project Manager. A copy of this document will be returned to the CONTRACTOR with an indication of the approval or denial of access for the named employee. The Background Security Check shall be returned to the CONTRACTOR also, but must be kept available for audit until one year following Final Completion.

2.2.2 IDENTIFICATION BADGES

The CONTRACTOR shall provide Security Identification Badges for each of their employees and their SUBCONTRACTORS’ employees. The badges shall be picture badges conforming to all the requirements of the “Facility Security Procedure for Contractors, SP-1070”. The badge must be worn by all persons at all times while present on the work site, and must be worn above the waist and be clearly visible from the front. Following a satisfactory review of each person’s Background Security Check, and presentation of government-issued picture identification, the UTILITY will apply a permanent access authorization decal to the badge.

3.0 PARKING

Due to limited parking spaces, contractors and their subcontractors are expected to park their vehicles outside the facility. If there are spaces for parking inside the facility, the AWU superintendent will notify the contractors through their project manager or superintendents.

--- End of Section 00819 ---

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MODIFICATIONS TO BIDDING REQUIREMENTS AND CONTRACT FORMS

Section 00820

Section 00100 – INSTRUCTIONS TO BIDDERS

Add the following under Paragraph 1. Preparation of Bid:

Contingent Award of Contract: This contract is contingent upon release of funds from the Texas Water Development Board (TWDB). Any contract(s) awarded under this Invitation for Bids is/are expected to be funded in part by a loan or grant from the Texas Water Development Board and a grant from the United States Environmental Protection Agency, U.S. EPA. Neither the state of Texas, the U.S. EPA, nor any of its departments, agencies, or employees are or will be a party to this Invitation for Bids or any resulting contract.

American Iron and Steel (TWDB Requirements): Any contract(s) awarded under this Invitation for Bids is/are subject to the American Iron and Steel (AIS) requirements of 33 U.S.C §1388 for Clean Water State Revolving Fund projects or Public Law 114-113, Consolidated Appropriations Act, 2016, or subsequent appropriations acts, for Drinking Water State Revolving Fund projects. The Contractor must complete the statement of understanding regarding this requirement, found in Supplemental Contract Conditions, Item No. 9.

Add the following to Paragraph 1.5 Minimum Wages:

1.5.1 Davis-Bacon Wage Rate Requirements (TWDB Requirements)

- (A) Davis-Bacon prevailing wage requirements apply to the construction, alteration or repair of treatment works carried out, in whole or in part, with assistance made available by the Clean Water State Revolving Fund (CWSRF) or a construction project financed, in whole or in part, from the Drinking Water State Revolving Fund (DWSRF).
- (B) The Davis-Bacon prevailing wage requirements apply to Contractors and Subcontractors performing on federally funded or assisted contracts in excess of \$2,000 for the construction, alteration or repair (including painting) of a treatment works project under the CWSRF or a construction project under the DWSRF.
- (C) For prime contracts in excess of \$100,000, Contractors and Subcontractors must also, under the provisions of the Contract Work Hours and Safety Standards Act, as amended, pay laborers and mechanics, including guards and watchmen, at least one and one-half times their regular rate of pay for all hours worked over 40 in a workweek.
The Fair Labor Standards Act may also apply to Davis-Bacon covered contracts.
- (D) Any contracts in excess of \$2,000 must include the provisions of the Davis-Bacon Wage Rate Requirements. If the Owner (sub-recipient) is a governmental entity such as a city or district, it must insert in full the contract clauses found in TWDB Guidance DB-0156, Appendix 1: Section 3, Section 4 if the contract exceeds \$100,000, and Section 5. If the Owner (sub-recipient) is a non-governmental entity such as a water supply corporation or a private company, it must insert in full the contract clauses found in TWDB Guidance DB-0156, Appendix 2: Section 3, Section 4 if the contract exceeds \$100,000, and Section 5. The Owner (sub-recipient) must ensure all prime contracts require the same full text

Bidding Requirements, Contract Forms and Conditions of the Contract

in any subcontracts. See TWDB Guidance DB-0156 for the text of the contract language that must be included.

Additional information on Davis-Bacon Wage Rate Requirements and its applicability to this contract can be found in TWDB Guidance DB-0156.

Add the following Paragraph 1.12:

1.12 Equal Employment Opportunity and Affirmative Action (TWDB Requirements). All qualified applicants will receive consideration for employment without regard to race, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age (40 or older), disability, or genetic information. Bidders on this work will be required to comply with the Department of Labor regulations at 41 CFR Part 60-4, relating to Construction Contractors--Affirmative Action Requirements, which include the President's Executive Order No. 11246, as amended by Executive Order No. 11375 and Executive Order No. 13672, in the award and administration of contracts awarded under TWDB financial assistance agreements. Failure by the Contractor to carry out these requirements is a material breach, which may result in the termination of the awarded financial assistance.

Add the following Paragraph 1.13:

1.13 Debarment and Suspension Certification (TWDB Requirements). This contract is subject to the federal requirements of Subpart C of 2 CFR Part 180 and Part 1532 regarding Debarment and Suspension. The Contractor will comply with the assurances provided with the bid that leads to a contract.

Add the following Paragraphs 7.6.

7.6 One copy of the Bidder's Certifications form (TWDB form WRD-255), complete and signed.

Add the following Paragraphs 11.2.4 and 11.2.5.

11.2.4 One copy of Contractor's Act of Assurance (TWDB form ED-103)

11.2.5 One copy of Contractor's Act of Assurance Resolution (TWDB form ED-104)

Add the following paragraph 18:

18. ADDITIONAL FORMS AND INFORMATION

The following forms and guidance documents, mentioned throughout this Section and the Contract Documents, are available on the TWDB site at: <http://www.twdb.texas.gov/financial/instructions/index.asp>

Forms:

Contractor's Act of Assurance (ED-103)

Contractor's Resolution on Authorized Representative (ED-104)

Bidder's Certifications- EEO (WRD – 255)

Monthly Davis Bacon Wage Rate Certificate of Compliance Submittal by Owner (Sub-Recipient) (DB-0154)

Guidance Documents:

TWDB-0210 Disadvantaged Business Enterprise Guidance

Requirements for American Iron and Steel (AIS) Guidance (TWDB-1106)

Guidance on Davis-Bacon Wage Rate Requirements for State Revolving Fund Projects (DB-0156)

SECTION 00830 – WAGE RATES AND PAYROLL REPORTING

Reference Paragraph 4.2; delete the second sentence and replace with the following:

Contractor shall provide copies of payroll records to Owner on a weekly basis.

END

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WAGE RATES AND PAYROLL REPORTING

Section 00830HH

WAGE RATE DETERMINATION**Heavy and Highway**

County Name: TRAVIS

Wages based on DOL General Decision: TX20200007 01/03/2020 TX19 and City of Austin Ordinance # 20160324-015

DOL Rate column is for information only. The Total Minimum Wage Rate is derived from the Adjusted Wage Rate Required pursuant to City Ordinance, and can be met using any combination of cash and non-cash qualified fringe benefits, provided the cash component is at least \$15.00/ hour.

Classification	DOL Rate For info Only	Adjusted Wage Rate Required Pursuant to City Ordinance	Total Minimum Wage Rate Required
Agricultural Tractor Operator	\$12.69	\$15.00	\$15.00
Asphalt Distributor Operator	\$15.55	\$15.55	\$15.55
Asphalt Paving Machine Operator	\$14.36	\$15.00	\$15.00
Asphalt Raker	\$12.12	\$15.00	\$15.00
Boom Truck Operator	\$18.36	\$18.36	\$18.36
Broom or Sweeper Operator	\$11.04	\$15.00	\$15.00
Cement Mason/Concrete Finisher	\$12.56	\$15.00	\$15.00
Concrete Pavement Finishing Machine Operator	\$15.48	\$15.48	\$15.48
Crane, Hydraulic, 80 tons or less	\$18.36	\$18.36	\$18.36
Crane, Lattice Boom, 80 tons or less	\$15.87	\$15.87	\$15.87
Crane, Lattice Boom, over 80 tons	\$19.38	\$19.38	\$19.38
Crawler Tractor	\$15.67	\$15.67	\$15.67
Directional Drilling Locator	\$11.67	\$15.00	\$15.00
Directional Drilling Operator	\$17.24	\$17.24	\$17.24
Electrician	\$26.35	\$26.35	\$26.35
Excavator 50,000 lbs. or less	\$12.88	\$15.00	\$15.00
Excavator, over 50,000 lbs.	\$17.71	\$17.71	\$17.71
Flagger	\$10.60	\$15.00	\$15.00
Form Builder/Form Setter - Paving & Curb	\$12.94	\$15.00	\$15.00
Form Builder/Form Setter - Structures	\$12.87	\$15.00	\$15.00
Foundation Drill Operator, Truck Mounted	\$16.93	\$16.93	\$16.93
Front End Loader Operator, 3CY or less	\$13.04	\$15.00	\$15.00
Front End Loader, over 3CY	\$13.21	\$15.00	\$15.00

Bidding Requirements, Contract Forms Conditions of the Contract

Laborer, Common	\$10.60	\$15.00	\$15.00
Laborer, Utility	\$12.27	\$15.00	\$15.00
Loader/Backhoe Operator	\$14.12	\$15.00	\$15.00
Mechanic	\$17.10	\$17.10	\$17.10
Milling Machine	\$14.18	\$15.00	\$15.00
Motor Grader Operator - Fine Grade	\$18.51	\$18.51	\$18.51
Motor Grader Operator, Rough	\$14.63	\$15.00	\$15.00
Painter - Structures	\$18.34	\$18.34	\$18.34
Pavement Marking Machine Operator	\$19.17	\$19.17	\$19.17
Pipelayer	\$12.79	\$15.00	\$15.00
Reclaimer/Pulverizer	\$12.88	\$15.00	\$15.00
Reinforcing Steel Setter	\$14.00	\$15.00	\$15.00
Roller Operator, Asphalt	\$12.78	\$15.00	\$15.00
Roller Operator, Other	\$10.60	\$15.00	\$15.00
Scraper Operator	\$12.27	\$15.00	\$15.00
Servicer	\$14.51	\$15.00	\$15.00
Spreader Box Operator	\$14.04	\$15.00	\$15.00
Structural Steel Worker	\$19.29	\$19.29	\$19.29
Traffic Signal Installer/Light Pole Worker	\$16.00	\$16.00	\$16.00
Trenching Machine Operator, Heavy	\$18.48	\$18.48	\$18.48
Truck Driver Tandem Axle Semi-Trailer	\$12.81	\$15.00	\$15.00
Truck Driver, Lowboy/Float	\$15.66	\$15.66	\$15.66
Truck Driver, Single Axle	\$11.79	\$15.00	\$15.00
Truck Driver, Off Road Hauler	\$11.88	\$15.00	\$15.00
Truck Driver, Single or Tandem Axle Dump	\$11.68	\$15.00	\$15.00
* Welders	\$15.97	\$15.97	\$15.97
Work Zone Barricade Servicer	\$11.85	\$15.00	\$15.00

The Wage Compliance information detailed below was excerpted from DOL General Decision TX170016 or other sources.

1. ADDITIONAL TRADE INFORMATION

Unlisted classifications needed for work not listed within the scope of the classifications listed may be added upon the advance approval of Contract Procurement. CONTRACTOR shall submit to City of Austin Contract Procurement the following: classification, a bona fide definition of work to be performed and a proposed wage with sample payrolls conforming to area practice **prior** to the start of the job for that type of work. Proposed trade may not be performed by any trade already listed.

2. WAGES

The Total Minimum Wage Rate may be met by any combination of cash wages and credible "bona fide" fringe benefits paid for by the employer. Overtime must be used in computing overtime pay. Wages must be calculated using the Total Minimum Wage Rate specified in the Wage Rate Determination or the actual basic rate of pay, whichever is higher.

City of Austin Ordinance No. 2016324-015 requires that construction workers are paid a minimum Wage of at least \$15.00/hour. The cash portion of their compensation must meet or exceed this amount.

3. PROPER DESIGNATION OF TRADE

A work classification from the Prevailing Wage Poster for each worker must be made based on the actual type of work he/she performed on the job. In summary the work performed, not the "title" determines the correct worker classification and wage. Each worker must be paid no less than the adjusted wage rate on the wage decision for that classification **regardless** of his/her level of skill (exclusive of a bona fide apprentice currently registered in a DOL approved apprentice program - proof of individual registration must be supplied in advance to the City of Austin).

4. SPLIT CLASSIFICATION

If a firm has employees that perform work in more than one classification, it can pay the adjusted wage rates specified for each classification ONLY if it maintains accurate time records showing the amount of time spent in each classification. If accurate time records are not maintained, these employees must be paid the highest adjusted wage rate of all the classifications of work performed by each worker. Accurate time records tracking how many hours a worker performed the work of one trade and then switched to another trade must be accounted for on a daily basis and reflected on Employer Certified Payroll accordingly.

*WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
=====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

In the listing above, the "SU" designation means that rates listed under the identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

5. WAGE DETERMINATION APPEALS PROCESS

5.1 Has there been an initial decision in the matter? This can be:

- .1 An existing published wage determination
- .2 A survey underlying a wage determination
- .3 A Wage and Hour Division letter setting forth a position on a wage determination

matter

.4 A conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in .2 and .3 should be followed.

5.2 With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determination
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W. Washington, DC 20210

5.3 If the answer to the question in .1 is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W. Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

5.4 If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W. Washington, DC 20210

5.5 All decisions by the Administrative Review Board are final.

END

WAGE RATES AND PAYROLL REPORTING

Section 00830

1. PAYMENT

1.1 Classification Definitions, Building and Heavy and Highway

1.1.1 Definitions for Building Construction and Heavy and Highway classifications shall conform to the current "Occupational Information Network (O*NET)" as approved by the U.S. Department of Labor. For interpretive guidance, the Core Task list in O*NET will be used to make prevailing wage determinations. Final classification of workers will be made by the OWNER.

1.2 Minimum Wages

1.2.1 Workers on Project shall be paid not less than wage rates, including fringe benefits, as published by the Department of Labor (DOL) or the \$15.00 minimum wage required by City of Austin Ordinance No. 20160324-015, whichever is higher. The Total Minimum Wage required can be met using any combination of cash and non-cash qualified fringe benefits provided the cash component meets or exceeds the \$15.00 minimum wage required.

1.2.2 Such wage rates shall be used throughout the Contract. If a classification is to be used, which is not listed in the attached wage rates, CONTRACTOR shall submit to OWNER rates and classification proposed for use, for approval, prior to performance of the Work.

1.2.3 All laborers and mechanics working upon the Work for this Project shall be paid unconditionally and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by Secretary of Labor under the Copeland Act, Title 29 CFR, Part 3) full wages accrued and when due, computed at rates not less than wage rates bound herein pertaining to type of Work being performed. When Work is of such a nature that both Building and Heavy and Highway wage scales are incorporated into contract, CONTRACTOR shall pay wage rates to mechanics or laborers performing Work in more than one classification at the rate indicated for each classification for time actually worked as determined by area practice applicable to type (Site Construction Crafts or Building Construction Crafts) of Work being performed without regards to skill. Salaried specialists (project superintendent and administrative personnel only) in the permanent employment of CONTRACTOR do not fall under any Wage Classification. A supervisor/foreman who is not exempt under 29 CFR Part 541 and who spends more than a substantial amount of time (20 percent) in a given workweek as a laborer or mechanic must be paid the applicable Wage Rate for the classification of work performed for all hours engaged in such work as a laborer or mechanic.

1.2.4 Wage rates shall be posted by CONTRACTOR at site(s) of Work in prominent, easily accessible places where they can be seen by all workers. The following shall also be posted by the CONTRACTOR: City of Austin wage contact posters (English and Spanish), City of Austin Equal Employment Opportunity posters (English and Spanish), Workers' Compensation Notice (English and Spanish), Texas Payday Law (English and Spanish), City Rest Break Ordinance

(English and Spanish), City of Austin Non-Discrimination Statement (related to Title VI of the Civil Rights Act), and Federal Notices, as appropriate.

1.3 Overtime Requirements

1.3.1 No CONTRACTOR, Subcontractor, or Sub-subcontractor contracting for any part of contract Work which may require or involve the employment of laborers or mechanics shall require or permit any laborer or mechanic in any workweek in which he is employed on such Work, to work in excess of forty hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times their basic rate of pay for all hours in excess of forty hours in such workweek.

1.3.2 Overtime wages must be calculated using the Adjusted Wage Rate specified in the Wage Rate Determination or the actual basic rate of pay, whichever is higher.

2. APPRENTICES

2.1 Locally and Federally Funded Projects

2.1.1 The terms journeyman and apprentice apply to both union and independent workers, and are not intended to imply that these positions are union workers only.

2.1.2 Apprentices and Trainees will be permitted to work as such only when they are registered, individually, under a bonafide Apprenticeship or Trainee program registered with the Bureau of Apprenticeship and Training, United States Department of Labor. The allowable ratio of Apprentices or Trainees to journeymen in any craft classification shall not be greater than the ratio permitted to CONTRACTOR as stated in the registered apprenticeship program standards. Any employee listed on a payroll at an Apprentice or Trainee wage rate, who is not registered as above, shall be paid the wage rate provided in Contract for Work employee actually performed. CONTRACTOR, Subcontractor, or Subsubcontractor shall furnish to OWNER written evidence of registration of his program for Apprentices and Trainees as well as of the appropriate ratios and wage rates, for the area of construction prior to using any Apprentices or Trainees on this Contract.

3. WITHHOLDING PAYMENTS

3.1 OWNER may withhold or cause to be withheld from CONTRACTOR as much of the accrued payments as necessary to pay laborers and mechanics employed by CONTRACTOR, Subcontractors, or Sub-subcontractors the amount of wages required to comply with the Contract. In the event of nonpayment of wages to laborers or mechanics working on the site of the Work of this Contract, OWNER may, after Written Notice to CONTRACTOR, take such action as may be necessary to cause suspension of any further payments or advance of funds to CONTRACTOR until such violations have ceased and until restitution has been made. Payments may also be withheld if CONTRACTOR fails to maintain weekly payroll reports or fails to provide copies in a timely manner upon request of Owner.

4. PAYROLLS

4.1 CONTRACTOR shall keep records showing:

4.1.1 The name, address and occupation of each worker employed by the CONTRACTOR or subcontractor(s) in the construction of the public work.

4.1.2 The actual per diem wages paid to each worker

4.1.3 Employee Certification. CONTRACTOR, all levels of Subcontractors shall identify in writing, the classification agreed to by all laborers and mechanics employed by them in the execution of the Contract, and pay not less than rates specified in the attached Wage Rate Determination(s). Contractor shall prepare a completed form for the signature of Employee and a witness shall sign the form in the presence of Employee. If work performed by worker is different than the trade classification agreed upon, the worker shall be paid for that work no less than the minimum prevailing wage for that specified trade.

4.1.4 Payroll Deduction Authorization Form. CONTRACTOR, Subcontractor, and Sub subcontractor shall prepare for employee signature a payroll deduction authorization form to identify all payroll deductions excluding those required by statute, such as federal income taxes, Medicare and social security.

4.2 The record shall be open at all reasonable hours to inspection by the officers and agents of the Owner as requested. CONTRACTOR will be responsible to provide copies of records as requested by the Owner within two (2) working days. Payrolls relating to this Work shall be maintained during term of Contract and preserved for a period of three (3) years thereafter by CONTRACTOR for all laborers and mechanics working on the Work.

4.3 A Statement of Compliance, a letter signed and dated by party responsible for supervising the payment of persons employed by CONTRACTOR or subcontractor shall accompany payrolls required by Owner. The Statement of Compliance letter shall identify but is not limited to:

4.3.1 Name of signatory party and title

4.3.2 Name of project, payroll period and

4.3.3 Name of CONTRACTOR or Subcontractor

4.4 The signed letter attests that the payroll complies with 29CFR issued by the Secretary of Labor.

4.5 Federal Funding. In the event that federal funding is used:

4.5.1 Contractor and all levels of Subcontractors shall submit weekly certified payroll reports and signed wage compliance statements to the Owner's designated office no later than seven (7) calendar days after the scheduled payday.

4.5.2 Contractors and all levels of Subcontractors shall pay all "mechanics and laborers" not less often than once per week, for work performed the previous week.

4.5.3 Submit to the Owner's designated office Standard Form 1413, Statement and Acknowledgement, from each subcontractor prior to the subcontractor performing work on the project.

5. NONCOMPLIANCE

5.1 According to Chapter 2258 Texas Government Code Title 10A, a CONTRACTOR or subcontractor(s) who violates this section shall pay to the political subdivision on whose behalf the contract is made, \$60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.

5.2 Confirmed Disciplinary action taken by CONTRACTOR against employees who provide information during an interview or investigation by the Owner on wages received, may result in suspension or debarment from consideration of award of City contracts.

6. AREA PRACTICE

6.1 Heavy and Highway Construction Rates shall be used on this Project, unless the Project consists primarily of Building Construction and Building Construction Rates are to be used.

6.1.1 Building Construction consists generally of all aspects of construction of buildings, which are sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment or supplies, including without limitation the installation of utilities and equipment, both above and below grade level, as well as incidental demolition, grading, utilities, paving and other site work. Buildings need not be "habitable" to be classified as Building Construction and the installation of heavy machinery and/or equipment will not generally change a Building Construction project's classification.

6.1.2 The determination of Building Construction Wage Rates includes all construction trades and work necessary to complete a building, regardless of the number of contracts involved, so long as all such contracts are closely related in purpose, time and place.

6.2 For projects that involve both Building Construction and Heavy and Highway trades, the following classifications shall be used:

6.2.1 A multiple classification shall be used if Building Construction items are more than 20% of the Heavy and Highway project cost.

6.2.2 A multiple classification shall be used if Heavy and Highway Construction items are more than 20% of the Building Construction Project cost.

6.3 Split classifications/multiple wage rate schedules: When construction work requires that an employee perform work under multiple classifications or multiple wage scales, the employer must pay that worker (at least) the highest prevailing wage or the employer payroll records must accurately set forth the times spent performing the work of each classification and under each scale. For those projects that involve both Building Construction and Heavy and Highway trades, the Heavy and Highway wage rates may only be applied to workers when engaged in site work at least five (5) feet beyond the building.

7. TEXAS OPEN RECORDS ACT

Bidding Requirements, Contract Forms and Conditions of the Contract

7.1 Unless covered by an exception to mandatory disclosure under the Texas Public Information Act, Chapter 552, Texas Government Code, any and all documents submitted to the City of Austin become Public Records and are, therefore, subject to public disclosure.

Wage Rates for This Project Are Attached

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CONSTRUCTION TRAINING PROGRAM REQUIREMENTS

Section 00840

The **City of Austin Construction Training Program (the “Program”)** is intended to train workers on City of Austin’s construction projects in order to develop a pool of qualified, ready-to-work skilled and semi-skilled construction workers. This training commitment is not intended and shall not be used to discriminate against any applicant.

Training Requirement. Establishment of the Construction Training Requirement for each project will be based on project scope, dollar amount, and opportunities available to achieve the training requirements. The requirements will be established either prior to solicitation, or during contract negotiations, using the criteria in Charts A and B. Program requirements will be subject to availability of Trainees and Graduates.

Chart A - Evaluation Criteria	
<ol style="list-style-type: none"> 1. Material cost vs labor cost 2. Scope of work 3. Schedule of values (a comprehensive list of work for a particular project) 4. Project duration and schedule 5. Unique aspects of the project 6. Available training programs for the specific training plan 7. Workforce determined by the number of workers that will be on the project enough days to establish a training program. 	

Chart B – Construction Training Requirements	
Estimated Construction Cost	Apprentice/ On-the-Job Training (OJT) /Construction Ready (CR) Trainee Requirements
\$500K to \$2.5M	2 – Construction Ready Trainees*
Over \$2.5M to \$5M	4 - Construction Ready Trainees*
Over \$5M to \$10M	6 - Construction Ready Trainees*
Over \$10M (Significant Budget)	OJT/Apprentice/Graduate/Trainee Minimum 15%

*These requirements may also be satisfied by workers enrolled in or graduated from DOL registered/approved training programs.

CONSTRUCTION TRAINING PROGRAM REQUIREMENTS

Section 00840

1. DEFINITIONS

1.1 *Capital Contracting Office (CCO)* – The City of Austin’s Office responsible for administering the Construction Training Program

1.2 *City’s Approved Minimum Wage Rate* – a minimum wage rate established by the City of Austin for workers performing construction activities on City of Austin contracts

1.3 *DOL or U.S. DOL* – United States Department of Labor

1.4 *Horizontal Construction Project* – civil construction, such as roads, bridges, and utilities

1.5 *Journeyman* – a fully-trained tradesperson, who may or may not be a union worker, and may or may not have completed a DOL-approved OJT Training Program

1.6 *Trainee* – For the purposes of the City of Austin Construction Training Program, those individuals enrolled in or graduates of a DOL-approved OJT Training Program

1.7 *On-The-Job-Training (OJT) Program* – a DOL-approved training program as described under 29 CFR 5.16

1.8 *Training Plan* – a plan identifying how a contractor intends to meet its training requirement, subject to OWNER’s review and approval

1.9 *Construction Training Program Reporting Form* – a form provided by the OWNER which documents the contractor’s training activities and trainee status.

1.10 *Workforce* – the estimated number of full-time employees to be employed on the project, taking into consideration training opportunities

2. TRAINING REQUIREMENTS

2.1 For Horizontal Construction Projects with a construction budget over \$10,000,000, a minimum of 15% of the Workforce are to be Graduates of or current enrollees in a DOL-approved OJT Training Program or DOL-certified Bilingual Training Program. Graduates must not satisfy more than half of the training requirement.

2.2 Any OJT Trainees enrolled in a DOL-approved training program must be paid at least the percentage of the prevailing journeyman wage rate as specified in the training program for that trade, but may NOT be paid less than the City’s Approved Minimum Wage Rate.

3. CONTRACTOR’S RESPONSIBILITIES

3.1 Prior to the issuance of the Notice to Proceed, the Contractor shall provide a Training Plan for OWNER’s approval, listing the anticipated trades to be used. The plan shall specify how the CONTRACTOR intends to satisfy its contract requirement. The CONTRACTOR will have fulfilled its

CONSTRUCTION TRAINING PROGRAM REQUIREMENTS

Section 00840

responsibilities under Section 00840 of the contract by having complied with the CONTRACTOR's Training Plan approved by the OWNER.

3.2 In the event that a CONTRACTOR subcontracts a portion of the contract work, CONTRACTOR shall determine if the requirements of the program will be assumed by the subcontractor(s). The CONTRACTOR should ensure that this training provision is made applicable to such subcontract; however, the CONTRACTOR shall retain the responsibility for meeting the training requirements imposed by this provision.

3.3 CONTRACTOR shall provide training in the construction trades. CONTRACTOR may pay a percentage of the prevailing wage rate for each trade as specified in the DOL-approved training program, but not less than the City's Approved Minimum Wage Rate.

3.4 OWNER will provide a list of available DOL-approved training organizations. The CONTRACTOR shall contact those training organizations as needed in order to recruit workers for the program.

3.5 The Trainees may be distributed among the work classifications on the basis of the CONTRACTOR's needs and the availability of journeymen in the various classifications.

3.6 The CONTRACTOR shall submit a Construction Training Program Reporting Form to CCO for each Trainee, as specified in the approved Training Plan. This shall indicate work classification and graduation details, as well as training status changes. If a Trainee is terminated or resigns, the CONTRACTOR is required to make a reasonable effort to replace the Trainee within 30 calendar days.

3.7 For each trainee performing work on the project, the CONTRACTOR must submit to CCO the following:

- 3.7.1 evidence of enrollment in the appropriate training program,
- 3.7.2 completed Employee Certifications, as stipulated in Section 00830 (Wage Rates and Payroll Reporting), for each Trainee,
- 3.7.3 summary of planned training for the enrollee from the training provider

3.8 The CONTRACTOR must provide the Trainee a copy of the training program.

3.9 The Trainee(s) shall remain on the project as long as training opportunities exist or until the training is completed.

3.10 **CONTRACTOR's Reasonable Efforts to Comply.** The CONTRACTOR will be responsible for demonstrating the steps taken to meet the training requirement. If CONTRACTOR has fewer Trainees employed on the project than specified in the Training Plan, the CONTRACTOR must submit evidence of recruitment efforts. These shall include the following:

- 3.10.1 contacts made to OWNER for a current list of approved training providers
- 3.10.2 log of applicants contacted
- 3.10.3 log of training organizations contacted

CONSTRUCTION TRAINING PROGRAM REQUIREMENTS

Section 00840

3.10.4 documented outreach efforts made to all available training organizations (per current OWNER list) to satisfy the requirement

3.10.5 documentation of CONTRACTOR's recruitment efforts performed until program requirements are met or project is complete as part of the Construction Training Program Reporting Form

4. **NON-COMPLIANCE**

4.1 Lack of demonstrated reasonable effort to comply with the Construction Training Program will be reflected in the Contractor's Performance Evaluation and may impact the receipt of future business with the City of Austin.

ADDENDUM
Section 00900

Notice to Bidders: This form, Addendum, Section 00900, is included for your information only. If an actual Addendum is issued for this project, the format shown below will be used. Additionally, issued addenda will be bound at the beginning of the Project Manual following the Table of Contents at the time of contract execution.

ADDENDUM NO. _____

Date _____, _____

City of Austin

Project Name Ullrich WTP Low Service Pump station Electrical Feed Renewal

C.I.P. No. 5335.016 IFB No.: _____

This Addendum forms a part of the Contract and corrects or modifies original Bid Documents, dated _____, ____ (first advertisement date). **Acknowledge receipt of this addendum in space provided on bid form.** Failure to do so may subject bidder to disqualification.

A. Project Manual Revisions:

B. Drawing Revisions:

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

Approved by OWNER

Approved by ENGINEER/ARCHITECT (as applicable per license requirements)

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ITEM NO. 102S - CLEARING AND GRUBBING 8-20-07**102S.1 - Description**

This item shall govern the removal and disposal of all trees, stumps, brush, roots, shrubs, vegetation, logs, rubbish and other objectionable material.

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

102S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A permit when utility adjustments are made in the right-of-way, and
- B. A plan for removal and deposition of all clearing and grubbing materials and debris.

102S.3 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures indicated on the Drawings shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Section 00700, "General Conditions" and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Areas within the construction limits indicated on the Drawings shall be cleared of all trees, stumps, brush, etc., as defined in section 102S.1; except trees or shrubs scheduled for preservation which shall be carefully trimmed as directed, in accordance with Item No. 610S, " Preservation of Trees and Other Vegetation" and shall be protected from scarring, barking or other injuries during construction operations. All exposed cuts over 2 inches (50 millimeters) in diameter, exposed ends of pruned limbs or scarred bark shall be treated with an approved asphalt material within 24 hours of the pruning or injury.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings and/or specified in the Contract Documents. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed.

Within the construction limits or areas indicated, all obstructions, stumps, roots, vegetation, abandoned structures, rubbish and objectionable material shall be removed to the following depths:

1. In areas to receive 6 inches (150 mm) or more embankment, a minimum of 12 inches (300 mm) below natural ground.
2. In areas to receive embankment less than 6 inches (150 mm), a minimum of 18 inches (450 mm) below the lower elevation of embankment, structure or excavation.
3. In areas to be excavated a minimum of 18 inches (450 mm) below the lower elevation of the embankment, structure or excavation.
4. In all other areas a minimum of 12 inches (300 mm) below natural ground.

Holes remaining after removal of all obstructions, objectionable material, trees, stumps, etc. shall be backfilled with select embankment material and compacted by approved methods. All cleared and grubbed material shall be disposed of in a manner satisfactory to the Engineer or designated representative. Unless otherwise provided, all materials as described above shall become the property of the Contractor and removed from the site and disposed of at a City of Austin or Texas Commission on Environmental Quality (TCEQ) permitted disposal site.

Burning materials at the site shall conform to Standard Contract Document Section 01550, "Public Safety and Convenience".

102S.4 - Measurement

"Clearing and Grubbing", when included in the contract as a pay item, will be measured by the acre (hectare: 1 hectare is equal to 2.471 acres), 100 foot (100 feet is equal to 30.5 meters) stations or lump sum, regardless of the width of the right of way.

102S.5 - Payment

The work and materials presented herein will not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used, unless specified as a separate pay item in the contract bid form. When included for payment, it shall be paid for at the unit bid price for "Clearing and Grubbing". This price shall include full compensation for all work herein specified, including the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the Work.

Payment, when included as a contract pay items, will be made under one of the following:

Pay Item No. 102S-A:	Clearing and Grubbing	Per Acre.
Pay Item No. 102S-B:	Clearing and Grubbing	Per 100 foot Station.
Pay Item No. 102S-C:	Clearing and Grubbing	Lump Sum.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
Specification Item 102S, "CLEARING AND GRUBBING"	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
00700	General Conditions
01550	Public Safety and Convenience

City of Austin Utilities Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 5.2.0	Permit for Excavation in the Public Right-of-Way

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS

Specification 102S, "CLEARING AND GRUBBING"

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

<u>Designation</u>	<u>Description</u>
Article 15-12-166	Permit Required
Article 15-12-173	Conditions for Permit Issuance
Article 15-12-	Permit Term

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<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
01500	Temporary Facilities
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 104S	Removing Portland Cement Concrete
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 203	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 236S	Rolling (Proof)
Item No. 602S	Sodding for Erosion Control

Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
610S-1	Tree Protection Fence Locations
610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B
621S-1	Diversion
622S-1	Diversion Dike
624S-1	Earth Outlet Sediment Trap
625S-1	Grade Stabilization Structure
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale With Stone Center
628S	Triangular Sediment Filter Dike
628S-1	Hay Bale Dike

629S-1	Brush Berm
630S-1	Interceptor Dike
631S-1	Interceptor Swale
632S-1	Storm Inlet Sediment Trap
633S-1	Landgrading
634S-1	Level Spreader
635S-1	Perimeter Dike
636S-1	Perimeter Swale
637S-1	Pipe Slope Drain (Flexible)
637S-2	Pipe Slope Drain (Flexible)
638S-1	Pipe Outlet Sediment Trap
639S-1	Rock Berm
641S-1	Stabilized Construction Entrance
642S-1	Silt Fence
643S-1	Stone Outlet Structure
644S-1	Stone Outlet Sediment Trap
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
<u>Designation</u>	<u>Description</u>

Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 260	Lime Treatment for Materials Used as Subgrade (Road Mixed)
Item No. 265	Lime-Fly Ash (LFA) Treatment for Materials Used as Subgrade
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture Density Relationship of Subgrade

	& Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

ITEM NO. 104S - REMOVING PORTLAND CEMENT CONCRETE 9-26-12**104S.1 - Description**

This item shall govern the demolition, removal and satisfactory disposal of existing Portland cement concrete, as classified, at locations indicated on the Drawings or as directed by the Engineer or designated representative.

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

104S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A permit when utility adjustments are made in the right-of-way, and
- B. A plan for removal and deposition of all 'broken up' existing Portland cement (p.c.) concrete materials and debris.

104S.3 - Classification

Existing Portland cement concrete, when removed under this section, will be classified as follows:

- 1. Concrete Curb will include curb, curb and gutter and combinations thereof,
- 2. Concrete Slabs will include, but not be limited to, house slabs, patio slabs, porch slabs, concrete riprap and concrete pavement,
- 3. Sidewalks and Driveways will include concrete sidewalks and driveways,
- 4. Concrete Walls will include all walls, regardless of height, and wall footings,
- 5. Concrete Steps will include all steps and combinations of walls and steps,
- 6. Abandoned Foundations will include abandoned utility foundations,
- 7. Miscellaneous Concrete shall include all other concrete items, which are not identified in items 1 through 6 above.

104S.4 - Materials

Mortar shall conform to mortar specified in Standard Specification Item No. 403, "Concrete for Structures".

104S.5 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Section 00700, "General Conditions". A permit shall be required when utility adjustments are to be made in preparation for highway construction, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

The existing Portland cement concrete shall be broken up, removed in accordance with Item No. 101S, "Preparing Right of Way" and disposed of by the Contractor and deposited at a permitted disposal site.

When it is specified that only a portion of the existing Portland cement (p.c.) concrete is to be removed and that the remaining p.c. concrete will continue to serve its purpose, special care shall be exercised to avoid damage to that portion which will remain in place. Unless otherwise established by the Engineer or designated representative, existing p.c. concrete shall be cut to the neat lines, that are indicated on the

Drawings, by sawing with an appropriate type circular concrete saw to a minimum depth of ½ inch (12.5 mm). Any reinforcing steel encountered shall be cut off 1 inch (25 mm) inside of p.c. concrete sawed line. Any existing p.c. concrete, which is damaged or destroyed beyond the neat lines so established, shall be replaced at the Contractor's expense. Remaining p.c. concrete shall be mortared to protect the reinforcing steel and provide a neat clean appearance.

When reinforcement is encountered during the removal of portions of existing structures to be modified, a minimum of 1 foot (300 mm) of steel length shall be cleaned of all old p.c. concrete and left in place to tie into the new construction where applicable. All unsuitable material shall be removed and replaced with approved material. All foundations, walls or other objectionable material shall be removed to a minimum depth of 18 inches (450 mm) below all structures and 12 inches (300 mm) below areas to be vegetated.

104S.6 - Measurement

When included in the contract as a separate pay item, the removal of p.c. concrete curb and p.c. concrete wall as prescribed above will be measured by the lineal foot (meter: 1 meter is equal to 3.281 feet) in its original position regardless of the dimensions or size. The removal of p.c. concrete slabs, p.c. concrete sidewalks and driveways, as prescribed above, will be measured by the square foot (square meter: 1 square meter is equal to 10.764 square feet) in original position, regardless of the thickness and existence of reinforcing steel. Portland cement concrete steps removed will be measured per lineal foot (meter: 1 meter is equal to 3.281 feet) of each individual step tread including the bottom step. The removal of p.c. concrete foundations will be measured per each individual foundation. The removal of miscellaneous concrete will be measured per lump sum.

104S.7 - Payment

The work and materials presented herein will generally not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used. When specified in the contract bid form as a separate pay item, the item will be paid for at the contract unit bid price(s) for "Remove P.C. Concrete Curb", "Remove P.C. Concrete Slab", "Remove P.C. Concrete Sidewalks and Driveways", "Remove P.C. Concrete Walls", "Remove P.C. Concrete Steps", "Remove P.C. Concrete Foundations" and "Remove Miscellaneous P.C. Concrete". The bid prices shall include full compensation for all Work herein specified, including the disposal of all material not required in the Work, the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the Work.

Payment will be made under one of the following:

Pay Item No. 104S-A:	Remove P.C. Concrete Curb	Per Lineal foot.
Pay Item No. 104S-B:	Remove P.C. Concrete Slab	Per Square foot.
Pay Item No. 104S-C:	Remove P.C. Concrete Sidewalks and Driveways	Per Square foot
Pay Item No. 104S-D:	Remove P.C. Concrete Wall	Per Lineal foot.
Pay Item No. 104S-E:	Remove P.C. Concrete Steps	Per Lineal foot.
Pay Item No. 104S-F:	Remove P.C. Concrete Foundations	Per Each.

Pay Item No. 104S-G:	Remove Miscellaneous P.C. Concrete	Per Lump Sum.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 104S, "REMOVING CONCRETE"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
00700	General Conditions
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 5.2.0	Permit for Excavation in the Public Right-of-Way
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation

REMOVING PORTLAND CEMENT CONCRETE

Item No. 104S

Item No. 132S	Embankment
Item No. 403	Concrete for Structures
Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS**Specification Item 104S, "REMOVING CONCRETE"****City of Austin Standard Contract Documents**

<u>Designation</u>	<u>Description</u>
01500	Temporary Facilities
01550	Public Safety and Convenience

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

<u>Designation</u>	<u>Description</u>
Article 15-12-166	Permit Required
Article 15-12-173	Conditions for Permit Issuance
Article 15-12-174	Permit Term

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
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Item No. 201S	Subgrade Preparation
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
610S-1	Tree Protection Fence Locations
610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B
621S-1	Diversion
622S-1	Diversion Dike
624S-1	Earth Outlet Sediment Trap
625S-1	Grade Stabilization Structure
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale With Stone Center

REMOVING PORTLAND CEMENT CONCRETE

Item No. 104S

628S	Triangular Sediment Filter Dike
628S-1	Hay Bale Dike
629S-1	Brush Berm
630S-1	Interceptor Dike
631S-1	Interceptor Swale
632S-1	Storm Inlet Sediment Trap
633S-1	Landgrading
634S-1	Level Spreader
635S-1	Perimeter Dike
636S-1	Perimeter Swale
637S-1	Pipe Slope Drain (Flexible)
637S-2	Pipe Slope Drain (Flexible)
638S-1	Pipe Outlet Sediment Trap
639S-1	Rock Berm
641S-1	Stabilized Construction Entrance
642S-1	Silt Fence
643S-1	Stone Outlet Structure
644S-1	Stone Outlet Sediment Trap
Texas Department of Transportation: <u>Standard Specifications for Construction and Maintenance of</u>	

<u>Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 104	Removing Concrete
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 420	Concrete Structures

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ITEM NO. 110S - STREET EXCAVATION 11-18-04**110S.1 - Description**

This item shall govern: (1) the excavation and proper utilization or otherwise satisfactory disposal of all excavated material, of whatever character, within the right of way or other limits of the work indicated and (2) the construction, compaction, shaping and finishing of all earthwork on the entire project in accordance with the specification requirements herein outlined, in conformity with the required lines, grades and typical cross sections indicated on the Drawings or as directed by the Engineer or designated representative. When not otherwise included in the Contract Documents, this item shall include the Work described in specification Item Nos. 101S, "Preparing Right of Way", 102S, "Clearing and Grubbing", 104S, "Removing Portland Cement Concrete", 132S, "Embankment", 201S, "Subgrade Preparation" and 236S, "Proof Rolling".

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

110S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A permit when utility adjustments are made in the right-of-way,
- B. A plan for removal and deposition of all 'Waste' materials, and
- C. A Blasting Permit if blasting is note required. Blasting is not allowed on the project.

110S.3 - Classification

All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

110S.4 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Section 00700, "General Conditions" and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed, that conform to Item No. 610S, "Preservation of Trees and Other Vegetation".

All street excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections. The Contractor will be required to set blue-tops for the subgrade along centerlines, at quarter points and curb lines or edge of pavement at intervals not exceeding 50 feet (15 meters). Suitable excavated materials shall be utilized, insofar as practicable, in constructing any required embankments. The construction of all embankments shall conform to Item No. 132S, "Embankment".

All earth cuts for base and/or pavement structure construction shall be scarified to a uniform depth of at least 6 inches (150 millimeters) below the required finished subgrade elevation for the entire roadbed width. The material shall be mixed, reshaped by blading, sprinkled and then rolled in accordance with Section 2 of the City of Austin Specification Item 132S, "Embankment".

High PI materials (i.e. PI 20 %) which exhibit a Plasticity Index (PI) greater by 5 % than the surrounding materials or any materials with a moisture content greater than 2 percent (%) in excess of optimum moisture shall be classified as unsuitable and must be removed or manipulated to meet the above criteria before use.

Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor. Unsuitable material encountered below the subgrade elevation in roadway cuts, when declared "Waste" by the Engineer, shall be replaced with material from the roadway excavation or with other suitable material as approved by the Engineer or designated representative. It shall become the Contractor's responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

110S.5 - Measurement

All accepted street excavation will be measured by either Method A or B as follows:

A. Method A

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) by the average end areas. Cross sectional areas shall be computed from the existing ground surface to the established line of the subgrade over the limits of the right of way or other work limits shown on the Drawings, including parkway slopes and sidewalk areas.

B. Method B

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards), based upon the average end areas taken from pre-construction cross sections and planned grades. The planned quantities for street excavation will be used as the measurement for payment of this item.

110S.6 - Payment

This item will be paid for at the contract unit bid price for "Street Excavation", as provided under measurement Method A or B as included in the bid. The bid price shall include full compensation for all work herein specified, including subgrade preparation, unless specified otherwise, and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 110S-A:	Street Excavation	Per Cubic yard.
Pay Item No. 110S-B:	Street Excavation, Plan Quantity	Per Cubic yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>
<u>Specification Item 110S, "STREET EXCAVATION"</u>

City of Austin Standard Contract Documents

<u>Designation</u>	<u>Description</u>
00700	General Conditions
01550	Public Safety and Convenience

City of Austin Utilities Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 5.2.0	Permit for Excavation in the Public Right-of-Way

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 236S	Proof Rolling
Item No. 610S	Preservation of Trees and Other Vegetation

RELATED CROSS REFERENCE MATERIALS

<u>Specification Item 110S, "STREET EXCAVATION"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
01500	Temporary Facilities
<u>City of Austin Code of Ordinances, Volume 2</u>	
<u>Designation</u>	<u>Description</u>
Article 14-11-181	Permit Required
Article 14-11-189	Conditions for Permit Issuance
Article 14-11-190	Excavation Sequence and Permit Term
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 203S	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)

Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
610S-1	Tree Protection Fence Locations
610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B
610S-6	Tree Protection, Tree Wells
621S-1	Diversion
622S-1	Diversion Dike
624S-1	Earth Outlet Sediment Trap

625S-1	Grade Stabilization Structure
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale With Stone Center
628S	Triangular Sediment Filter Dike
628S-1	Hay Bale Dike
629S-1	Brush Berm
630S-1	Interceptor Dike
631S-1	Interceptor Swale
632S-1	Storm Inlet Sediment Trap
633S-1	Landgrading
634S-1	Level Spreader
635S-1	Perimeter Dike
636S-1	Perimeter Swale
637S-1	Pipe Slope Drain (Flexible)
637S-2	Pipe Slope Drain (Rigid)
638S-1	Pipe Outlet Sediment Trap
639S-1	Rock Berm
641S-1	Stabilized Construction Entrance
642S-1	Silt Fence
643S-1	Stone Outlet Structure

644S-1	Stone Outlet Sediment Trap
Texas Department of Transportation: <u>Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 260	Lime Treatment for Materials Used as Subgrade (Road Mixed)
Item No. 265	Lime-Fly Ash (LFA) Treatment for Materials Used as Subgrade

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

ITEM NO. 111S - EXCAVATION 9-26-12

111S.1 - Description

This item shall govern: (1) the excavation and proper utilization or satisfactory disposal of all excavated materials, of whatever character, within the limits of the Work and (2) construction, compaction, shaping and finishing of all designated earthwork areas in accordance with the specification requirements outlined herein and in conformity with the required lines, grades and typical cross sections indicated on the Drawings or as directed by the Engineer or designated representative. When not otherwise included in the Contract Documents, this item shall include the work described in Specification Item Nos. 101S, "Preparing Right of Way", No. 102S, "Clearing and Grubbing", No. 104S, "Removing Portland Cement Concrete", No. 132S "Embankment" and No. 201S, "Subgrade Preparation".

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

111S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A permit when utility adjustments are made in the right-of-way,
- B. A plan for removal and deposition of all 'Waste' materials, and
- C. A Blasting Permit if blasting is not required. Blasting is not allowed on the project.

111S.3 - Classification

All excavation shall be unclassified and shall include all materials encountered regardless of their nature or the manner in which they are removed.

111S.4 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures shall be in place. The existing utilities shall be located and shall be protected as specified in the Standard Contracts Document Section 00700, "General Conditions" and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed, that conform to Specification Item No. 610S, "Preservation of Trees and Other Vegetation".

All excavation shall be performed as specified herein and shall conform to the established alignment, grades and cross sections indicated on the Drawings. Suitable excavated materials shall be utilized, insofar as practical, in constructing required embankments. The construction of all embankments shall conform to Specification Item No. 132S, "Embankment". No material shall be stockpiled within the banks of a waterway.

Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor. Unsuitable material encountered below the subgrade elevation in roadway cuts, when declared "Waste" by the Engineer or designated representative, shall be replaced with material from the roadway excavation or with other suitable material as approved by the Engineer. It shall become the Contractor's responsibility to dispose of this material off the limits of the right of way in an environmentally sound manner at a permitted disposal site.

All blasting shall conform to the Provisions of the Standard Contract Document Section 01550, "Public Safety and Convenience". In all cases, a Blasting Permit must be obtained in advance from the City of Austin, Public Works Department.

Adequate dewatering and drainage of excavation shall be maintained throughout the time required to complete the excavation work.

111S.5 - Measurement

All accepted excavation will be measured by either Method A or B as follows:

(1) Method A

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) by the average end area methods. Cross-sectional areas shall be computed from the existing ground surface to the established line of the subgrade, as shown on typical sections in the Drawings, over the limits of the right of way or other work limits, including parkway slopes and sidewalk areas.

(2) Method B

Measurement of the volume of excavation in cubic yards (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) based upon the average end area method taken from pre-construction cross sections and planned grades. The planned quantities for excavation will be used as the measurement for payment for this item.

111S.6 - Payment

This item will be paid for at the contract unit bid price for "Excavation", as provided under measurement Method A or B as included in the bid. The bid price shall include full compensation for all work herein specified including dewatering, drainage, subgrade preparation, unless otherwise indicated, and the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the work.

Payment will be made under one of the following:

Pay Item No. 111S-A:	Excavation	Per Cubic Yard.
Pay Item No. 111S-B:	Excavation, Plan Quantity	Per Cubic Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 111S, "EXCAVATION"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>

00700	General Conditions
01550	Public Safety and Convenience
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 5.2.0	Permit for Excavation in the Public Right-of-Way
<u>City of Austin Technical Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 236S	Proof Rolling
Item No. 610S	Preservation of Trees and Other Vegetation

<u>RELATED CROSS REFERENCE MATERIALS</u>
<u>Specification Item 111S, "EXCAVATION"</u>
<u>City of Austin Standard Contract Documents</u>

<u>Designation</u>	<u>Description</u>
01500	Temporary Facilities
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 120S	Channel Excavation
Item No. 203	Lime Treatment for Materials In Place
Item No. 204S	Portland Cement Treatment for Materials In Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 610S-1	Tree Protection Fence Locations
No. 610S-2	Tree Protection Fence, Type B Chainlink

No. 610S-3	Tree Protection Fence, Type B Wood
No. 610S-4	Tree Protection Fence, Modified Type A
No. 610S-5	Tree Protection Fence, Modified Type B
No. 621S-1	Diversion
No. 622S-1	Diversion Dike
No. 624S-1	Earth Outlet Sediment Trap
No. 625S-1	Grade Stabilization Structure
No. 627S-1	Grass Lined Swale
No. 627S-2	Grass Lined Swale With Stone Center
No. 628S	Triangular Sediment Filter Dike
No. 628S-1	Hay Bale Dike
No. 629S-1	Brush Berm
No. 630S-1	Interceptor Dike
No. 631S-1	Interceptor Swale
No. 632S-1	Storm Inlet Sediment Trap
No. 633S-1	Landgrading
No. 634S-1	Level Spreader
No. 635S-1	Perimeter Dike
No. 636S-1	Perimeter Swale
No. 637S-1	Pipe Slope Drain (Flexible)

No. 637S-2	Pipe Slope Drain (Flexible)
No. 638S-1	Pipe Outlet Sediment Trap
No. 639S-1	Rock Berm
No. 641S-1	Stabilized Construction Entrance
No. 642S-1	Silt Fence
No. 643S-1	Stone Outlet Structure
No. 644S-1	Stone Outlet Sediment Trap
<u>The Code of the City of Austin, Code of Ordinances, Volume 1</u>	
<u>Designation</u>	<u>Description</u>
Article 15-12-166	Permit Required
Article 15-12-173	Conditions for Permit Issuance
Article 15-12-174	Permit Term
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening

Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 260	Lime Treatment for Materials Used as Subgrade (Road Mixed)
Item No. 265	Lime-Fly Ash (LFA) Treatment for Materials Used as Subgrade
Texas Department of Transportation: <u>Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

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ITEM NO. 130S - BORROW 9-26-12

130S.1 - Description

This item shall govern required excavation, removal and proper utilization of materials secured from sources, selected by the Contractor and approved by the Engineer or designated representative. The compaction of embankments constructed from borrow as provided herein shall conform to the appropriate sections of Specification Item Nos. 132S, "Embankment" and 236S, "Proof Rolling".

Borrow will be used only when indicated on the Drawings or directed by the Engineer or designated representative and shall only be acquired from approved sources.

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

130S.2 - Submittals

The submittal requirements of this specification item may include:

- A. Identification of Class, source and characteristics (P.I., linear shrinkage, etc.) of proposed borrow material, and
- B. A plan for managing and maintaining borrow sites.

130S.3 - Materials

All authorized borrow shall conform to one of the following classes:

Class A (Select Borrow)

Class A Borrow material shall consist of suitable granular material, free from vegetation or other objectionable matter and reasonably free from lumps of earth. When tested by standard TxDOT laboratory methods Tex-105-E, Tex-106-E and Tex-107-E, the Class A Select Borrow, shall meet the following requirements:

The Liquid Limit shall not exceed	45
The Plasticity Index shall not exceed	15
The bar linear shrinkage shall not be less than	2

Class B (Borrow)

Class B Borrow material shall consist of suitable non swelling [i.e. soils with a plasticity index (P.I.) less than 20] earth material such as loam, clay or other such materials that will form a stable embankment.

Class C (Topsoil) See Standard Specification Item No. 601S.3(A)

Class C Borrow material shall consist of approved soils, which shall be clean, friable and capable of supporting plant life. This material shall also be free of stones and all other debris.

130S.4 - Construction Methods

Prior to commencing this work, all required erosion control and environmental measures shall be in place. All suitable materials removed from excavations shall be used, insofar as practicable in the formation of embankments conforming to Specification Item No. 132S, "Embankment", as otherwise indicated on the Drawings or as directed by the Engineer or designated representative. The completed work shall conform to the established alignment, grades and cross section as shown on the Drawings. The additional material necessary to complete the work described above shall be "Borrow" of the class specified.

The Contractor shall arrange for borrow from one of the following sources:

1. Existing borrow pit,
2. New borrow pit, or
3. Surplus excavated material from a site, with a site development permit.

The Contractor shall notify the Engineer 3 weeks prior to opening a pit or any other borrow source to allow necessary testing for approval of materials. All borrow sites shall comply with the requirements of the site development permit.

During construction, borrow sources shall be kept drained to permit final cross sections to be measured, when required.

Borrow sites shall be managed and maintained to minimize the impact of the appearance of the natural topographic features and at no time create a potential hazard to the public.

130S.5 - Measurement

Borrow will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.196 cubic yards) in its final position based upon the average end areas, calculated from pre-construction cross sections and plan grades. The plan quantities for Borrow or Topsoil will be used as the measurement for payment for this item.

130S.6 - Payment

All work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering on the road; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work.

Payment will be made under one of the following:

Pay Item No. 130S-A:	Class A (Select Borrow), Plan Quantity	Per Cubic Yard.
Pay Item No. 130S-B:	Class B (Borrow), Plan Quantity	Per Cubic Yard.
Pay Item No. 130S-T:	Class C (Topsoil), Plan Quantity	Per Cubic Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 130S, "BORROW"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 132S	Embankment
Item No. 236S	Rolling (Proof)
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-107-E	Determination of Bar Linear Shrinkage of Soils

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 130S, "BORROW"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
00700	General Conditions
<u>City of Austin Standard Specifications</u>	

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 610S-1	Tree Protection Fence Locations
No. 610S-2	Tree Protection Fence, Type B Chainlink
No. 610S-3	Tree Protection Fence, Type B Wood

No. 610S-4	Tree Protection Fence, Modified Type A
No. 610S-5	Tree Protection Fence, Modified Type B
No. 621-1	Diversion
No. 622-1	Diversion Dike
No. 624-1	Earth Outlet Sediment Trap
No. 625-1	Grade Stabilization Structure
No. 626-1	Grass Lined Swale
No. 627-1	Grass Lined Swale With Stone Center
No. 628S	Triangular Sediment Filter Dike
No. 628S-1	Hay Bale Dike
No. 629S-1	Brush Berm
No. 630S-1	Interceptor Dike
No. 631S-1	Interceptor Swale
No. 632S-1	Storm Inlet Sediment Trap
No. 633S-1	Landgrading
No. 634S-1	Level Spreader
No. 635S-1	Perimeter Dike
No. 636S-1	Perimeter Swale
No. 637S-1	Pipe Slope Drain (Flexible)
No. 637S-2	Pipe Slope Drain (Flexible)

No. 638S-1	Pipe Outlet Sediment Trap
No. 639S-1	Rock Berm
No. 641S-1	Stabilized Construction Entrance
No. 642S-1	Silt Fence
No. 643S-1	Stone Outlet Structure
No. 644S-1	Stone Outlet Sediment Trap
Texas Department of Transportation: <u>Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Texas Department of Transportation: <u>Manual of Testing Procedures</u>	

<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

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ITEM NO. 132S - EMBANKMENT 8-20-07

132S.1 - Description

This item shall govern the placement and compaction of suitable materials obtained from approved sources for utilization in the construction of street or channel embankments, berms, levees, dikes and structures. When not otherwise included in the Contract Documents or indicated on the Drawings, this item shall include the work described in Specification Item Nos. 101S, "Preparing Right of Way", 102S, "Clearing and Grubbing", 104S, "Removing Portland Cement Concrete", 201S, "Subgrade Preparation" and No. 236S, "Proof Rolling".

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

132S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A plan identifying source, material type, classification and characteristics (P.I., optimum moisture-density, etc.) of the proposed embankment material,
- B. Type and size of equipment proposed to produce the required compaction, and
- C. Compaction (Density-moisture, etc) test results for in-place embankment layers.

132S.3 - Construction Methods

A. General

Prior to the placement of any embankment, all tree protection and tree wells and erosion control devices shall be in place and all operations involving Standard Specification Item No. 101S, "Preparing Right of Way" and/or Standard Specification Item No. 102S, "Clearing and Grubbing" shall have been completed for the areas over which the embankment is to be placed. Stump holes or other small excavations encountered within the limits of the embankments shall be backfilled with suitable material and thoroughly tamped by approved methods before commencement of the embankment construction.

The area of embankment placement shall be proof rolled (Specification Item No. 236S, "Proof Rolling") and any unstable or spongy areas shall be undercut and backfilled with suitable material or otherwise mechanically manipulated and compacted by approved methods. Where shown on the Drawings or required by the Engineer or designated representative, the ground surface thus prepared shall be compacted by sprinkling and rolling. The surface of the ground, including those plowed and loosened or roughened by small washes, shall be restored to approximately its original slope and the ground surface thus prepared shall be compacted by sprinkling and rolling.

Construction equipment shall not be operated within the drip line of trees, unless otherwise indicated. Construction materials shall not be stockpiled under the canopies of trees. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed in accordance with Item No. 610S, "Preservation of Trees and Other Vegetation".

Unless otherwise indicated on the Drawings and with the exception of rock, the surface of the ground of all unpaved areas, which are to receive embankment, shall be loosened by scarifying or plowing to a depth of not less than 4 inches (100 mm). The loosened material shall be re-compacted with the new embankment as hereinafter specified.

The surface of hillsides, which are to receive embankment, shall be loosened, by scarifying or plowing, to a depth of not less than 4 inches (100 mm) and benches constructed before the

embankment materials are placed. The embankment shall then be placed in layers, as hereinafter specified, beginning at the low side with partial width layers and increasing the widths of the layers as the embankment is raised. The material, which has been loosened during preparation of the original ground surface, shall be re-compacted simultaneously with the embankment material placed at the same elevation.

Where embankments are to be placed adjacent to or over existing roadbeds, the roadbed slopes shall be plowed or scarified to a depth of not less than 6 inches (150 mm) and the embankment along the roadbed slopes shall be built up in successive layers, as hereinafter specified, to the elevation of the old roadbed. Then, if specified, the top surface of the old roadbed shall be scarified to a minimum depth of 6 inches (150 mm) and re-compacted along with the next layer of the new embankment. The total depth of the scarified and added material shall not exceed the permissible layer depth, specified hereinafter.

Trees, stumps, roots, vegetation or other unsuitable materials shall not be placed in embankment.

All embankment shall be constructed in layers approximately parallel to the finished grade and unless otherwise indicated, each layer shall be so constructed as to provide a uniform slope of 1/4 inch per foot (20 mm per meter) from the centerline of the roadbed to the outside. In the case of superelevated curves, each layer shall be constructed to conform to the specified superelevation or cross slope.

The embankment shall be continuously maintained at its finished section and grade until that portion of the work is accepted. After completion of the embankment to the finished section and grade, the Contractor shall proof roll the subgrade or finished grade in accordance with Specification Item No. 236S, "Proof Rolling". Any unstable or spongy areas shall be undercut and backfilled with suitable material or otherwise mechanically manipulated and compacted by approved methods. After acceptance of the embankment, re-vegetation activities shall commence immediately to minimize the soil loss and air pollution.

B. Earth Embankments

Earth embankments shall be defined as embankments composed of soil material other than rock and shall be constructed of acceptable material from approved sources.

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.

Minor quantities of rocks with a maximum dimension of 4 inches (100 mm) may be incorporated in the earth embankment layers, provided that the rock is not placed immediately adjacent to structures.

Each layer of embankment shall be uniform as to material type and classification, density and moisture content before beginning compaction. Where layers of unlike materials abut each other, each layer shall be feathered on a slope of 1:20 or the materials shall be so mixed as to prevent abrupt changes in the soil. Any material placed in the embankment by dumping in a pile or windrows shall not be incorporated in a layer in that position. All such piles or windrows shall be incorporated in an embankment layer by blading and mixing or by similar methods. Clods or lumps of material shall be broken down into smaller sizes and the embankment material in a layer shall be mixed by blading, harrowing, discing or similar methods to insure that a uniform material of uniform density is secured in each layer.

The water required in sprinkling the layers, to obtain the moisture content necessary for optimum compaction, shall be evenly applied. It shall be the responsibility of the Contractor to secure uniform moisture content throughout the layer by such methods as may be necessary.

All earth cuts, whether full width or partial width side hill cuts and which are not required to be excavated below the subgrade elevation, shall be scarified to a uniform depth of at least 6 inches (150 mm) below grade. The material shall be mixed and reshaped by blading, sprinkled and rolled in accordance with the requirements outlined above for earth embankments to the same density required for the adjacent embankment.

Compaction of embankments shall conform to Item No. 201S, "Subgrade Preparation". 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.

It is the intent of this specification to provide the required density and moisture control for each layer of earth embankment and select material based on the plasticity characteristics of the embankment soil. Each layer shall be sprinkled as required and compacted to the extent necessary to provide the density specified below, unless otherwise indicated.

Description	Density, Percent	Moisture
Non-swelling Soils (PI less than 20)	Not less than 95	
Swelling Soils (PI between 20 and 35)	Not less than 95 nor more than 102	Not less than optimum
Swelling Soils (P.I. greater than 35)	Not less than 95 nor more than 100	Not less than optimum

The Plasticity Index (PI) will be established in accordance with TxDOT Test Methods Tex-104-E, Tex-105-E and Tex-106-E and the density determination will be made in accordance with TxDOT Test Method Tex-114-E, "Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade and Embankment Soil". Field density measurements will be made in accordance with TxDOT Test Method Tex-115-E, "Field Method for Determination of In-Place Density of Soils and Base Materials".

After each layer of earth embankment or select material is complete, tests, as necessary, will be conducted as directed by the Engineer or designated representative. If the material fails to meet the density specified, the course shall be reworked as necessary to obtain the specified compaction.

C. Rock Embankments

Rock embankments shall be defined as those composed principally of rock and shall be constructed of accepted material from approved sources. Rock embankments shall not be placed immediately adjacent to structures.

Except as otherwise indicated on the Drawings, 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. When, in the opinion of the Engineer or designated representative, the rock sizes necessitate a greater thickness of layer than specified, the layer thickness may be increased as necessary, but in no case shall the thickness of layer exceed 2½ feet (750 mm). Each layer shall be constructed by starting at one end and dumping the rock on top of the layer being constructed then pushing the material ahead with a bulldozer in such a manner that the larger rock will be placed on either the ground or the preceding embankment layer. Each layer shall be constructed in such a manner that

the interstices between the larger stones are filled with small stones and spalls which have been created by this operation and from the placement of succeeding layers of material.

The maximum dimension of any rock used in embankment shall be less than the thickness of the embankment layer and in no case shall any rock over 2 feet (600 mm) in its greatest dimension be placed in the embankment, unless otherwise approved by the Engineer or designated representative. All oversized rocks, which are otherwise suitable for construction, shall be broken to the required dimension and utilized in embankment construction where indicated. When preferred by the Contractor and acceptable to the Engineer or designated representative, oversized rocks may be placed at other locations where the embankment layer is of greater depth, thus requiring less breakage.

Each layer shall be compacted to the required density as outlined for "Earth Embankments", above, except in those layers where rock will make density testing difficult, the Engineer or designated representative may accept the layer by visual inspection or proof rolling conforming to Specification Item No. 236S, "Proof Rolling".

Unless otherwise indicated, the upper 3 feet (1 meter) of the embankment shall not contain stones larger than 4 inches (100 mm) in their greatest dimension and shall be composed of material so graded that the density and uniformity of the surface layer may be secured in accordance with TxDOT Test Method Tex-114-E.

Exposed oversize material shall be broken up or removed.

D. At Culverts and Bridges

Embankment materials, which are to be placed adjacent to culverts and bridges and cannot be compacted by the blading and rolling equipment that was used in compacting the adjoining sections of embankment, shall be compacted in the manner prescribed under Item No. 401, "Structural Excavation and Backfill".

Embankment constructed around 'spill through' type abutments shall be constructed in 6 inch (150 mm) loose layers of a uniform suitable material and shall be placed so as to maintain approximately the same elevation on each side of the abutment. All materials shall be mixed, wetted and compacted as specified above. Embankment material placed adjacent to any portion of a structure or above the top of any culvert or similar structure shall be free of any appreciable amount of gravel or stone particles and shall be thoroughly compacted by mechanical compaction equipment.

132S.4 - Measurement

All accepted embankment, when included in the contract as a separate pay item, will be measured in place and the volume computed in cubic yards (cubic meters: 1 cubic meter is equal to 1.196 cubic yards) by the method of average end areas. No allowance shall be made for shrinkage.

132S.5 - Payment

The work and materials presented herein will generally not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used. However, when specified in the contract bid form as a separate pay item, it shall be paid for at the contract unit bid price for "Embankment". The bid price shall include full compensation for all work herein specified, including the furnishing of all materials, (except "Borrow" when paid as a separate bid item) compaction, equipment, tools, labor, water for sprinkling, proof rolling and incidentals necessary to complete the work.

Payment, when included in the contract as a separate pay item, will be made under:

Pay Item No. 132S-A:	Embankment	Per Cubic Yard.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 132S, "EMBANKMENT"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 201S	Subgrade Preparation
Item No. 236S	Proof Rolling
Item No. 401	Structural Excavation and Backfill

Item No. 610S	Preservation of Trees and Other Vegetation
Texas Department of Transportation: <u>Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
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-107-E	Determination of Bar Linear Shrinkage of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 132S, "EMBANKMENT"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
00700	General Conditions
<u>City of Austin Standard Specifications</u>	

<u>Designation</u>	<u>Description</u>
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 610S-1	Tree Protection Fence Locations
No. 610S-2	Tree Protection Fence, Type B Chainlink
No. 610S-3	Tree Protection Fence, Type B Wood
No. 610S-4	Tree Protection Fence, Modified Type A
No. 610S-5	Tree Protection Fence, Modified Type B
No. 621S-1	Diversion
No. 622S-1	Diversion Dike
No. 624S-1	Earth Outlet Sediment Trap

No. 625S-1	Grade Stabilization Structure
No. 627S-1	Grass Lined Swale
No. 627S-2	Grass Lined Swale With Stone Center
No. 628S	Triangular Sediment Filter Dike
No. 628S-1	Hay Bale Dike
No. 629S-1	Brush Berm
No. 630S-1	Interceptor Dike
No. 631S-1	Interceptor Swale
No. 632S-1	Storm Inlet Sediment Trap
No. 633S-1	Landgrading
No. 634S-1	Level Spreader
No. 635S-1	Perimeter Dike
No. 636S-1	Perimeter Swale
No. 637S-1	Pipe Slope Drain (Flexible)
No. 637S-2	Pipe Slope Drain (Flexible)
No. 638S-1	Pipe Outlet Sediment Trap
No. 639S-1	Rock Berm
No. 641S-1	Stabilized Construction Entrance
No. 642S-1	Silt Fence
No. 643S-1	Stone Outlet Structure

No. 644S-1	Stone Outlet Sediment Trap
Texas Department of Transportation: <u>Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Texas Department of Transportation: <u>Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Texas Department of Transportation: <u>Manual of Testing</u>	

<u>Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-107-E	Determination of Bar Linear Shrinkage of Soils

ITEM NO. 201S - SUBGRADE PREPARATION 8-20-07**201S.1 - Description**

This item shall govern scarifying; blading and rolling the subgrade to obtain a uniform texture and provide as nearly as practicable a uniform density for the top 6 inches (150 mm) of the subgrade.

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

201S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A plan identifying classification and characteristics (P.I., optimum moisture-density, etc.) of insitu subgrade soils, as well as the source, classification and characteristics of any proposed borrow material,
- B. Type and size of equipment proposed to produce the required compaction, and
- C. Compaction (moisture-density, etc) test results for in-situ subgrade soils and/or borrow materials.

201S.3 - Construction Methods

Prior to initiation of subgrade preparation activities, all operations involving Standard Specification Item No. 101S, "Preparing Right of Way" and/or Standard Specification Item No. 102S, "Clearing and Grubbing" shall be completed. The surface of the subgrade shall be scarified and shaped in conformity with the typical sections and the lines and grades indicated on the Drawings; by the removal of existing material or addition of approved material as established by the Engineer or designated representative. Any deviation in the subgrade cross section which exceeds ½ inch in a length of 10 feet (12 mm in a length of 3 meters), measured longitudinally, shall be corrected by loosening, adding or removing material, and then reshaping and compacting by sprinkling and rolling.

All unsuitable material shall be removed and replaced with approved material. All foundations, walls or other objectionable material shall be removed in accordance with Standard Specification Item No. 104S, "Removing Portland Cement Concrete" to a minimum depth of 18 inches (450 mm) under all structures and 12 inches (300 mm) under areas to be vegetated. All holes, ruts and depressions shall be filled with approved material and compacted by approved methods.

The subgrade shall be prepared sufficiently in advance to insure satisfactory prosecution of the Work. The Contractor will be required to set blue tops for the subgrade on the centerline, at the quarter points and along the curb lines or edge of pavement at maximum intervals of 50 feet (15 meters). The subgrade shall be tested by proof rolling in conformity with Standard Specification Item No. 236S, "Proof Rolling" prior to placement of the first course of base material. Any unstable or spongy subgrade areas identified by proof rolling shall be corrected either by additional re-working, drying and compaction, or by removal and replacement of unsuitable materials. When specifically directed by the Engineer or designated representative, the Contractor shall re-work the subgrade* as follows:

- A. Remove the unstable subgrade to the full depth of the unstable insitu material or to a minimum depth of 6 inches (150 mm), whichever is greater;
- B. Spread the material over a sufficient area to allow reworking of the excavated material;
- C. Disc, scarify or otherwise breakup the excavated material and allow to dry (Note: If approved by the Engineer or designated representative, the addition of lime or other additive may be used to aid in the drying process or to stabilize the unstable material);

- D. Fill the excavated area with the re-worked material and compact to specified densities; and
- E. Proof roll the re-worked area.

* The Rework process will not be allowed for unstable organic subgrade soils. These type soils will be permanently removed and replaced with materials approved by the Engineer or designated representative.

All suitable material removed in accordance with Standard Specification Item No. 111S, "Excavation", may be utilized in the subgrade with the approval of the Engineer or designated representative. All other material required for completion of the Subgrade, including those defined in accordance with Specification Item No. 130S, "Borrow", shall also be subject to approval by the Engineer or designated representative.

It is the intent of this specification to provide the required density and moisture control for the subgrade based on the plasticity characteristics of the approved materials. The subgrade materials shall be sprinkled as required and compacted to the extent necessary to provide the density specified below, unless otherwise indicated on the Drawings. The Plasticity Index (P.I.) will be established in accordance with TxDOT Test Methods Tex-104-E, Tex-105-E and Tex-106-E. The density determination will be made in accordance with TxDOT Test Method Tex-114-E and field density measurements will be made in accordance with TxDOT Test Method Tex-115-E.

Description	Density, Percent	Moisture
Non-swelling Soils (P.I. less than 20)	Not less than 95	
Swelling Soils (P.I. between 20 and 35)	Not less than 95 nor more than 102	Not less than optimum
Swelling Soils (P.I. greater than 35)	Not less than 95 nor more than 100	Not less than optimum

Subgrade materials on which planting or turf will be established shall be compacted to a minimum of 85 percent of the density as determined in accordance with TxDOT Test Method Tex-114-E. Field tests for density in accordance with TxDOT Test Method Tex-115-E will be made as soon as possible after compaction operations are completed. If the material fails to meet the density specified, it shall be reworked as necessary to obtain the density required.

Prior to placement of any base materials, the in-place density and moisture content of the top 6 inches (150 mm) of compacted subgrade shall be checked. If the tests indicate that the relative density and moisture do not meet the limits specified in the table above, the subgrade shall be reworked as necessary to obtain the specified compaction and moisture content. All initial testing will be paid for by the City of Austin. All retesting shall be paid for by the Contractor.

201S.4 - Measurement

All acceptable subgrade preparation when included in the contract as a separate pay item, will be measured by the square yard (square meter: 1 square meter equals 1.196 Square yards). The measured area includes the entire width of the roadway for the entire length as indicated on the Drawings.

201S.5 - Payment

The work and materials presented herein will generally not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used when specified as a separate pay item in the contract bid form, subgrade preparation shall be measured as specified above and paid for at the contract unit bid price for "Subgrade Preparation". The bid price shall include full compensation for all work herein specified, including the furnishing of all materials, equipment, tools and labor and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 201S:	Subgrade Preparation	Per Square Yard.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 201S, "SUBGRADE PREPARATION"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No.	Proof Rolling

236S	
Texas Department of Transportation: <u>Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 201S, "SUBGRADE PREPARATION"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No.132S	Embankment
Texas Department of Transportation: <u>Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>

Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Texas Department of Transportation: <u>Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials

ITEM NO. 210S - FLEXIBLE BASE 2-24-10

210S.1 - Description

This item governs furnishing and placing a crushed stone base course for surfacing, pavement, or other base courses. "Flexible Base" shall be constructed on an approved, prepared surface in one or more courses conforming to the typical sections and to the lines and grades, indicated on the Drawings or established by the Engineer or designated representative.

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

210S.2 - Submittals

The submittal requirements of this specification item may include:

- A. Source, gradation and test results for the crushed limestone material,
- B. Notification that the crushed limestone stockpile is completed and ready for testing, and
- C. Field density test results for in-place compacted flexible base.

210S.3 - Material

A. Mineral Aggregate

The material shall be crushed argillaceous limestone meeting the requirements specified herein. The material shall be from sources approved by the City and shall consist of durable crushed stone that has been screened to the required gradation.

Flexible base materials shall be tested according to the following TxDOT standard test methods:

a) Preparation for Soil Constants and Sieve Analysis	Tex-101-E
b) Liquid Limit	Tex-104-E
c) Plastic Limit	Tex-105-E
d) Plasticity Index	Tex-106-E
e) Sieve Analysis	Tex-110-E
f) Wet Ball Mill	Tex-116-E
g) Triaxial Test	Tex-117-E, Part II

1. Plasticity Index shall be determined in accordance with Tex-107-E (Linear Shrinkage) when liquid limit is unattainable as defined in Tex-104-E.
2. When a soundness value is required on the drawings, the material shall be tested in accordance with Tex-411-A.

Base material shall be stockpiled after crushing, then tested by the City's designated laboratory and approved by the Engineer or designated representative prior to being hauled to the Project.

The material shall be well graded and shall meet the following requirements:

Sieve Designation		Other Requirements	% Retained	
US	SI			
1 3/4"	45 mm		0	
7/8 "	22.4 mm		10—35	
3/8 '	9.5 mm		30—50	
#4	4.75 mm		45—65	
#40	425 µm		70—85	
		Maximum Plasticity Index		10
		Maximum Wet Ball Mill		42
Maximum Increase in passing #40 (425 µm) sieve from Wet Ball Mill Test			20	

Minimum compressive strength when subjected to the triaxial test shall be 35 psi at 0 psi lateral pressure [240 kiloPascal (kPa) at 0 kPa lateral pressure] and 175 psi at 15 psi lateral pressure [1200 kiloPascal (kPa) at 100 kPa lateral pressure].

B. Asphaltic Material

Prime Coat. Prime Coat shall conform to the requirements of Standard Specification Item 306S, "Prime Coat", except for measurement and payment.

210S.4 - Stockpiling, Storage and Management

A. Managing Material:

The stockpile shall be constructed on a relatively smooth area that has been cleared of debris, weeds, brush, trees and grass. Stockpiles shall contain between 25,000 and 50,000 cubic yards (19,100 to 38,200 cubic meters). The stockpile shall be constructed using scrapers, bottom dumps or

other similar equipment that allows dumping and spreading without rehandling. The stockpile shall be constructed to allow dumping and spreading in one direction only. The height of the stockpile shall not exceed the capabilities of available equipment to make a full cut (bottom to top) on any of the four sides.

A stockpile shall be completed before being tested by the City. The Contractor's supplier shall notify the City when a stockpile has been completed and is ready to be tested. The stockpile shall not be added to after it has been tested.

The Contractor shall provide material only from stockpiles that have been inspected, tested and accepted by the City. A ticket showing the date, source, stockpile number, and net weight (mass) shall be provided to the Inspector with each load of material delivered to the Project.

Material shall be loaded from the stockpile by making successive vertical cuts through its entire depth.

B. Test Sampling:

The Contractor's supplier may choose the method of sample gathering for testing by the City's laboratory as follows:

1. The supplier shall make a full-height cut a sufficient distance into each side of the stockpile to obtain a uniform sample. The four samples (one from each side of the stockpile) shall then be combined and mixed into a single "test" specimen from which the City's laboratory can obtain a sample.
2. As the stockpile is constructed, a perpendicular cut will be made across the spreading direction at every two feet to four feet (0.6 to 1.2 meters) of height and the sample used to start a "mini" stockpile. The process shall be repeated in two feet to four feet (0.6 to 1.2 meter) increments of height, until the stockpile and the "mini" stockpile are completed. Samples shall be obtained from the "mini" stockpile in the same manner described in (1) above.

C. Testing and Acceptance:

When initial tests indicate that the material is unacceptable, the City may, if requested by the Contractor's supplier, sample and test the material one more time. The additional sampling and testing shall be paid for by the supplier.

210S.5 - Construction Methods

A. Preparation of Subgrade:

Flexible base shall not be placed until the Contractor has verified by proof rolling that the subgrade has been prepared and compacted in conformity with Standard Specification Item 201S, "Subgrade Preparation," to the typical sections, lines and grades indicated on the Drawings. Any deviation shall be corrected and proof rolled prior to placement of the flexible base material.

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

B. First Lift:

Immediately before placing the flexible base material, the subgrade shall be checked for conformity with grade and section. The thickness of each lift of flexible base shall be equal increments of the total base depth. No single lift shall be more than six inches (150 mm) or less than three inches (75 mm) compacted thickness.

The material shall be delivered in approved vehicles. It shall be the responsibility of the Contractor to deliver the required amount of material. If it becomes evident that insufficient material was placed, additional material as necessary shall be delivered and the entire course scarified, mixed and compacted.

Material deposited upon the subgrade shall be spread and shaped the same day unless otherwise approved by the Engineer or designated representative. In the event inclement weather or other unforeseen circumstances render spreading of the material impractical, the material shall be spread as soon as conditions allow.

Additionally, if the material cannot be spread and worked the same day it is deposited, the Contractor shall "close up" the dump piles before leaving the job site. "Closed up" shall be defined as the use of a motor grader to blade all dump piles together, leaving no open space between piles.

The material shall be spread, sprinkled, if required, then thoroughly mixed; bladed, dragged and shaped to conform to the typical sections indicated on the Drawings.

All areas and "nests" of segregated coarse or fine material shall be corrected or removed and replaced with well-graded material.

Each lift shall be sprinkled as required to bring the material to optimum moisture content, then compacted to the extent necessary to provide not less than the percent density specified in Section 210S.5.D, "Density." In addition to the requirements specified for density, the full depth of flexible base material shall be compacted to the extent necessary to remain firm and stable under construction equipment. After each section of flexible base material is completed, tests, as necessary, will be made by the Engineer or designated representative. As a minimum, three in-place density tests per section per day will be taken. If the material fails to meet the density requirements, it shall be reworked as necessary to meet these requirements. All initial testing will be paid for by the City. All retesting shall be paid for by the Contractor.

Throughout the entire operation, the surface of the material shall be maintained by blading and, upon completion, shall be smooth and shall conform to the typical section indicated on the Drawings and to the established lines and grades.

In that area on which pavement is to be placed, any deviation in excess of 1/4 inch (6.5 mm) in cross section or 1/4 inch in a length of 16 feet (6.5 mm in a length of 5 meters) measured longitudinally shall be corrected by loosening, adding or removing material, and by reshaping and recompacting. All irregularities, depressions or weak spots shall be corrected immediately by scarifying the areas affected, adding suitable material as required, and by reshaping and recompacting. Should the lift, due to any reason or cause, lose the required stability, density and/or finish before the surfacing is complete, it shall be recompacted and refinished at the Contractor's expense.

C. Succeeding Lifts:

Construction methods for succeeding lifts shall be the same as prescribed for the first lift. For that lift of the flexible base upon which the curb and gutter will be constructed, as well as the last flexible base lift (i.e. top of the flexible base), the Contractor shall check the surface of the lift for conformity to the lines and grades by setting "blue tops" at intervals not exceeding 50 feet (15 meters) on the centerline, at quarterpoints, at curb lines or edge of pavement, and at other points that may be indicated on the Drawings.

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

D. Density:

The flexible base shall be compacted to not less than 100 percent density as determined by TxDoT Test Method Tex-113-E.

Field density determination shall be made in accordance with TxDoT Test Method Tex-115-E unless otherwise approved by the Engineer or designated representative. Each lift of the flexible base shall also be tested by proof rolling in conformity with Standard Specification Item 236S "Proof Rolling."

E. Priming:

After the flexible base material has been compacted to not less than 100 percent density, and tested by proof rolling, a prime coat will be applied in accordance with Standard Specification Item 306S, "Prime Coat."

F. Curing:

Pavement materials, such as a tack coat or surface course, shall not be placed on the primed surface until the prime coat has been absorbed into the base course. At least 24 hours, or longer if designated by the Engineer or designated representative, shall be allowed when cutback asphalt is used as the prime coat.

210S.6 - Measurement

"Flexible Base" will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.196 cubic yards), complete in place, as indicated in the Contract Documents.

210S.7 - Payment

This item will be paid for at the contract unit bid price for "Flexible Base". The unit bid price shall include full compensation for all work specified herein, including the furnishing, hauling, placing and compacting of all materials; for rolling, proof rolling, recompact and refinishing; for all water required; for retesting as necessary; for priming; and for all equipment, tools, labor and incidentals necessary to complete the Work.

Prime coat will not be measured nor paid for directly but shall be included in the unit price bid for Standard Specification Item 210S, "Flexible Base."

Payment will be made under one of the following:

Pay Item No. 210S-A:	Flexible Base	Per Cubic Yard.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 210S, "Flexible Base"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>

Item No. 201S	Subgrade Preparation
Item No. 236S	Proof Rolling
Item No. 306S	Prime Coat
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Tex-101-E	Preparation of Soil and Flexible Base Materials for Testing
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-107-A	Determination of Bar Linear Shrinkage of Soils
Tex-110-E	Determination of Particle Size Analysis of Soils
Tex-113-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials and Cohesionless Sands
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials
Tex-116-E	Ball Mill Method for Determination of the Disintegration of Flexible Base Material
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-411-A	Soundness of Aggregate By Use of Sodium Sulfate or Magnesium Sulfate

RELATED CROSS REFERENCE MATERIALSSpecification 210S, "Flexible Base"City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
No. 1000S-2	Flexible Base with Asphalt Surface Trench Repair-Existing Pavement
No. 510S-3	Typical Trench with Paved Surface
No. 1000S	Bus Stop Paving
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections-(4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections

City of Austin Utility Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 5.8.2	Flexible Base
Section 5.7.3	Flexible Base with Asphalt Surface
Section 5.9.1	Excavation in Alley

<u>City of Austin Transportation Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 3.2.0	General Criteria
Section 3.4.3.D	Layer Data-Minimum Thickness
Table 3-1	Minimum Layer Thickness
Section 3.4.3.F	Layer Data- Minimum Thickness
Table 3-2	Layer Thickness Increment
Section 3.4.3.J	Layer Data-Stiffness Coefficient
Table 3-3	Stiffness Coefficient
Table 3-9	Recommended Salvage values
Table 3-10	AASHTO Layer Coefficients

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ITEM NO. 220S - SPRINKLING FOR DUST CONTROL 2-24-10**220S.1 - Description**

This item shall govern the authorized application of water for dust control on specified streets, detours, haul routes or construction sites, as shown on the Drawings or directed by the Engineer or designated representative, for the purpose of maintaining these areas relatively free of dust.

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

220S.2 - Submittals

The submittal requirements of this specification item include

- A. The manufacturer, model and description of the proposed dust control equipment,
- B. The sprinkling plan including application rate, pattern of sprinkling and scheduled times of application.

220S.3 - Materials

Water shall be furnished by the Contractor and shall be clean and free from industrial wastes and other objectionable matter.

220S.4 - Construction Methods

Dust control shall only be conducted when directed by the Engineer or designated representative. The Contractor shall furnish and operate an approved sprinkler, equipped with positive and rapidly working cut-off valves and approved spray bars to insure the distribution of water in a uniform and controllable rate of application over the entire width sprinkled. The Contractor shall apply the water in the quantity specified on the Drawings or as directed by the Engineer or designated representative.

It shall be the Contractor's continuous responsibility at all times, including nights, holidays and weekends until acceptance of the project by the City, to maintain the specified areas relatively free of dust in a manner that will cause the least inconvenience to the public.

220S.5 - Measurement

Sprinkling for dust control will be included in the unit price bid for other items of the contract unless included as a separate pay item in the contract. When included for payment in the contract as a separate contract pay item, it will be measured in units of 1,000 gallons (3.785 kiloliters) actually placed as authorized by the Engineer or designated representative.

220S.6 - Payment

When this item is specified on the Drawings as a separate pay item, the water furnished and the work performed as prescribed by this item and measured as provided under Section 220S.5, "Measurement" will be paid for in accordance with the contract unit bid price for 'Sprinkling for Dust Control'. The unit bid price shall include total compensation for all labor, materials, tools, machinery, equipment and incidentals necessary to complete the work as indicated on the Drawings.

Payment, when specified in the contract, will be made under the following:

Pay Item No. 220S-A:	Sprinkling for Dust Control (Water) -	Per 1000 gallon Unit.
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End

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 220S, "Sprinkling For Dust Control"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation

SPRINKLING FOR DUST CONTROLItem No. 220S

Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling

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ITEM NO. 230S - ROLLING (FLAT WHEEL) 8-20-07**230S.1 - Description**

This item shall govern compaction of subgrade, embankment, flexible base, surface treatments and asphalt surfaces by the operation of approved power rollers as herein specified and as directed by the Engineer or designated representative.

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

230S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A plan describing the condition of each roller proposed for the work, as well as the type, size, weight, configuration (three wheel, tandem, etc) for each individual roller, and
- B. The operating speed proposed for each individual roller.

230S.3 - Equipment**A. Embankments and Flexible Bases**

Power rollers shall be of the 3-wheel, self-propelled type, weighing not less than 10 tons (9 megagrams) and shall provide compression on the rear wheels of not less than 325 pounds per linear inch (5.80 kilograms per linear millimeter) of wheel width. All wheels shall be flat. The rear wheels shall have a diameter of not less than 48 inches (1.2 meters) and each shall have a wheel width of not less than 20 inches (510 millimeters).

B. Surface Treatments and Pavements

Power rollers shall be the 3-wheel or tandem, self-propelled type, weighing not less than 3 tons (2.7 megagrams) nor more than 6 tons (5.4 megagrams). All wheels shall be flat. Rollers shall be equipped with an adequate scraping or cleaning device on each wheel. Rollers used to compact asphalt mixture shall be equipped with a water system, which will keep all tires uniformly wet.

In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment, as determined by the Engineer or designated representative, its use shall be discontinued and the Contractor will be required to furnish the specified equipment.

Rollers shall be maintained in good repair and operating condition and shall be approved by the Engineer or designated representative.

230S.4 - Construction Methods

This work shall only be conducted at the direction of the Engineer or designated representative. A sufficient number of rollers shall be provided to compact the material in a satisfactory manner. When operations are isolated and a single roller unit cannot produce the required compaction satisfactorily, additional roller units shall be provided.

A. Subgrades, Embankments and Flexible Base

The subgrade, embankment layer or base course shall be sprinkled, if required by Standard Specification Item Nos. 201S, "Subgrade Preparation" and 210S, "Flexible Base". Rolling with a power roller shall start longitudinally at the sides of the designated area and proceed towards the center, overlapping on successive trips by at least 1/2 the width of the rear wheel of the power roller. On superelevated curves, rolling shall begin at the low sides and progress toward the high sides. Alternate trips of the roller shall be slightly different in length. Rolling shall be conducted in accordance with Standard Specification Item Nos. 201S, "Subgrade Preparation" and 210S, "Flexible Base". The rollers, unless otherwise directed by the Engineer or designated representative, shall be operated at a speed between 2 and 3 miles (3 and 5 kilometers) per hour.

B. Surface Treatments and Pavements

Rolling shall be done as called for in the surface treatment (Items 310S and 320S) and asphalt pavement (Item 340S) Standard Specification Items. The sequence of work shall be as specified above for embankment layer or base course. The operating speed shall be determined by the Contractor and approved by the Engineer or designated representative.

230S.5 - Measurement and Payment

Compensation will not be allowed for materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 230S, "ROLLING (FLATWHEEL)"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 201S	Subgrade Preparation
Item No. 210S	Flexible Base
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement

<u>RELATED CROSS REFERENCE MATERIALS</u>

<u>Specification 230S, "ROLLING (FLATWHEEL)"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 236S	Proof Rolling
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections

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

<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening

Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 264	Lime and Lime Slurry
Item No. 300	Asphalts, Oils and Emulsions

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

<u>Designation</u>	<u>Description</u>
Item No. 301	Asphalt Anti-stripping Agents
Item No. 310	Prime Coat (Cutback Asphaltic Materials)
Item No. 314	Emulsified Asphalt Treatment
Item No. 316	Surface Treatments
Item No. 345	Asphalt Stabilized Base (Plant Mixed)

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
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Tex-101-E	Surveying and Sampling Soils for Highways
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures by Extraction
Tex-222-F	Method of Sampling Bituminous Mixtures
Tex-228-F	Determination of Asphalt Content of Bituminous Mixtures By The Nuclear Method
Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

ITEM NO. 232S - ROLLING (PNEUMATIC TIRE) 8-20-07**232S.1 - Description**

This item shall govern compaction of embankment, flexible base, surface treatments or pavements by the operation of approved pneumatic tire rollers as herein specified and as directed by the Engineer or designated representative.

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

232S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A plan describing the condition of each roller proposed for the work, as well as the type of traction (self propelled or drawn), Type, size, weight, tire pressure and configuration for each individual roller, and
- B. The operating speed proposed for each individual roller.

232S.3 - Equipment**A. General Requirements**

When used on seal coats, asphaltic surface treatments and bituminous mixture pavements, the roller shall be self propelled and equipped with smooth tread tires whether "Rolling (Light Pneumatic Tire)" or "Rolling (Medium Pneumatic Tire)" is specified on the Drawings. The roller shall be so constructed as to be capable of being operated in both a forward and a reverse direction. When used on bituminous mixture pavements, the roller shall have suitable provisions for moistening the surface of the tires while operating.

When turning is impractical or detrimental to the work and when specifically directed by the Engineer or designated representative, the roller shall be capable of being operated in a forward or backward motion.

In lieu of the rolling equipment specified, the Contractor may, upon written permission of the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment, as determined by the Engineer or designated representative, its use shall be discontinued and the Contractor will be required to furnish the specified equipment.

Rollers shall be maintained in good repair and operating condition and shall be approved by the Engineer or designated representative.

Tire pressure is critical to successful operation of the roller. The Contractor shall have equipment on the construction site to inflate tires as required.

B. Light Pneumatic Tire Roller

The light pneumatic tire roller shall consist of not less than 9 pneumatic tired wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The pneumatic tire roller, under working conditions, shall have an

effective rolling width of approximately 60 inches (1.5 meters) and shall be so designed that by ballast loading, the total load may be varied uniformly from 9,000 pounds (4 megagrams) or less to 18,000 pounds (8 megagrams) or more. The roller shall be equipped with tires that will afford ground contact pressures to 45 pounds per square inch (310 kiloPascals) or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the particular tires furnished. The roller under working conditions shall provide a uniform compression under all wheels. Individual tire inflation pressures shall be within + 5 psi (+ 34 kiloPascals) of each other. The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type. The roller, when drawn or propelled by either type of equipment, shall be considered a light pneumatic tire roller unit.

C. Medium Pneumatic Tire Roller (Type A)

The medium pneumatic tire roller (Type A) shall consist of not less than 7 pneumatic tired wheels, running on axles in such manner that the rear group of tires will cover the entire gap between adjacent tires of the forward group and mounted in a rigid frame and provided with a loading platform or body suitable for ballast loading. The front axle shall be attached to the frame in such a manner that the roller may be turned within a minimum circle. The pneumatic tire roller, under working conditions, shall have an effective rolling width of approximately 84 inches (2.1 meters) and shall be so designed that, by ballast loading, the total load may be varied uniformly from 23,500 pounds (10.5 megagrams) or less to 50,000 pounds (22.5 megagrams) or more. The roller shall be equipped with tires that will afford ground contact pressures of 80 pounds per square inch (550 kiloPascals) or more. The operating load and tire air pressure shall be within the range of the manufacturer's chart. The roller under working conditions shall provide a uniform compression under all wheels. Individual tire inflation pressures shall be within + 5 psi (+ 34 kiloPascals) of each other.

The pneumatic tire roller shall be drawn by a suitable crawler type tractor, a pneumatic tired tractor, a truck of adequate tractive effort or may be of the self-propelled type. The roller, when drawn or propelled by any type of equipment, shall be considered a medium pneumatic tire roller unit. The power unit shall have adequate tractive effort to properly move the operating roller at variable uniform speeds up to approximately 5 miles per hour (8 kilometers per hour).

D. Medium Pneumatic Tire Roller (Type B)

The medium pneumatic tire roller (Type B) shall conform to the requirements for Medium Pneumatic Tire Roller (Type A) as specified above, except that the roller shall be equipped with tires that will afford ground contact pressures to 90 psi (620 kiloPascals) or more.

232S.4 - Construction Methods

The embankment layer or the base course shall be sprinkled in accordance with Standard Specification Item Nos. 201S, "Subgrade Preparation" and 210S, "Flexible Base". Rolling with a pneumatic tire roller shall start longitudinally at the sides of the designated area and shall proceed towards the center, overlapping on successive trips by at least 1/2 of the width of the pneumatic tire roller. On superelevated curves, rolling shall begin at the low sides and progress toward the high sides. Alternate trips of the roller shall be slightly different in length.

The light pneumatic tire roller shall be operated at speeds, which shall be between 3 and 11 miles per hour (between 6 and 19 kilometers per hour) for asphalt surfacing work and between 2 and 6 miles per hour (between 3 and 10 kilometers per hour) for all other work.

The medium pneumatic tire roller shall be operated at speeds as directed by the Engineer or designated representative, which produce a satisfactory product.

Sufficient rollers shall be provided to compact the material in a satisfactory manner. When operations are so isolated from one another that 1 roller unit cannot produce the required compaction satisfactorily, additional roller units shall be provided.

232S.5 - Measurement and Payment

Compensation will not be allowed for materials, equipment or labor required by this item. These items shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 232S, "Rolling (Pneumatic Tire)"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 201S	Subgrade Preparation
Item No. 210S	Flexible Base

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 232S, "Rolling (Pneumatic Tire)"</u>	
<u>City of Austin Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
Section 00700	General Conditions
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right-of-Way

Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 230S	Rolling (Flat Wheel)
Item No. 236S	Proof Rolling
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>

No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
tem No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading

Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 264	Lime and Lime Slurry
Item No. 300	Asphalts, Oils and Emulsions
Item No. 301	Asphalt Anti-stripping Agents
Item No. 310	Prime Coat (Cutback Asphaltic Materials)
Item No. 314	Emulsified Asphalt Treatment
Item No. 316	Surface Treatments
Item No. 345	Asphalt Stabilized Base (Plant Mixed)
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-101-E	Surveying and Sampling Soils for Highways
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils

Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soil & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures by Extraction
Tex-228-F	Determination of Asphalt Content of Bituminous Mixtures By The Nuclear Method
Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

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ITEM NO. 234S - ROLLING (TAMPING) 8-20-07**234S.1 - Description**

This item shall govern compaction of embankment, lime-treated subgrade or other courses by the operation of approved tamping rollers as herein specified and as directed by the Engineer or designated representative.

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

234S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A plan describing the condition of each roller proposed for the work, as well as the type of traction (self propelled or drawn), Type of roller, size, weight, and configuration of each individual tamping roller, and
- B. The operating speed proposed for each individual tamping roller.

234S.3 - Equipment

The tamping rollers shall consist of 2 metal rollers, drums or shells of 40 inches (1 meter) minimum diameter; each not less than 42 inches (1.067 meters) in length. The drums shall be unit mounted in a rigid frame in such a manner that each roller may oscillate independently of the other.

Each roller, drum or shell shall be surmounted by metal studs with tamping feet projecting not less than 7 inches (180 millimeters) from the surface and spaced not less than 6 inches (150 millimeters) nor more than 10 inches (254 millimeters), measured diagonally center to center and the cross-sectional area of each tamping foot, measured perpendicularly to the axis of the stud, shall not be less than 5 nor more than 8 square inches (less than 3200 nor more than 5200 square millimeters). The roller shall be supplemented with cleaning teeth to provide self-cleaning.

The roller shall be so designed that, by ballast loading, the load on each tamping foot may be varied uniformly from 125 to 550 psi (860 to 3800 kiloPascals) of cross sectional area. The load per tamping foot will be determined by dividing the total weight (mass) of the roller by the number of tamping feet in 1 row parallel to or approximately parallel to the axis of the roller. The compression to be provided at any time shall be as directed by the Engineer or designated representative.

The tamping roller shall be drawn by suitable power equipment of adequate tractive effort. Two tamping rollers, consisting of 4 cylinders, conforming to the above prescribed requirements, drawn by approved power equipment, shall be considered a roller unit.

Where turning is impractical or detrimental to the work and when specifically directed by the Engineer or designated representative, the roller shall be capable of being operated in a forward and backward direction. When operations are confined to narrow widths and when specifically directed in writing by the Engineer or designated representative, 1 tamping roller consisting of 2 cylinders, fastened to the front end of approved power equipment shall be considered a roller unit.

In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment. If the substituted compaction equipment fails to produce the desired compaction within the same period of time as would be expected of the specified equipment, as determined by the Engineer or designated representative, its use shall be discontinued and the Contractor will be required to furnish the specified equipment.

Rollers shall be maintained in good repair and operating condition and shall be approved by the Engineer or designated representative.

234S.4 - Construction Methods

The embankment layer, subbase or the base course shall be sprinkled in accordance with Standard Specification Item Nos. 201S, "Subgrade Preparation" and 203, "Lime Treatment for Materials In Place". Rolling with a tamping roller unit shall start longitudinally at the sides of the designated area and proceed toward the center, overlapping on successive trips by at least 1/2 of the width of the tamping roller unit. On superelevated curves, rolling shall begin at the low sides and progress toward the high sides. Alternate trips of the unit shall be slightly different in length. The tamping roller unit, unless otherwise directed by the Engineer or designated representative, shall be operated at a speed between 2 and 3 miles per hour (3 and 5 kilometers per hour).

Sufficient rollers shall be provided to compact the material in a satisfactory manner. When operations are so isolated from one another that one roller cannot perform the required compaction satisfactorily, additional rollers shall be provided and operated as directed by the Engineer.

234S.5 - Measurement and Payment

No additional payment will be made for the materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 234S, "Rolling (Tamping)"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 201S	Subgrade Preparation
Item No. 203S	Lime Treatment for Materials in Place

<u>RELATED CROSS REFERENCE MATERIALS</u>
<u>Specification 234S, "Rolling (Tamping)"</u>
<u>City of Austin Contract Documents</u>

<u>Designation</u>	<u>Description</u>
Section 00700	General Conditions
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 132	Embankment
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 202S	Hydrated Lime and Lime Slurry

Item No. 210S	Flexible Base
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 236S	Proof Rolling
Item No. 301	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections

No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 264	Lime and Lime Slurry
Item No. 300	Asphalts, Oils and Emulsions
Item No. 301	Asphalt Anti-stripping Agents
Item No. 310	Prime Coat (Cutback Asphaltic Materials)
Item No. 314	Emulsified Asphalt Treatment

Item No. 316	Surface Treatments
Item No. 345	Asphalt Stabilized Base (Plant Mixed)
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-101-E	Surveying and Sampling Soils for Highways
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soils and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures
Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

ITEM NO. 236S - PROOF ROLLING 8-20-07**236S.1 - Description**

This item shall govern furnishing and operating heavy pneumatic tired compaction equipment for locating unstable areas of embankment, subgrade and flexible base courses.

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

236S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A plan describing the condition of each roller proposed for the work, as well as the type of traction (self propelled or drawn), Type of roller, size, weight, tire pressure (if appropriate) and configuration of each individual roller, and
- B. The operating speed proposed for each individual roller.

236S.3 - Equipment**A. Standard Proof Roller:**

The proof rolling equipment shall have a loading platform or body suitable for ballast loading that is supported on a minimum of two (2) axles with not more than two (2) pneumatic tired wheels per axle. All wheels shall be arranged so that they will carry approximately equal loads when operating on uneven surfaces. Pneumatic proof rolling equipment with multiple pivotal axles and more than two tires along the front or rear axle axis shall have articulating axle supports to equally distribute the load to all tires over uneven surfaces.

The proof roller unit, under working conditions, shall have a minimum contact width of 7½ feet (2.3 meters) and shall be so designed that the gross roller weight may be varied uniformly from 25 tons to 50 tons (23 megagrams to 45 megagrams) by ballast loading. The tires shall be capable of operating under various loads with variable air pressures up to 145 psi (up to 1000 kiloPascals). The tires shall be smooth tread and shall impart a minimum ground contact pressure of 75 pounds per square inch (520 kiloPascals). Tires shall be practically full of liquid (i.e. when liquid will flow from the valve stem of a fully inflated tire with the stem in the uppermost position). The operating load and tire pressure shall be within the range of the manufacturer's chart as directed by the Engineer or designated representative.

The proof roller shall be drawn by a power train of adequate tractive effort or may be of a self-propelled type. The proof rolling equipment shall be equipped with a reverse mode transmission or be capable of turning 180 degrees in the street width. When a separate power train is used to draw the proof roller, the power train weight shall not be considered in the weight of the proof roller. The power train shall be rubber-tired when rolling subgrade and base materials. A cleated or track-type power train may be used on earth and rock embankments.

B. Alternate Equipment:

With the written approval of the Engineer or designated representative, the Contractor may utilize alternate equipment on embankment courses, subgrade and base courses subject to the requirements of the standard proof roller except with respect to minimum contact width, axle/tire arrangement and tire tread.

Alternate equipment for stability testing of embankments shall be restricted to equipment that can be shown to impart a stress distribution on the embankment structure equivalent to or greater than the stress induced by the concentrated weight of a standard proof roller.

C. Equipment Submittals:

All standard proof rollers and proposed alternate equipment must be approved by the Engineer or designated representative prior to their use. The Contractor shall furnish the Engineer or designated representative with charts or tabulations showing the contact areas and contact pressures for the full range of tire inflation pressures and for the full range of loadings for the particular tires furnished.

Alternate equipment submittals for proof rolling of embankments shall be signed and sealed by a registered Professional Engineer licensed in the State of Texas.

236S.4 - Construction Methods

A. General:

Within the ranges set forth in Section 236S.3, the load and tire inflation pressures shall be adjusted as directed by the Engineer or designated representative. It is proposed to use a contact pressure corresponding as nearly as practical to the maximum supporting value of the earthwork or base. The entirety of prepared surfaces to be tested by this method shall be proof rolled by a minimum of two passes of the proof roller tires. Each succeeding trip of the proof roller shall be offset by not greater than one tire width.

When alternate equipment is proposed and only one axle meets minimum requirements, only the qualifying axle shall be used to proof roll. If the operation of the proof roller shows an area to be unstable, the substandard area shall be brought to satisfactory stability and uniformity by additional curing, compaction, or by removal and replacement of unsuitable materials. The re-worked area shall then be proof rolled.

Proof rollers shall be operated at speeds between 2 and 6 miles per hour (3 and 10 kilometers per hour) or as directed by the Engineer or designated representative.

Acceptable limits of elastic and plastic deformation of prepared subgrade courses shall be established by proof rolling Test Sections of representative soil conditions, previously tested and approved for density and moisture requirements of the governing subgrade and earth embankment items. Proof rolling of first course base over a plastic subgrade may be waived by the Engineer or designated representative if it is determined that the prepared first course base will be damaged by the proof roller.

B. Roadway Construction:

The subgrade and all lifts of base material shall be proof rolled in new roadway construction and in the reconstruction of existing streets. Proof rolling of the curb course base shall be substituted for proof rolling of final course base at the direction of the Engineer or designated representative. Proof rolling may be waived by the Engineer or designated representative where construction is limited to turn lanes, street widening less than 7½ feet (2.3 meters) in width, or where the site is otherwise congested.

C. Trenches:

Trenches shall be proof rolled where no limitations to the operation of the proof roller exist as may be determined by the Engineer subject to the provisions hereunder.

All trenches shall be proof rolled in new roadways or in existing roadways under reconstruction. Trenches shall be proof rolled at the street subgrade elevation by longitudinal and perpendicular passes of the roller as may be dictated by the width of the trench.

Proof rolling of trenches in existing paved streets shall be limited to pavement cross-sections capable of sustaining the weight of the proof rolling equipment without imparting damage to the remaining pavement structure as determined by the Engineer. Trenches less than 4 feet (1.2 meters) in width shall be exempted of all proof rolling requirements. Only the final course base shall be proof rolled in trenches 4 feet (1.2 meters) or wider but narrower than the proof roller contact width. The subgrade, the first course and the final course base shall be proof rolled in trenches 7½ feet (2.3 meters) or wider.

D. Embankment Construction:

All embankment courses shall be proof rolled, unless otherwise directed by the Engineer or designated representative.

If required by the Engineer or designated representative, stability testing of embankments constructed to the finished cross-section and elevation or to interim elevations shall either be conducted with a standard proof roller or alternate equipment, which can be proven to impart a horizontal and vertical pressure distributions equivalent to or greater than those induced by a standard proof roller.

236S.5 - Measurement and Payment

No direct payment will be made for the materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 236S, "Proof Rolling"</u>	
<u>City of Austin Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
Section 00700	General Conditions
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation

Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 204S	Portland Cement Treatment For Materials in Place
Item No. 206S	Asphalt Stabilized Base (Plant Mix)
Item No. 210S	Flexible Base
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
No. 1000S-10	Local Street Sections
No. 1000S-11(1)	Residential and City of Austin Neighborhood Collector Street Sections
No. 1000S-11(2)	Industrial and Commercial Collector Street Sections
No. 1000S-12(1)	Primary Collector Street Sections
No. 1000S-12(2)	Primary Arterial Street Sections
No. 1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
No. 1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
No. 1000S-14	Major Arterial Street Sections

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

<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening

(60°C pascals)			(300)		(600)		(900)
Ductility 77°F (25°C), 5 cm/min, cm	T 202	100	-	70	-	50	-

C. Polymer Modified Asphalt Cement

Polymer modified asphalt cement must be smooth, homogeneous, and shall comply with the requirements listed in Table 3.

Table 3: Polymer Modified Asphalt Cement Requirements

Polymer Modified Viscosity Grade		AC-5		AC-10		AC-15P		AC-45P*	
Polymer Type		SBR		SBR		SBS		SBS	
Property	Test Method	Min	Max	Min	Max	Min	Max	Min	Max
Polymer in % (solids basis)	Tex-533-C	2.0	-	2.0	-	3.0	-	3.0	-
Viscosity									
140°F, poise (60°C, pascals)	T 202	700 (70)	- -	1300 (130)	- -	1500 (150)	- -	4500 (450)	- -
275°F, poise (135°C, pascals)	T 202	- -	7.0 (0.7)	- -	8.0 (0.8)	- -	8.0 (0.8)	14.0 (1.4)	
Penetration, 77°F (25°C), 100 g, 5 s.	T 49	120	-	80	-	100	150	50	74
Ductility, 5cm/min., 39.2°F, cm	T 51	70	-	60	-	-	-	15	-
Elastic Recovery, 50°F (10°C), %	Tex-539-C	-	-	-	-	55	-		-
Polymer Separation, 48 hrs**.	Tex-540-C	None		None		None		None	
Flash Point, C.O.C., °F (°C),	T 48	425	-	425	-	425	-	425	-
		(218)	-	(218)	-	(218)	-	(218)	-

Item No. 132	Embankment
Item No. 150	Blading
Item No. 158	Specialized Excavation Work
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
Item No. 264	Lime and Lime Slurry
Item No. 300	Asphalts, Oils and Emulsions
Item No. 301	Asphalt Anti-stripping Agents
Item No. 310	Prime Coat (Cutback Asphaltic Materials)
Item No. 314	Emulsified Asphalt Treatment
Item No. 316	Surface Treatments
Item No. 345	Asphalt Stabilized Base (Plant Mixed)
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-101-E	Surveying and Sampling Soils for Highways
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils

Tex-105-E	Determination of Plastic limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils & Base Materials
Tex-117-E	Triaxial Compression Tests for Disturbed Soil and Base Materials
Tex-120-E	Soil Cement Testing
Tex-121-E	Soil Lime Testing
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures
Tex-600-J	Sampling and Testing of Hydrated Lime, Quicklime & Commercial Lime Slurry

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ITEM NO. 301S - ASPHALTS, OILS, AND EMULSIONS 8-20-07

301S.1 - Description

This item includes the requirements for cutback asphalts, emulsified asphalts, polymer modified asphalt cements, performance graded asphalt binders and other miscellaneous asphaltic materials and latex additives.

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

301S.2 - Submittals

Submittals shall include test results for each the materials described herein when specifically identified on the drawings and/or referenced in associated standard specification items and standard details.

Submittals may include samples of the base asphalt cement and polymer additives.

301S.3 - Materials

When tested in accordance with designated TxDOT, AASHTO and/or ASTM test methods, the various materials shall meet the applicable requirements of this specification.

A. Acronyms

The acronyms used in this specification are defined in the following table.

Table 1: Acronyms

Acronym	Definition	Acronym	Definition
Test Method Prefix		Polymer Modifier	
Tex	TxDOT	SBR or L	Styrene-Butadiene Rubber (Latex)
T	AASHTO	SBS	Styrene-Butadiene-Styrene Block Copolymer
D	ASTM	TR	Tire Rubber, from ambient temperature grinding of truck and passenger tires
		P	Polymer Modified
AC	Asphalt Cement	SS	Slow Setting
RC	Rapid Curing	H-suffix	Harder Residue (Lower Penetration)
MC	Medium Curing	AE	Asphalt Emulsion

SCM	Special Cutback Material	S-suffix	Stockpile Usage
HF	High Float	AE-P	Asphalt Emulsion Prime
C	Cationic	EAP&T	Emulsified Asphalt Prime and Tack
RS	Rapid Setting	PCE	Prime, Cure, and Erosion Control
MS	Medium Setting	PG	Performance Grade

B. Asphalt Cement

The material shall be homogeneous, free from water, shall not foam when heated to 350°F (177°C) and shall meet the requirements in Table 2.

Table 2: Asphalt Cement Requirements

Viscosity Grade		AC-10		AC-20		AC-30	
Property	Test Method	Min	Max	Min	Max	Min	Max
Viscosity: 140°F, poises (60°C, pascals)	T 202	800 (80)	1200 (120)	1600 (160)	2400 (240)	2400 (240)	3600 (360)
Viscosity: 275°F, stokes (135°C, pascals)	T 202	1.9 (.19)	-	2.5 (.25)	-	3.0 (.30)	-
Penetration: 77°F (25°C), 100g, 5s	T 49	85	-	55	-	45	-
Flash Point, C.O.C. °F (°C)	T 48	450 (232)	-	450 (232)	-	450 (232)	-
% Solubility trichloroethylene	T44	99.0	-	99.0	-	99.0	-
Spot test	Tex 509-C						
Viscosity: 140°F stokes	T 202	-	3000	-	6000	-	9000

Tests on Residue from Thin Film Oven Test: (T179)									
Retained Penetration Ratio, 77°F (25°C), % original	T 49	-	-	-	-	0.60	1.00	0.60	0.90

* The SBS block copolymer may be pre-blended with a polymer processing oil (up to a 1:1 ratio of polymer to oil) to aid the solution of the polymer in the asphalt.

** A 350-gram (0.77 pound) sample of the asphalt-SBS blend is stored for 48 hours at 325°F (163°C). Upon completion of the storage time, the sample is visually examined for separation of the SBS from the asphalt (smoothness and homogeneity). If a question still exists about the separation of the SBS, samples shall be taken from the top and bottom of the sample for Infrared Spectroscopy analysis. A difference of 0.4% or more in the concentration of the SBS between the top and bottom samples shall constitute separation.

D. Cutback Asphalt

Cutback asphalt shall meet the requirements presented in Tables 4 and 5 for the specified type and grade.

Table 4: Rapid Curing Type Cutback Asphalt Requirements

Type-Grade		RC-250		RC-800		RC-3000	
Properties	Test Method	Min	Max	Min	Max	Min	Max
Water, percent	T55	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., °F (°C)	T79	80 (27)	-	80 (27)	-	80 (27)	-
Kinematic viscosity @ 140°F, cst (60°C, mm ² /s)	T201	250	400	800	1600	3000	6000
Distillation Test:	T78						
Distillate, % by volume of total distillate to 680°F (360°C):							
to 437°F (225°C):		40	75	35	70	20	55
to 500°F (260°C):		65	90	55	85	45	75

to 600°F (316°C):		85	-	80	-	70	-
Residue from Distillation, Volume %		70	-	75	-	82	-
Tests of Distillation Residue:							
Penetration, 100g, 5 sec., 77°F (25°C), cm	T49	80	120	80	120	80	120
Ductility, 5 cm/min., 77°F, 5 cm/min., cm	T51	100	-	100	-	100	-
(25°C, 50 mm/min., mm)		1000	-	1000	-	1000	-
Solubility in trichloroethylene, %	T44	99.0	-	99.0	-	99.0	-
Spot Test	Tex 509-C	ALL NEGATIVE					

Table 5: Medium Curing Type Cutback Asphalt Requirements

Type		MC-30		MC-70		MC-250		MC-800		MC-3000	
Properties	Test Method	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Water, %	T55	-	0.2	-	0.2	-	0.2	-	0.2	-	0.2
Flash Point, T.O.C., °F (°C)	T79	100 (38)	-	100 (38)	-	150 (65)	-	150 (65)	-	150 (65)	-
Kinematic viscosity. @ 140°F. cst (60°C, mm ² /s)	T201	30	60	70	140	250	500	800	1600	3000	6000
Distillation Test:	T78										
Distillate, as % by volume to total distillate to 680°F(360°C);, shall be as follows:											
to 437°F (225°C):		-	25	-	20	-	10	-	-	-	-

to 500°F (260°C):		40	70	20	60	15	55	-	35	-	15
to 600°F (316°C):		75	93	65	90	60	87	45	80	15	≥75
Residue from 80°F (225°C) distillation											
Volume Percent		50	-	55	-	67	-	75	-	80	-
Tests on Distillation Residue:											
Penetration	T49	120	250	120	250	120	250	120	250	120	250
@77°F (25°C), 100g, s, 01 mm:											
Ductility	T51										
@ 77°F, 5 cm/min, cms		100*	-	100*	-	100*	-	100*	-	100*	-
(25°C, 50 mm/min., mm)		1000*	-	1000*	-	1000*	-	1000*	-	1000*	-
% Solubility in trichloroethylene	T44	99.0	-	99.0	-	99.0	-	99.0	-	99.0	-
Spot Test	Tex 509-C	ALL NEGATIVE									

* If penetration of residue is more than 200 and the ductility at 77°F (25°C) is less than 100 cm (1000 mm), the material will be acceptable if its ductility at 60°F (16°C) is more than 100cm (1000 mm).

E. Emulsified Asphalt

The material shall be homogenous. It shall show no separation of asphalt after thorough mixing and shall meet the requirements for the specified type and grade presented in Tables 6, 7 and 8.

Table 6: Anionic Emulsion Requirements

	Type	Medium Setting	Slow Setting
--	------	----------------	--------------

	Grade	MS-2		SS-1		SS-1h	
Property	Test Method	Min	Max	Min	Max	Min	Max
Furol Viscosity @ 77°F (25°C), sec.	T72	-	-	20	100	30	100
@ 122°F(50°C), sec		100	300	-	-	-	-
Sieve Test, %.	T59	-	0.1	-	0.1	-	0.1
Miscibility (Standard Test)	T59	-	-	Passing		Passing	
Cement Mixing, %	T59	-	-	-	2.0	-	2.0
% Demulsibility: 35 cc 0.02N CaCl ₂	T59	-	30	-	-	-	-
Storage Stability 1 day, %	T59	-	1	-	1	-	1
Freezing Test, 3 Cycles*	T59	Passing		Passing	Passing		
Distillation Test	T59						
Distillation Residue, %		65	-	60	-	60	-
Distillate Oil Portion, %		-	½	-	½	-	½
Tests of Residue from Distillation:							
Penetration @ 77°F (25°C), 100g, 5s	T49	120	160	120	160	70	100
Solubility in Trichloroethylene, %	T44	97.5	-	97.5	-	97.5	-
Ductility @ 77F, 5 cm/min., cm	T51	100	-	100	-	80	-
(@ 25°C, 50 mm/min., mm)		1000	-	1000	-	800	-

* Applies only when Engineer or designated representative specifies the material for winter use.

Table 7: High Float anionic Emulsion Requirements

	Type	Rapid Setting		Medium Setting	
	Grade	HFRS-2		AES-300	
Property	Test Method	Min	Max	Min	Max
Viscosity, Saybolt Furol	T72				
@ 77°F (25°C), sec.		-	-	75	400
@ 122°F (50°C), sec.		150	400	-	-
Oil Portion of Distillate, %	T59	-	2	-	7
Sieve Test, %	T59	-	0.1	-	0.1
Particle Charge	T59	positive		positive	
Coating Ability and Water Resistance:	T59				
Coating, dry aggregate		-	-	good	
Coating, after spraying		-	-	fair	
Coating, wet aggregate				fair	
Coating, after spraying				fair	
% Demulsibility: 35 ml 0.02 N CaCl ₂	T59	50	-	-	-
Storage Stability Test, 1 day, %	T59	-	1	-	1
Distillation Test	T59				
Residue by Distillation, % by weight		65	-	65	-
Oil Distillate, by volume of emulsion, %		-	1/2	-	5

Tests on Residue from Distillation:					
Penetration at 77°F (25°C), 100g, 5s	T49	100	140	300	-
Solubility in Trichloroethylene, %	T44	97.5	-	97.5	-
Ductility @ 77°F., 5 cm/min, cms	T51	100	-	-	-
(25°C., 50 mm/min, mm)		(1000)			
Float Test at 140°F (60°C), sec.	Tex 509-C	1200	-	1200	-

Table 8: Cationic Emulsion Requirements

	Type	Rapid Setting				Medium Setting				Slow Setting			
	Grade	CRS-2		CRS-2h		CMS-2		CMS-2s		CSS-1		CSS-1h	
Property	Test Method	Min	Max	Min	Max	Min.	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T72												
@ 77°F (25°C), sec.		-	-	-	-	-	-	-	-	20	100	20	100
@ 122°F (50°C), sec.		150	400	150	400	100	300	100	300	-	-	-	-
Storage stability test, 1 day %	T59	-	1	-	1	-	1	-	1	-	1	-	1
% Demulsibility: *, **	T59	40	-	40	-	-	-	-	-	-	-	-	-
Coating, ability & water resistance	T59												
Coating, dry aggregate		-	-	-	-	good		good		-	-	-	-

Coating, after spraying		-	-	-	-	fair		fair		-	-	-	-
Coating, wet aggregate		-	-	-	-	fair		fair		-	-	-	-
Coating, after spraying		-	-	-	-	fair		fair		-	-	-	-
Particle charge test	T59	Positive		Positive		Positive		Positive		Positive		Positive	
Sieve test, %	T59	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10	-	0.10
Cement Mixing test, %	T59	-	-	-	-	-	-	-	-	-	2.0	-	2.0
Distillation Test:	T59												
% Oil distillate, vol. of emulsion		-	1/2	-	1/2	-	7	-	5	-	1/2	-	1/2
Residue by Distillation,% by wt.		65	-	65	-	65	-	65	-	60	-	60	-
Tests on Residue from Distillation:													
Penetration, 77°F	T49	120	160	80	110	120	200	300	-	120	160	80	110
(25°C), 100g, 5s.													
Ductility,	T51												
77°F, 5 cm/min, cm		100	-	80	-	100	-	-	-	100	-	80	-
(25°C, 50 mm/min, mm)		1000	-	800	-	1000	-	-	-	1000	-	800	-
% Solubility in trichloroethylene	T44	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-	97.5	-

* At a level of 35 ml 0.8% sodium dioctyl sulfosuccinate.

** The demulsibility test shall be made within 30 days from date of shipment.

F. Polymer Modified Emulsions

The material shall be homogenous. It shall show no separation of asphalt after thorough mixing and shall meet the requirements for the specified type and grade presented in Tables 9 and 10.

G. Specialty Emulsions

Specialty emulsions may be either asphaltic-based or resin-based and must meet the requirements included in Table 11.

H. Recycling Agent

Recycling agent and emulsified recycling agent must meet the requirements of Table 12. Additionally, recycling agent and residue from emulsified recycling agent, when added in the specified proportions to the recycled asphalt, must meet the properties specified on the drawings.

Table 9: Polymer Modified Emulsified Asphalt Requirements

Type-Grade		Rapid Setting				Medium Setting						Slow Setting	
		RS-1P		HFRS-2P		AES-150P		AES-300P		AES-300S		SS-1P	
Property	Test Method	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72												
77°F, sec.		-	-	-	-	75	400	75	400	75	400	30	100
122°F, sec.		50	200	150	400	-	-	-	-	-	-	-	-
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1	-	0.1
Miscibility	T 59	-		-		-		-		-		pass	
Coating Ability and Water Resistance:	T 59												
dry aggregate/after spray		-		-		good/fair		good/fair		good/fair		-	
wet aggregate/after spray		-		-		fair/fair		fair/fair		fair/fair		-	
Demulsibility, 35 ml of 0.02 N CaCl ₂ , %	T 59	60	-	50	-	-	-	-	-	-	-	-	-

Storage Stability, 1 day, %	T 59	-	1	-	1	-	1	-	1	-	1	-	1
Breaking Index, g	Tex-542-C	-	80	-	-	-	-	-	-	-	-	-	-
Distillation Test: ¹	T 59												
Residue by Distillation, % by wt.		65	-	65	-	65	-	65	-	65	-	60	-
Oil Distillate, % by vol of emulsion		-	3	-	0.5	-	3	-	5	-	7	-	0.5
Tests: Residue from Distillation:													
Polymer Content, wt. % (solids basis)	Tex-533-C	-	-	3.0	-	-	-	-	-	-	-	3.0	-
Penetration, 77°F, (25°C) 100 g, 5 sec.	T 49	225	300	90	140	150	300	300	-	300	-	100	140
Solubility in Trichloroethylene, %	T 44	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-	97.0	-
Viscosity, 140°F, poise 60°C, Pa-s	T 202	-	-	1500	-	-	-	-	-	-	-	1300	-
Float Test, 140°F, sec.	T 50	-	-	1200	-	1200	-	1200	-	1200	-	-	-
Ductility ² ,													
39.2°F, 5 cm/min., cm	T 51	-	-	50	-	-	-	-	-	-	-	50	-
(4°C, 5 cm/min., mm)		-	-	500	-	-	-	-	-	-	-	500	-
Elastic Recovery ² , 50°F,(10°C), %	Tex-539-C	55	-	55	-	-	-	-	-	-	-	-	-

Tests on RTFO Curing of Distillation Residue:	Tex-541-C												
Elastic Recovery, 50°F, (10°F) %	Tex-539-C	-	-	-	-	50	-	50	-	30	-	-	-

¹ Exception to AASHTO T 59: Bring the temperature on the lower thermometer slowly to 350°F +/- 10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 +/- 5 min. from the first application of heat.

² HFRS-2P must meet one of either the Ductility or Elastic Recovery.

Table 10: Polymer Modified Cationic Emulsified Asphalt Requirements

Type-Grade		Rapid Setting				Slow Setting	
		CRS-1P		CRS-2P		CSS-1P	
Property	Test Method	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72	-	-	-	-	20	100
77°F (25°C), sec.		50	150	150	400	-	-
122°F (50°C), sec.		-	0.1	-	0.1	-	0.1
Sieve Test, %	T 59	60	-	70	-	-	-
Demulsibility, 35 ml of 0.8% sodium dioctyl sulfosuccinate, %	T 59	-	1				
Storage Stability, 1 day, %	T 59	-	1	-	1	-	1
Breaking Index, g	Tex-542-C		80	-	-	-	-
Particle Charge	T 59	positive		positive		positive	

Distillation Test: ¹	T 59	65	-	65	-	62	-
Residue by Distillation, % by wt.							
Oil Distillate, % by volume of emulsion		-	3	-	0.5	-	0.5
Tests on Residue from Distillation:							
Polymer Content, wt. % (solids basis)	Tex-533-C	-	-	3.0	-	3.0	-
Penetration, 77°F (25°C), 100 g, 5 sec.	T 49	225	300	90	150	55	90
Viscosity, 140°F, poise (60°C, Pa-s)	T 202	-	-	1300	-	-	-
Solubility in Trichloroethylene, %	T 44	97.0	-	97.0	-	97.0	-
Softening Point, °F	T 53	-	-	-	-	135	-
Ductility, 77°F, 5 cm/min., cm (25°C, 5 cm/min., mm)	T 51	-	-	-	-	70 700	-
Ductility ² , 39.2°F, 5 cm/min., cm (4°C, 5 cm/min., mm)	T 51	-	-	50	-	-	-
Elastic Recovery ² , 50°F (10°C), %	Tex-539-C	45	-	55	-	-	-

¹ Exception to AASHTO T 59: Bring the temperature on the lower thermometer slowly to 350°F +/- 10°F. Maintain at this temperature for 20 min. Complete total distillation in 60 +/- 5 min. from the first application of heat.

² CRS-2P must meet one of either the Ductility or Elastic Recovery.

Table 11: Specialty Emulsion Requirements

Type-Grade		Medium Setting		Slow Setting
		AE-P	EAP&T	PCE ¹

Property	Test Method	Min	Max	Min	Max	Min	Max
Viscosity, Saybolt Furol	T 72						
77°F (25°C), sec.		-	-	-	-	10	100
122°F (50°C), sec.		15	150	-	-	-	-
Sieve Test, %	T 59	-	0.1	-	0.1	-	0.1
Miscibility ²	T 59	-		pass		pass	
Demulsibility, 35 ml of 0.10 N CaCl ₂ , %	T 59	-	70	-	-	-	-
Storage Stability, 1 day, %	T 59	-	1	-	1	-	-
Particle Size ³ , % by volume ≤ 2.5 m	Tex-238-F	-	-	90	-	-	-
Asphalt Emulsion Distillation to 500°F (260°C) followed by Cutback Asphalt Distillation of Residue to 680°F (360°C):	T 59 & T 78						
Residue after both Distillations, % by wt.		40	-	-	-	-	-
Total Oil Distillate from both distillations, % by volume of emulsion		25	40	-	-	-	-
Distillation:	T 59						
Residue by Distillation, % by wt.		-	-	60	-	-	-
Evaporation:4	T 59						
Residue by Evaporation, % by wt.		-	-	-	-	60	-
Tests on Residue after all Distillation(s):							
Viscosity, 140°F, poise (60°C, Pa-s)	T 202	-	-	800	-	-	-

Kinematic Viscosity, 140°F, cSt (60°C, mm ² /s)	T 201	-	-	-	-	100	350
Flash Point, C.O.C., °F (°C)	T 48	-	-	-	-	400 204	-
Solubility in Trichloroethylene, %	T 44	97.5	-	-	-	-	-
Float Test, 122°F (50°C), sec	T 50	50	200	-	-	-	-

¹ Supply with each shipment of PCE:

a) a copy of a lab report from an approved analytical lab, signed by a lab official, indicating the PCE formulation does not meet any characteristics of a Resource Conservation Recovery Act (RCRA) hazardous waste;

b) a certification from the producer that the formulation supplied does not differ from the one tested and that no listed RCRA hazardous wastes or PCB's have been mixed with the product; and

c) a Materials Safety Data Sheet.

² Exception to AASHTO T 59: In dilution, use 350 ml of distilled or deionized water and a 1000-ml beaker.

³ Tex-238-F, beginning at "Particle Size Analysis by Laser Diffraction," "Procedure" (using - medium: distilled or deionized water and dispersant: none), or other approved method.

⁴ Exception to AASHTO T 59: Leave sample in the oven until foaming ceases, then cool and weigh.

Table 12: Recycling Agent and Emulsified Recycling Agent Requirements

Property	Test Method	Recycling Agent		Emulsified Recycling Agent	
		Min	Max	Min	Max
Viscosity, Saybolt Furol, 77°F, sec.	T 72	-	-	15	100
Sieve Test, %	T 59	-	-	-	0.1

Miscibility ¹	T 59	-		No Coagulation	
Evaporation Test: ²	T 59				
Residue by Evaporation, % by wt.		-	-	60	-
Tests on Recycling Agent or Residue from Evaporation:					
Flash Point, C.O.C., °F	T 48	400	-	400	-
Kinematic Viscosity,	T 201				
140°F, cSt		75	200	75	200
275°F, cSt		-	10.0	-	10.0

¹ Exception to AASHTO T 59: Use 0.02 N CaCl₂ solution in place of water.

² Exception to AASHTO T 59: Maintain sample at 300°F until foaming ceases, then cool and weigh.

I. Crack Sealer

This section sets forth the requirements for a polymer modified emulsion suitable for sealing fine cracks, and a rubber asphalt compound suitable for sealing cracks of 1/8 inch (3 mm) or greater width.

1. Polymer Modified Asphalt Emulsion Crack Sealer

For cracks on the order of 1/8 inch (3 mm) width, HFRS-2P polymer modified emulsion as described in the table included in Section F, Polymer Modified Emulsions of this item may be used. Requirements for the polymer modified emulsion and rubber-asphalt crack-sealing compound are presented in Table 13.

Table 13: Polymer Modified Asphalt Emulsion Crack Sealer Requirements

Property	Test Methods	Min	Max
Rotational Viscosity, 77°F, cP	ASTM D 2196, Method A	10,000	25,000
Sieve Test, %	T 59	-	0.1

Storage Stability, 1 day, %	T 59	-	1
Evaporation	Tex-543-C		
Residue by Evaporation, % by wt.		65	-
Tests on Residue from Evaporation:			
Penetration, 77°F, 100 g, 5 sec.	T 49	35	75
Softening Point, °F	T 53	140	-
Ductility, 39.2°F, 5 cm/min., cm	T 51	100	-

2. Rubber-Asphalt Crack Sealing Compound

This specification item may be a proprietary product. The compound shall be capable of being melted and applied at a temperature of 400°F (200°C) or less by a suitable oil jacketed kettle equipped with a pressure pump, a hose and a nozzle. It shall contain no water or highly-volatile matter. It shall not be tracked by vehicular traffic once it cools to road pavement temperature.

The rubber-asphalt crack sealing compound shall meet requirements in Table 14.

Table 14: Rubber-Asphalt Crack Sealer Requirements

Property	Test Methods	Class A		Class B	
		Min	Max	Min	Max
CRM Content, Grade A or B, % by wt.	Tex-544-C	22	26	-	-
CRM Content, Grade B, % by wt.	Tex-544-C	-	-	13	17
Virgin Rubber Content ¹ , % by wt.		-	-	2	-
Flash Point ² , COC, °F	T 48	400	-	400	-
Penetration ³ , 77°F, 150g, 5 sec.	T 49	30	50	30	50
Penetration ³ , 32°F, 200g, 60 sec.	T 49	12	-	12	-

Softening Point, °F	T 53	-	-	170	-
Bond ⁴ , 3 cycles, 20°F	Tex-525-C	-	Pass		

¹ Provide certification that the min. % virgin-rubber was added.

² Before passing the test flame over the cup, agitate the sealing compound with a 3/8 to 1/2 in. (9.5 to 12.7 mm) wide, square-end metal spatula in a manner so as to bring the material on the bottom of the cup to the surface, i.e., turn the material over. Start at one side of the thermometer, move around to the other, and then return to the starting point using 8 to 10 rapid circular strokes. Accomplish agitation in 3 to 4 sec. Pass the test flame over the cup immediately after stirring is completed.

³ Exception to AASHTO T 49: Substitute the cone specified in ASTM D 217 for the penetration needle.

⁴ No crack in the crack sealing materials or break in the bond between the sealer and the mortar blocks over 1/4 in. deep for any specimen after completion of the test.

a. Properties of Rubber Used in Sealer. The rubber shall be one of the following types;

1) Type I - Ground tire rubber.

2) Type II - A mixture of ground tire rubber and high natural reclaimed scrap rubber. The natural rubber content, determined by ASTM D 297, shall be a minimum of 25 percent.

b. Ground Rubber. The ground rubber shall comply with the following gradation requirements when tested by TxDOT Test Method Tex-200-F, Part I.

Table 15: Ground Rubber Gradation Requirements

Sieve Size		Percent Retained	
U.S.	SI	Type I	Type II
No. 8	2.36 mm	0	-
No. 10	2.00 mm	0-5	0
No. 30	600mm	90-100	50-70
No. 50	300mm	95-100	70-95

No. 100	150mm	-	95-100
---------	-------	---	--------

The ground rubber shall be free from fabric, wire, cord or other contaminating materials.

- c. Packaging. The rubber-asphalt crack sealing compound shall be packaged in boxes, which contain two 30-35 pound (14-16 kilogram) blocks that are individually packaged in a liner made of polyethylene, or other packaging approved by the Engineer or designated representative.

J. Performance Graded Binders

Performance graded binders must be smooth, homogeneous, show no separation when tested in accordance with Test Method Tex-540-C, and must meet the requirements in the following table.

Separation testing is not required if:

- a modifier is introduced separately at the mix plant either by injection in the asphalt line or mixer, or
- the binder is blended on site in continuously agitated tanks, or
- binder acceptance is based on field samples taken from an in-line sampling port at the hot mix plant after the addition of modifiers.

Table 16: Performance Graded Binder Requirements (Printer-friendly version in PDF)

Performance Grade	PG 58			PG 64				PG 70				PG 76				PG 82		
	- 22	- 28	- 34	- 16	- 22	- 28	- 34	- 16	- 22	- 28	- 34	- 16	- 22	- 28	- 34	- 16	- 22	- 28
Average 7-day Max Pavement Design Temperature, °C ¹	58			64				70				76				82		
Min Pavement Design Temperature, °C ¹	≥- 22	≥- 28	≥- 34	≥- 16	≥- 22	≥- 28	≥- 34	≥- 16	≥- 22	≥- 28	≥- 34	≥- 16	≥- 22	≥- 28	≥- 34	≥- 16	≥- 22	≥- 28
ORIGINAL BINDER																		
Flash Point, AASHTO T 48: Min,	230°C																	

Viscosity, AASHTO TP 48: ^{2,3} Max, 3.0 Pas, Test Temperature,	135°C																	
Dynamic Shear, AASHTO TP 5: ⁴ G*/sin (δ), Min, 1.00 kPa Test Temperature @ 10 ead/sec.,	58°C			64°C				70°C				76°C				82°C		
Elastic Recovery, ASTM D 6084, 50°F, % Min	-	-	30	-	-	30	50	-	30	50	60	30	50	60	70	50	60	70
ROLLING THIN FILM OVEN (Tex-541-C)																		
Mass Loss, Max, %	1.0																	
Dynamic Shear, AASHTO TP 5: G*/sin (δ) in, 2.20 kPa Test Temperature @10 red/sec.,	58°C			64°C				70°C				76°C				82°C		
PRESSURE AGING VESSEL (PAV) RESIDUE (AASHTO PP 1)																		
PAV Aging Temperature	100°C																	
Dynamic Shear, AASHTO TP 5: G*/sin (δ) Max, 5000 kPa Test Temperature10 rad/sec., °C	25	22	19	28	25	22	19	28	25	22	19	28	25	22	19	28	25	22
Creep Stiffness, AASHTO TP 1: ^{5,6} S, Max, 300 mPa, M - value, Min, 0.300 Test Temperature @ 60 sec., °C	- 12	- 18	- 24	-6	- 12	- 18	- 24	-6	- 12	- 18	- 24	-6	- 12	- 18	- 24	-6	- 12	- 18
Direct Tension, AASHTO TP 3: ⁶ Failure Strain, Min, 1.0% Test Temperature @1.0 mm/min., °C	- 12	- 18	- 24	-6	- 12	- 18	- 24	-6	- 12	- 18	- 24	-6	- 12	- 18	- 24	-6	- 12	- 18

¹ Pavement temperatures are estimated from air temperatures using an algorithm contained in the PGEXCEL3.xls software program, may be provided by the Department or by following the procedures as outlined in AASHTO MP 2 and PP 28.

² This requirement may be waived at the Department's discretion if the supplier warrants that the asphalt binder can be adequately pumped, mixed and compacted at temperatures that meet all applicable safety, environmental, and constructability requirements. At test temperatures where the binder is a Newtonian fluid, any suitable standard means of viscosity measurement may be used, including capillary (AASHTO T 201 or T 202) or rotational viscometry (AASHTO TP 48).

³ Viscosity at 135°C is an indicator of mixing and compaction temperatures that can be expected in the lab and field. High values may indicate high mixing and compaction temperatures. Additionally, significant variation can occur from batch to batch. Contractors should be aware that variation could significantly impact their mixing and compaction operations. Contractors are therefore responsible for addressing any constructability issues that may arise.

⁴ For quality control of unmodified asphalt binder production, measurement of the viscosity of the original asphalt binder may be substituted for dynamic shear measurements of $G^*/\sin(\delta)$ at test temperatures where the asphalt is a Newtonian fluid. Any suitable standard means of viscosity measurement may be used, including capillary (AASHTO T 201 or T 202) or rotational viscometry (AASHTO TP 48).

⁵ Silicone beam molds, as described in AASHTO TP 1-93, are acceptable for use.

⁶ If creep stiffness is below 300 mPa, direct tension test is not required. If creep stiffness is between 300 and 600 mPa, the direct tension failure strain requirement can be used instead of the creep stiffness requirement. The m-value requirement must be satisfied in both cases.

301S.4 - Equipment.

All equipment necessary to transport, store, sample, heat, apply, and incorporate asphalts, oils and emulsions shall be provided.

301S.5 - Construction

Typical materials used for specific applications are identified in Table 17. These are typical uses only and circumstances may require use of other material.

Table 17: Typical Material Use

Material Application	Typically Used Materials
Hot-Mixed, Hot-Laid Asphalt Mixtures	PG Binders, Modified PG Binders

Surface Treatment	AC-5, AC-10, AC-5 w/2% SBR, AC-10 w/2% SBR, AC-15P, AC-15-5TR, HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P, Surface Treatment
(Cool Weather)	RS-1P, CRS-1P, RC-250, RC-800, RC-3000, MC-250, MC-800, MC-3000, MC-2400L
Precoating	AC-5, AC-10, PG 64-22, SS-1, SS-1H, CSS-1, CSS-1H
Tack Coat	RC-250, SS-1, SS-1H, CSS-1, CSS-1H, EAP&T
Fog Seal	SS-1, SS-1H, CSS-1, CSS-1H
Hot-Mixed, Cold-Laid Asphalt Mixtures	AC-0.6, AC-1.5, AC-3, AES-300, AES-300P, CMS-2, CMS-2S
Patching Mix	MC-800, SCM I, SCM II, AES-300S
Recycling	AC-3, AES-150P, AES-300P, Recycling Agent, Emulsified Recycling Agent
Crack Sealing	SS-1P, Polymer Mod AE Crack Sealant, Rubber Asphalt Crack Sealers (Class A, Class B)
Prime	MC-30, AE-P, EAP&T, PCE
Curing Membrane	SS-1, SS-1H, CSS-1, CSS-1H, PCE
Erosion Control	SS-1, SS-1H, CSS-1, CSS-1H, PCE

301S.6 - Storage, Heating and Application Temperatures

Asphaltic materials should be applied at the temperature, which provides proper and uniform distribution. Within practical limits higher temperatures than necessary to produce the desired results shall be avoided. Satisfactory application usually should be obtained within the recommended ranges shown below.

No material shall be heated above the following maximum temperatures:

Table:18 Recommended Temperature Ranges

	Recommended	Maximum
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	Range; °F (°C)	Temperature; °F (°C) for	
Type-Grade	Application/Mixing	Allowable Application	Storage
AC-5, 10,20,30	275—350 (135—177)	375 (191)	400 (204)
AC-5 or AC-10 + 2% SBR	300—375 (142—191)	390* (199)	375 (191)
AC-10 + 3% SBR, AC-45P	300—350 (142—191)	350 (177)	360 (182)
RC-250	125—180 (52—82)	200 (93)	200 (93)
RC-800	170—230 (77—110)	260 (127)	260 (127)
RC-3000	215—275 (102—135)	285 (141)	285 (141)
MC-30, AEP	70—150 (21—66)	175 (79)	175 (79)
MC-70	125—175 (52—79)	200 (93)	200 (93)
MC-250	125—210 (52—99)	240 (116)	240 (116)
MC-800, SCM I, SCM II	175—260 (79—127)	275 (135)	275 (135)
MC-3000 & MC-2400 Latex	225—275 (107—135)	290 (143)	290 (143)
HFRS-2, MS-2, CRS-2, CRS-2H, HFRS-2P, CRS-2P,	120—160	180	180

CMS-2, CMS-2S, AES-300, AES-300S, AES-150P, AES-300P			
SS-1, SS-1h, SS-1P, CSS-1, CSS-1h, PCE, EAP & T, SS-1P, RS-1P, CRS-1P, CSS-1P, recycling agent, emulsified recycling agent, polymer modified AE crack sealant.	50—130 (10—54)	140 (60)	140 (60)
RS-2, RS-2h, MS-2, CRS-2, CRS-2h, CRS-2p, CMS-2, CMS-2S, HFRS-2, HFRS-2p, AES-300	110—160 (43—71)	170 (77)	170 (77)
Special Precoat Material	125—250 (52—121)	275 (135)	275 (135)
PG Binders, Modified PG Binders	275—350	350	350
Rubber Asphalt Crack Sealers (Class A, Class B)	350—375	400	-
Rubber-Asphalt Crack Sealer	350—375 (177—191)	400 (204)	-

* AC-5 + 2% SBR and AC-10 + 2% SBR, which is designated for surface treatment work, may be heated to a maximum temperature of 390°F (200°C) by the supplier loading through an in-line heater, or with the permission of the Engineer or designated representative, these materials may be heated to maximum of 390°F (200°C) by the Contractor just prior to application. When any of the SBR-modified asphalt cements are used in asphaltic concrete, the storage temperature at the mix plant should not exceed 350°F (177°C).

Attention is called to the fact that asphaltic materials (except emulsions) are very flammable and constitute fire hazards. Proper precautions should be used in all cases, especially with RC cutbacks.

Utmost care shall be taken to prevent open flames from coming in contact with the asphaltic material or the gases of it. The Contractor shall be responsible for any fires or accidents, which may result from heating the asphaltic materials.

301S.7 - Measurement and Payment

All asphaltic materials included in this specification 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.

End

SPECIFIC CROSS REFERENCE MATERIALS

<u>Specification Item 301S "Asphalts, Oils and Emulsions"</u>	
<u>American Association of State Highway and Transportation Officials (AASHTO)</u>	
<u>Designation</u>	<u>Description</u>
AASHTO T-44	Solubility of Bituminous Materials in Organic Solvents
AASHTO T-48	Flash and Fire Points by Cleveland Open Cup
AASHTO T-49	Penetration of Bituminous Materials
AASHTO T-50	Float Test for Bituminous Materials
AASHTO T-51	Ductility of Bituminous Materials
AASHTO T-53	Distillation of Road Tar
AASHTO T-55	Water in Petroleum Products and Bituminous Materials by Distillation
AASHTO T-59	Testing Emulsified Asphalt
AASHTO T-72	Saybolt Viscosity
AASHTO T-78	Distillation of Cut-Back Asphaltic (Bituminous) Products
AASHTO T-79	Flash Point with Tag Open-Cup Apparatus
AASHTO T-201	Kinematic Viscosity of Asphalts
AASHTO T-202	Viscosity of Asphalts by Vacuum Capillary Viscometer
AASHTO TP-1	Creep Stiffness
AASHTO TP-3	Direct Tension
AASHTO TP-5	Dynamic Shear
AASHTO TP-48	Rotational Viscometry

<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-200-F	Sieve Analysis of Fine and Coarse Aggregates
Tex-238-F	Laser Diffraction Particle Size Distribution Analyzer
Tex-509-C	Spot Test of Asphaltic Materials
Tex-525-C	Tests for Asphalt and Concrete Joint Sealers
Tex-533-C	Determination of Polymer Additive Percentages in Polymer Modified Asphalt Cements
Tex-539-C	
Tex-540-C	
Tex-541-C	
Tex-542-C	
Tex-543-C	
Tex-544-C	
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
D 217	Test Methods for Cone Penetration of Lubricating Grease
D 297	Test Methods for Rubber Products-Chemical Analysis
D 2186 Method A	Test Methods for Deposit-Forming Impurities in Steam

D 6084	Test Method for Elastic Recovery of Bituminous Materials by Ductilometer
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RELATED CROSS REFERENCE MATERIALS

Specification Item 301S "Asphalts, Oils and Emulsions"

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 206S	Asphalt Stabilized Base
Item No. 210S	Flexible Base
Item No. 302S	Aggregates for Surface Treatments
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 312S	Seal Coat
Item No. 313S	Rubber Asphalt Joint and Crack Sealant
Item No. 315S	Milling Asphaltic Concrete Paving
Item No. 320S	Two Course Surface Treatment

Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 341S	Paving Fabric
Item No. 350S	Heating, Scarifying and Repaving
Item No. 351S	Recycling Agent
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
1000S-10	Local Street Sections
1000S-11(1)	Residential and Neighborhood collector Street Sections
1000S-11(2)	Industrial and Collector Street Sections
1000S-12(1)	Primary Collector Street Sections
1000S-12(2)	Primary Arterial Street Sections
1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
1000S-13(2)	Minor Arterial Street Sections (4 Lanes divided)
1000S-14	Major Arterial Street
<u>Texas Department of Transportation: Standard Specifications for Construction And Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 300	Asphalts, Oils and Emulsions

Item 301	Asphalt Antistripping Agents
Item 310	Prime Coat (Cutback Asphaltic Materials)
Item 314	Emulsified Asphalt Treatment
Item 316	Surface Treatments
Item 345	Asphalt Stabilized Base (Plant Mixed)
Item 354	Planing and/or Texturing Pavement
Item 520	Weighing and Measuring Equipment
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-126-E	Molding, Testing and Evaluation of Bituminous Black Base Materials
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-211-F	Recovery of Asphalt from Bituminous Mixtures by Abson
Tex-215-	Determination of Asphalt Content of Rock Asphalt Process by Hot Solvent Method
Tex-217-F	Determination of Deleterious Material and Decantation Test for Coarse Aggregates
Tex-224-F	Determination of Flakiness
Tex-400-A	Method of Sampling Stone, Gravel, Sand and Mineral Aggregates
Tex-410-A	Abrasion of Coarse Aggregate Using the Los Angeles Machine
Tex-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
Tex-438-A	Accelerated Polish Test for Aggregate

Tex-460-A	Determination of Crushed Face Particle
Tex-501-C	Test for Water in Petroleum Products and Other Bituminous Materials
Tex-502-C	Test for Penetration of Bituminous Material
Tex-503-C	Test for Ductility of Bituminous Materials
Tex-504-C	Test for Flash and Fire Points of Petroleum Materials by Cleveland Open Cup
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-505-C	Test for Softening Point of Bituminous Materials by Ring-and-Ball Method
Tex-506-C	Test for Loss on Heating of Oils and Asphaltic Compounds
Tex-507-C	Proportion of Bitumen Soluble in Trichloroethylene
Tex-510-C	Determining the Effect of Heat and Air on Asphaltic Materials when Exposed in Thin Films
Tex-512-C	Test for Flash Points of Volative Flammable Materials by Tag Open-Cup Apparatus
Tex-513-C	Test for Saybolt Viscosity
Tex-515-C	Distillation of Cut-Back Asphalt Products
Tex-519-C	Float Test for Bituminous Materials
Tex-520-C	Test for Residue of Specified Penetration
Tex-521-C	Testing Emulsified Asphalts
Tex-528-C	Test for Absolute Viscosity of Asphalt Cements

Tex-529-C	Test for Kinematic Viscosity of Asphalts
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ITEM NO. 306S - PRIME COAT 2-24-10

306S.1 - Description

This item shall govern the application of asphaltic material on the completed base course and/or other approved areas in accordance with the Drawings, these specifications or as directed by the Engineer or designated representative.

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

306S.2 - Submittals

The submittal requirements of this specification item include:

- A. List of recommended materials (i.e. prime material, dispersal agent, etc.).
- B. Temperature Viscosity data and proposed temperature of application.
- C. Characteristics (i.e. manufacturer, rate of application, speed, etc.) of the proposed pressure distributor including calibration documentation.
- D. List of facilities and equipment proposed for temperature measurements.
- E. List of facilities and equipment proposed for storage and handling of asphaltic materials.

306S.3 - Materials

A. Asphalt Materials

The asphalt material for Prime Coat shall meet the requirements of Cutback Asphalt, MC-30, Emulsion, SS-1, Emulsion CSS-1 or AE-P, Standard Specification Item No. 301S, "Asphalts, Oils and Emulsions".

B. Water

Water shall be furnished by the Contractor and shall be clean and free from industrial wastes and other objectionable matter.

C. Dispersal Agent

Agent shall be added to water and sprayed on surfaces to be primed in accordance with asphalt manufacturer's recommendations.

306S.3 - Construction Methods

When, in the opinion of the Engineer or designated representative, the base course or other surface is satisfactory to receive the prime coat, the surface shall be prepared by sweeping or other approved methods as directed by the Engineer or designated representative. The surface shall be lightly sprinkled with water just prior to application of the asphaltic material unless this requirement is waived by the Engineer or designated representative. The Contractor shall submit a list of prime material(s) recommended for application on the work to the Engineer or designated representative for approval. When emulsions are approved, a dispersal agent shall be added to the water before sprinkling.

The asphaltic material shall be applied on the clean surface by an approved type of self-propelled pressure distributor operated so as to distribute the prime coat at a rate ranging from 0.1 to 0.3 gallons per square yard (0.45 to 1.36 liters per square meter) of surface area. The material shall be evenly and smoothly distributed under pressure sufficient to assure proper distribution. During the application of

prime coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutters or structures. The Contractor shall be responsible for cleaning all splattered areas.

Prime Coat may be applied when the temperature of the surface on which the prime coat is to be placed is 60°F (16°C) or above and the air temperature is above 50°F (10°C) and rising; the air temperature being taken in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions, in the opinion of the Engineer or designated representative, are not suitable.

The Contractor shall provide all necessary facilities and equipment for determining the temperature of the asphaltic material in all of the heating equipment and in the distributor, for determining the rate at which it is applied, and for securing uniformity at the junction of two (2) distributor loads.

The distributor shall have been calibrated within three (3) years from the date it is first used on this project. The Engineer or designated representative shall be furnished an accurate and satisfactory record of such calibration. After beginning the work, if the yield on the asphaltic material applied appears in error, the distributor shall be calibrated in a manner satisfactory to the Engineer or designated representative before proceeding with the work.

The Contractor shall be responsible for the maintenance of the surface until the work is accepted by the Engineer or designated representative. No traffic, hauling or placement of any subsequent courses shall be permitted over the freshly applied prime coat for a minimum of 48 hours or until the prime coat is accepted as dry and cured completely by the Engineer or designated representative.

All storage tanks, piping, retorts, booster tanks and distributors used in storing or handling asphaltic material shall be kept clean and in good operating condition at all times and they shall be operated in such a manner that there will be no contamination of the asphaltic material with foreign material. It shall be the responsibility of the Contractor to provide and maintain in good working order a recording thermometer at the storage heating unit at all times.

The Engineer or designated representative will approve the temperature of application based on the temperature-viscosity relationship that will permit application of the asphalt within the limits recommended in Standard Specification Item No. 301S, "Asphalts, Oils and Emulsions". The Contractor shall apply the asphalt at a temperature within 150F (80C) of the temperature specified in Standard Specification Item No. 301S, "Asphalt, Oils and Emulsions".

306S.5 - Measurement

The prime coat will be included in the unit price bid for Standard Specification Item No. 340S, "Hot Mix Asphaltic Concrete Pavement" unless included as a separate pay item in the contract. When included for payment, it shall be measured at point of delivery on the project in gallons (liters: 1 liter equals 0.264 gallons) at the applied temperature. The quantity to be paid for shall be the number of gallons used in the accepted prime coat.

306S.6 - Payment

The work performed and materials furnished as prescribed by this item, when included as a contract pay item, will be paid for at the unit bid price per gallon for "Prime Coat". The price shall include full compensation for cleaning the base course or other surface, for furnishing, heating, hauling and distributing the prime coat specified; for all freight involved and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 306S:	Prime Coat	Per Gallon.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 306S "Prime Coat"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 340S	Hot Mix Asphaltic Concrete Pavement

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 306S "Prime Coat"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 206S	Asphalt Stabilized Base
Item No. 210S	Flexible Base
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 320S	Two Course Surface Treatment

<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
1000S-10	Local Street Sections
1000S-11 (1)	Residential and Neighborhood collector Street Sections
1000S-11 (2)	Industrial and Collector Street Sections
1000S-12 (1)	Primary Collector Street Sections
1000S-12 (2)	Primary Arterial Street Sections
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1000S-14	Major Arterial Street
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 300	Asphalts, Oils and Emulsions
Item 301	Asphalt Antistripping Agents
Item 310	Prime Coat (Cutback Asphaltic Materials)
Item 314	Emulsified Asphalt Treatment
Item 345	Asphalt Stabilized Base (Plant Mixed)
Item 520	Weighing and Measuring Equipment

ITEM NO. 312S - SEAL COAT 9-26-12

312S.1 - Description

This item shall govern the construction of a surface treatment composed of a single application of asphalt or latex-asphalt covered with aggregate for the sealing of existing pavements in accordance with the details on the Drawings and this specification item.

312S.2 - Submittals

The submittal requirements of this specification item include:

- A. Recommended design mix (emulsion type, aggregate type, type and % of polymer)
- B. Test results on the emulsion (Saybolt Furol Viscosity, storage stability, demulsibility, sieve test, distillation test and residue tests).
- C. Test results on the aggregate (gradation and percent wear).
- D. Characteristics (i.e. manufacturer, rate of application, speed, etc.) of the proposed distributor and aggregate spreader.
- E. List of facilities and equipment proposed for temperature measurements.
- F. List of facilities and equipment proposed for storage and handling of asphaltic materials.

312S.3 - Materials

A. Asphaltic Materials

Asphaltic material shall conform to Item No. 301S, "Asphalts, Oils and Emulsions" as follows:

1. Patching

Patching shall be completed with Class D HMAC conforming to Item No. 340S, "Hot Mix Asphaltic Concrete".

2. Sealing

- a. Cool Weather of 65 to 80°F (18 to 27°C): HFRS-2.
- b. Warm Weather over 81°F (27°C): RS-2.

B. Aggregate

Aggregate material shall conform to Item No. 302S, "Aggregate for Surface Treatments". Unless otherwise specified on the drawings, the aggregate grading shall meet Grade 5.

C. Aggregate (Stockpiled) (Stockpiled)

Aggregate may be stockpiled only with permission of the Engineer or designated representative at locations designated for stockpiling. The Contractor shall be responsible for all remedial pollution control measures during the clean up of the stockpiling.

D. Latex Additive

The latex shall be an emulsion of styrene-butadiene low-temperature copolymer in water. The emulsion shall have good storage stability and possess the following properties:

Monomer ratio, Butadiene/Styrene	(73 ± 5)/(27 ±
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	5)
Minimum solids content, % by weight (mass)	45
Viscosity of emulsion at 77°F ± 1°F (25°C ± 1°C), Cps, Maximum (No. 3 spindle, 20 rpm, Brookfield RVT Viscometer)	2000

The manufacturer shall furnish the actual styrene-butadiene rubber (SBR) content for each batch of latex emulsion. This information shall accompany all shipments to facilitate proper addition rates.

312S.4 - Equipment

Equipment will consist of the following: asphalt storage and heaters, distributors, aggregate spreaders, blade equipped tractor and drag broom, pneumatic rollers, water truck with pump and rotary broom.

All storage tanks, piping, retorts, booster tanks and distributors used in storage or handling of asphaltic material shall be kept clean and in good operating condition at all times and they shall be operated in such manner that there will be no contamination of the asphaltic material. The Contractor shall provide and maintain in good working order a recording thermometer to continuously indicate the temperature of the asphaltic material at the storage-heating unit, when storing of asphalt is permitted.

The distributor shall have pneumatic tires of such width and number that the load produced on the street surface shall not exceed 650 pounds per inch (12 kilograms per millimeter) of tire width and shall be so designed, equipped, maintained and operated that asphaltic material at even heat may be applied uniformly on variable widths of surface at readily determined and controlled rates of from 0.05 to 0.2 gallons per square yard (0.25 to 0.9 liters per square meter), with a pressure range of from 25 to 75 pounds per square inch (170 to 515 kilopascals), and with an allowable variation from any specified rate not to exceed 5 percent. Distributor equipment shall include tachometer, pressure gauges, volume measuring devices and a thermometer for reading temperatures of tank contents.

The aggregate spreading equipment shall be adjusted and capable of spreading aggregate at controlled amounts per square yard (square meter: 1 square meter equals 1.196 square yards) in a continuous manner.

The drag broom shall be lightweight street type, mounted on a frame, designed to spread aggregate uniformly over the surface of a bituminous pavement and equipped with pull plates for towing. Towing equipment shall be pneumatic tired.

Rollers shall conform to Item No. 232S, "Rolling (Pneumatic Tire)", Light Pneumatic Tire Roller.

Rotary brooms shall be suitable for cleaning the surfaces of bituminous pavements.

Vacuum sweepers shall be suitable for removing any loose aggregate without disturbing the compacted seal coat.

312S.5 - Construction Methods

Prior to commencement of this work, all erosion control, environmental protection measures and all traffic control devices shall be in place.

Seal coats may be applied when the surface on which the seal coat is to be placed is 60°F (16°C) or above and the air temperature is above 50°F (10°C) and rising, if the temperature is measured in the shade and away from artificial heat. Asphaltic material shall not be placed when general weather conditions are not suitable for a satisfactory seal coat or when the environment could be damaged.

A. Cracks and Holes

Cracks and holes will be patched by the Contractor prior to seal coat operations. Patching materials shall be hot mix, hot laid asphaltic concrete in conformance with Standard Specification Item No. 340S, "Hot Mix Asphaltic Concrete Pavement" or other asphaltic materials as approved by the Engineer or designated representative.

B. Cleaning Existing Surfaces

Prior to placement of the seal coat, loose dirt and other objectionable material shall be removed from the existing surface. The surface will be cleaned with a rotary broom. Hand brooms will be used in areas not accessible to rotary brooms. The Engineer or designated representative must approve all streets before application of any asphalt.

C. Mixing Asphalt

When the air temperature is 80°F (27°C) or higher, latex shall be added to the asphalt at the rate of 1½ to 2 percent by weight (mass) [solid bases]. The actual rate shall be in accordance with the drawings and/or as approved by the Engineer or designated representative. The asphalt shall be heated to 150°F (65°C) before adding the latex. The mixture shall be thoroughly mixed before application.

The finished latex-asphalt shall meet the following requirements:

Viscosity at 140 F, stokes (60°C, Pa-s)	1500 (150) maximum
Ductility at 39.2 F, 1 cm per min, cm (4°C, 1 mm/min, mm)	100 minimum

D. Application of Asphaltic Material

Immediately following the preparation of the existing surface by cleaning, the asphaltic material shall be applied at the rate of 0.25 to 0.30 gallon per square yard (0.9 to 1.1 liters per square meter) as determined by the Engineer or designated representative, so that uniform distribution is obtained at all points. Skip streaks on the pavement, due to defective distributor nozzles, will be reshot with a distributor at the expense of the Contractor.

The Contractor shall calibrate the spray bar nozzles by spreading building paper as required on the surface for a sufficient distance back from the end of each application so that flow through sprays may be started and stopped on the paper and so that all sprays will operate properly over the entire length being treated. Building paper so used shall be immediately removed and loaded on a truck. At the end of each day, the paper shall be disposed of at a permitted site approved by the Engineer or designated representative.

Application temperatures will be determined by weather conditions but the temperature of the asphaltic material to be applied shall be between 150 and 160°F (65 and 71°C) as determined by the Engineer or designated representative. When a street to be sealed is continuous through several intersections, sealed area will include all spandrels and stub-outs, unless otherwise directed by the Engineer or designated representative. Spandrels will be hand sprayed. Contractor shall not apply

excessive amounts of asphaltic materials when hand spraying. Excessive materials applied shall be removed by the Contractor before spreading the aggregate.

The Contractor shall be required to seal all spandrels at the same time the adjacent streets are sealed, unless otherwise approved in writing by the Engineer.

During all applications, the surface of adjacent structures shall be protected in such a manner as to prevent their being splattered or marred. Building paper shall be spread on all manholes, valve boxes, junction boxes, etc. to protect the surface from asphaltic materials. The asphaltic material shall not be applied until the cover aggregate is available and ready to spread with assurance of continuous operation. No asphaltic material shall be placed which cannot be covered and rolled during daylight hours.

E. Spreading the Aggregate

The Contractor shall employ a mechanical aggregate spreader, which applies the aggregate uniformly over the surface at the rate of 15 to 20 pounds per square yard (8 to 11 kilograms per square meter). The actual rate shall be as directed by the Engineer or designated representative.

The covering material in the quantity specified shall be spread uniformly over the bituminous material as soon after application as possible. The aggregate shall be spread in the same width of application as for the asphaltic material and spread uniformly with the aggregate spreading equipment.

Trucks spreading aggregate shall be operated backward so that bituminous material will be covered before truck wheels pass over it. The aggregate shall be applied to a thickness that will not produce blanketing or stacking. Any blanketing or stacking shall be removed prior to rolling. Backspotting or sprinkling cover aggregate shall be done by hand spreading, which will be continued during the operations whenever necessary, as directed by the Engineer or designated representative.

F. Brooming and Rolling

Rolling shall be started as soon as sufficient aggregate is spread to prevent pick-up and continued until no more aggregate can be worked into the surface. The surface shall be blanket rolled. The Contractor shall manage the Work so that all rolling of all cover aggregate applied that day is accomplished with a minimum of four complete coverages with pneumatic rollers prior to sundown.

In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment.

In lieu of the rolling equipment specified, the Contractor may, upon written permission from the Engineer or designated representative, operate other compacting equipment that will produce equivalent relative compaction in the same period of time as the specified equipment.

Rollers shall be maintained in good repair and operating condition and shall be approved by the Engineer or designated representative.

The Contractor will be responsible for maintaining all streets for 48 hours after each street has been seal coated. Maintenance will consist of brooming, rolling and adding more aggregate as directed by the Engineer or designated representative.

G. Asphaltic Material Contractor's Responsibility

The Contractor shall furnish vendor's certified test report for asphaltic material shipped for the project. The report shall be delivered to the Engineer or designated representative before permission is granted for use of the material. Any change of source shall be reported prior to delivery.

312S.6 - Traffic Control Facilities

The Contractor shall arrange the seal coat operation in such a manner as to avoid excessive inconvenience to the public in the seal coat area.

The Contractor shall notify all abutting property owners along the street prior to initiation of the seal coat operation.

The Contractor shall have on the project site sufficient barricades, flag-persons and traffic control devices to assure a minimum of inconvenience to traffic around the construction area in conformance with the General Conditions of the Standard Contract Documents. If the Contractor's arrangements are satisfactory to the Engineer or designated representative, the seal coat operation will not be allowed to commence.

After the seal coat has been applied, the Contractor shall post appropriate warning signs along these streets as directed by the Engineer or designated representative and maintain such signs for 48 hours.

312S.7 - Final Cleanup

The Contractor shall vacuum sweep the completed seal coat and curb areas to remove loose aggregate as required during the first week after the traffic is allowed on the street.

312S.8 - Measurement

All accepted Seal Coat will be measured by one of the following methods:

- A. "Asphaltic Material" will be measured in gallons (liters: 1 liter equals 0.264 gallons) at the applied temperature at the point of application on the street.
- B. "Aggregate" will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.31 cubic yards) in vehicles as applied on the street.
- C. "Aggregate (Stockpiled)", if required to be furnished, will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.31 cubic yards) of material in vehicles at the point of stockpiling.
- D. "Complete in Place" will be measured by the square yard (square meter: 1 square meter equals 1.196 square yards) of surface area treated.

312S.9 - Payment

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid prices stipulated in the bid for "Seal Coat, Asphaltic Material", "Seal Coat, Aggregate", "Seal Coat, Aggregate (Stockpiled)" or "Seal Coat, Complete in Place". The unit bid prices shall each include full compensation for: a) furnishing, delivering and placing all materials; b) patching, brooming, compacting and rolling; c) cleaning the existing surface, covering excess asphaltic material, removing excess aggregate and cleaning gutters and cleaning stockpiles sites; d) a 48 hour maintenance period and e) all labor, equipment, tools and incidentals necessary to complete the work required as indicated on the drawings.

Payment will be made under one of the following:

Pay Item No. 312S-A:	Seal Coat, Asphaltic Material	Per Gallon.
Pay Item No. 312S-B:	Seal Coat, Aggregate	Per Cubic Yard.
Pay Item No. 312S-C:	Seal Coat, Aggregate (Stockpiled)	Per Cubic Yard.

Pay Item No. 312S-D:	Seal Coat, Complete in Place	Per Square Yard.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 312S, " Seal Coat"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 302S	Aggregates for Surface Treatments
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-200-F	Sieve Analysis of Fine and Coarse Aggregates
Tex-410-A	Abrasion of Coarse Aggregate Using the Los Angeles Machine
Tex-502-C	Test for Penetration of Bituminous Material
Tex-503-C	Test for Ductility of Bituminous Materials
Tex-504-C	Test for Flash and Fire Points of Petroleum Materials by Cleveland Open Cup
Tex-506-C	Test for Loss on Heating of Oils and Asphaltic Compounds
Tex-507-C	Proportion of Bitumen Soluble in Trichloro-ethylene

Tex-513-C	Test for Saybolt Viscosity
Tex-519-C	Float Test for Bituminous Materials
Tex-520-C	Test for Residue of Specified Penetration
Tex-521-C	Testing Emulsified Asphalts
Tex-528-C	Test for Absolute Viscosity of Asphalt Cements
Tex-529-C	Test for Kinematic Viscosity of Asphalts

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 312S, " Seal Coat"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 310S	Emulsified Asphalt Treatment
Item No. 313S	Rubber Asphalt Joint and Crack Sealant
Item No. 315S	Milling Asphaltic Concrete Paving and Non Portland Cement Concrete Bases
Item No. 316S	Polymerized Asphalt Interlayer Seal
Item No. 320S	Two Course Surface Treatment
Item No. 350S	Heating, Scarifying and Repaving
Item No. 801S	Construction Detours
Item No. 803S	Barricades, Signs and Traffic Handling
Item No. 870S	Work Zone Pavement Markings

Item No. 874S	Eliminating Existing Pavement Markings and Markers
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 300	Asphalts, Oils and Emulsions
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. 345	Asphalt Stabilized Base (Plant Mixed)
Item No. 520	Weighing and Measuring Equipment
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
00700	General Conditions
01500	Temporary Facilities
01550	Public Safety and Convenience
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>

Tex-509-C	Spot Test of Asphaltic Materials
Tex-510-C	Determining the Effect of Heat and Air on Asphaltic Materials when Exposed in Thin Films
Tex-512-C	Test for Flash Points of Volative Flammable Materials by Tag Open-Cup Apparatus

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**ITEM NO. 315S - MILLING ASPHALTIC CONCRETE PAVEMENT AND NON-PORTLAND CEMENT CONCRETE
9-26-12****315S.1 - Description**

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

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

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

315S.2 - Submittals

The submittal requirements of this specification item include:

- A. Characteristics (i.e. manufacturer, power, stability, speed, etc.) and capabilities (depth of cut, dust control, etc.) of the proposed milling equipment.
- B. Proposed plan for grade reference, control point spacing and support system.
- C. Proposed dust control plans including proposed equipment (type street sweeper, loader, water trucks, sprayers, etc.).

315S.3 - Equipment

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

The grade reference used by the Contractor may be of any type approved by the Engineer or designated representative. Control points, if required by the Drawings, shall be set at intervals not to exceed 50 feet (15 meters). The Contractor shall set the grade reference from the control points. The grade reference

shall have sufficient support so that the maximum deflection shall not exceed two millimeters (1/16 inch) between supports.

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

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

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

315S.4 - Construction Methods

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

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

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

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

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

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

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

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

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

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

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

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

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

315S.6 - Measurement

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

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

315S.7 - Payment

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

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

Payment will be made under the following:

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

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 315S "Milling Asphaltic Concrete"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 642S	Silt Fence (SF)
Item No. 864S	Abbreviated Pavement Markings

RELATED CROSS REFERENCE MATERIALSSpecification Item 315S "Milling Asphaltic Concrete"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 206S	Asphalt Stabilized Base
Item No. 210S	Flexible Base
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 306S	Prime Coat
Item No. 307S	Tack Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 312S	Seal Coat
Item No. 320S	Two Course Surface Treatment
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 341S	Paving Fabric
Item No. 350S	Heating, Scarifying and Repaving
Item No. 351S	Recycling Agent

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
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MILLING ASPHALTIC CONCRETE PAVEMENT AND NON-PORTLAND CEMENT CONCRETE

Item No. 315S

1000S-10	Local Street Sections
1000S-11(1)	Residential and Neighborhood collector Street Sections
1000S-11(2)	Industrial and Collector Street Sections
1000S-12(1)	Primary Collector Street Sections
1000S-12(2)	Primary Arterial Street Sections
1000S-13(1)	Minor Arterial Street Sections (4 Lanes)
1000S-13(2)	Minor Arterial Street Sections- (4 Lanes divided)
1000S-14	Major Arterial Street
<u>Texas Department of Transportation: Standard Specifications for Construction And Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 300	Asphalts, Oils and Emulsions
Item 301	Asphalt Antistripping Agents
Item 310	Prime Coat (Cutback Asphaltic Materials)
Item 314	Emulsified Asphalt Treatment
Item 345	Asphalt Stabilized Base (Plant Mixed)
Item 354	Planing and/or Texturing Pavement

ITEM NO. 340S - HOT MIX ASPHALTIC CONCRETE PAVEMENT 9-26-12**340S.1 - Description**

This item shall govern base, level up, and pavement surface courses composed of a compacted mixture of aggregate and asphaltic cement mixed hot in a mixing plant. The hot mix asphaltic (HMA) concrete pavement shall be constructed on a previously completed and approved subgrade, subbase material, base material, concrete slab or existing pavement.

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

340S.2 - Submittals

The submittal requirements of this specification item may include:

- A. A mix design submittal including the plant corrected Job Mix Formula (JMF) for the hot mix asphaltic concrete.
- B. Certification that the aggregate materials meet appropriate quality requirements.
- C. Particle-size gradation and specific gravity tests on all aggregate materials.
- D. Certification that the asphalt cement for paving materials meet appropriate quality requirements.

340S.3 - Materials

The Contractor shall furnish materials to meet the requirements specified herein and shall be solely responsible for the quality and consistency of the product delivered to the Project.

- A. Aggregate: The aggregate shall be composed of coarse aggregate, a fine aggregate and, if required or allowed, mineral filler and reclaimed asphalt pavement (RAP). RAP use will be allowed in all base course mixtures except as specifically excluded herein, in the Contract Documents or on the Drawings, provided no more than 20% RAP is used.

RAP use will not be permitted in pavement surface courses.

Aggregates shall meet the quality requirements of Table 1 and other requirements as specified herein. The aggregate contained in RAP will not be required to meet Table 1 requirements unless indicated otherwise on the Drawings.

1. Coarse Aggregate: Coarse aggregate is defined as that part of the aggregate retained on the No. 10 (2.00 mm) sieve and shall consist of clean, tough, durable fragments of crushed stone or crushed gravel of uniform quality throughout.

Gravel from each source shall be crushed to the extent that it has a minimum of 85% of the particles retained on the No. 4 (4.75 mm) sieve with two or more mechanically induced crushed faces as determined by TxDOT Test Method TEX-460-A (Part I). The material passing the No. 4 (4.75 mm) sieve and retained on the No. 10 (2.00 mm) sieve must be the produced from crushing aggregate that was originally retained on the No. 4 (4.75 mm) sieve.

2. Reclaimed Asphalt Pavement (RAP): RAP is defined as a salvaged, milled, pulverized, broken or crushed asphaltic pavement. The RAP to be used in the mix shall be crushed or broken to the extent that 100 percent will pass the 2-inch (50 mm) sieve.

The RAP shall be stockpiled in such a manner that assures that it will not become contaminated by dirt or other objectionable materials. Unless indicated otherwise on the Drawings, stockpiled, crushed RAP must not exhibit a decantation more than 5 percent or a plasticity index more than

8, when tested in accordance with TxDOT Test Method Tex-406-A, Part I, or Test Method Tex-106-E, respectively.

3. **Fine Aggregate:** Fine aggregate is defined as that part of the aggregate passing the No. 10 (2.00 mm) sieve and shall be of uniform quality throughout. A maximum of 15 percent of the total aggregate may be field sand or other uncrushed fine aggregate.

Screenings shall be supplied from sources whose coarse aggregate meets the abrasion and magnesium sulfate soundness loss requirements shown in Table 1.

- a. Unless indicated otherwise on the Drawings, stone screenings, which are the product of a rock crushing operation, are required and shall meet the following gradation requirements when tested in accordance with TxDOT Test Method Tex-200-F, Part I.

Material	Percent by Weight (Mass)
Passing 3/8 inch (9.50 mm) sieve	100
Passing No. 10 (2.00 mm) sieve	70—100
Passing No. 200 (75 μ m) sieve	0—15

- b. Crushed gravel screenings may be used with, or in lieu of, stone screenings only when indicated on the Drawings. Crushed gravel screenings must be the product of crushing aggregate that was originally retained on the No. 4 (4.75 mm) sieve and must meet the gradation for stone screenings shown above.
4. **Mineral Filler:** Mineral filler shall consist of thoroughly dried stone dust, Portland cement, fly ash, lime or other mineral dust approved by the Engineer or designated representative. The mineral filler shall be free from foreign matter.

Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

Fly ash obtained from a source using a process fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

The addition of baghouse fines or other collected fines will be permitted if the mixture quality is not adversely affected in the opinion of the Engineer or designated representative. In no case shall the amount of material passing the No. 200 (75 μ m) sieve exceed the tolerances of the job-mix formula or the master gradation limits.

When tested by TEX-200-F (Part I or Part III, as applicable), the mineral filler shall meet the following gradation requirements. Baghouse fines are not required to meet the gradation requirements.

Material	Percent by Weight (mass)
Passing No. 30 (600 μ m) Sieve	95—100
Passing No. 80 (187.5 μ m) Sieve, not less than	75
Passing No. 200 (75 μ m) Sieve, not less than	55

TABLE 1: AGGREGATE QUALITY REQUIREMENTS *

Requirement	Test Method	Amount
COARSE AGGREGATE		
Deleterious Material, percent, maximum	Tex-217-F, I	1.5
Decantation, percent, maximum	Tex-217-F, II	1.5
Los Angeles Abrasion, percent, maximum	Tex-410-A	40
Magnesium Sulfate Soundness Loss 5 cycle, percent, maximum	Tex-410-A	30
FINE AGGREGATE		
Linear Shrinkage, maximum	Tex-107-E, II	3

COMBINED AGGREGATES		
Sand Equivalent Value, minimum	Tex-203-F	45

* - Aggregates, without added mineral filler or additives, combined as used in the job-mix formula (Plant Corrected).

B. Asphaltic Material:

1. Paving Mixture: Asphalt cement for the paving mixture shall conform to the requirements of Standard Specification Item No. 301S, "Asphalts, Oils and Emulsions", for AC-20 or PG64-22, Styrene (SBS) Modified Asphalt Cement, AC-SBS Blend AC-45P or PG76-22S, unless otherwise indicated in the Project Documents.
2. Tack Coat: Tack Coat shall conform to Standard Specification Item No. 307S, "Tack Coat".

C. Additives: Additives to facilitate mixing and/or improve the quality of the asphaltic mixture or tack coat may be used with the authorization of the Engineer or designated representative. The Contractor may choose to use either lime or a liquid anti-stripping agent to reduce moisture susceptibility of the aggregate.

340S.4 - Paving Mixtures

An asphalt mixture design is developed by a laboratory process, which includes the determination of the quality and quantity of the asphalt cement and the individual aggregates, and the testing of the combined mixture (Laboratory Design). The Laboratory Design is subsequently revised to produce an appropriate job mix formula.

The job mix formula (JMF) lists the quantity of each component to be used in the mix after the laboratory design has been adjusted by running it through a particular plant (i.e. the mix design is Plant Corrected). The JMF will be the standard to which the Acceptance Plan will be applied. The JMF of one drum or batching unit shall not be used for another unit.

The Contractor shall submit to the Engineer on forms provided by the Engineer or designated representative, an asphalt mixture design reviewed, signed and sealed by a Registered Professional Engineer licensed in the State of Texas or certified by a TxDOT Level II Certified Asphalt Technician. An asphalt mixture design shall be submitted for a comprehensive review every two (2) years. Mix designs older than one year will not be accepted without a review of current test data of the proposed materials and current mix design to ensure that the materials meet specification requirements.

The JMF (Plant Corrected) shall be submitted to the Engineer or designated representative on a form provided by the Engineer through the Construction Inspector or Project Manager of the Project for review, for each individual Project, a minimum of three (3) working days before the mixture is to be placed. Under no circumstances will a mixture be placed before its use is reviewed and approved by the Engineer or designated representative.

Performance of the mix design shall remain the responsibility of the Contractor.

- A. Mixture Design: The mix shall be designed in accordance with TxDOT Construction Bulletin C-14 and Test Method Tex-204-F to conform with the requirements herein. The master grading limits of the appropriate type and the JMF will be plotted on a graduated chart with sieve sizes raised to the 0.45 power and will be submitted to the Engineer or designated representative with the asphalt mixture design.

The Bulk Specific Gravity of aggregates in RAP will be determined on extracted aggregates.

- B. Types: The blend of coarse aggregate, fine aggregate, and mineral filler, if allowed, that is established by TxDOT Test Method Tex-200-F, Dry Sieve Analysis, shall conform to the master gradation shown in Table 2 for the type of specified mixture. The voids in the mineral aggregate (VMA) will be determined as a mixture design requirement only, in accordance with TxDOT Test Method Tex-207-F, and shall not be less than the value indicated in Table 2.

TABLE 2: Master Grading - Percent Passing by Weight (Mass) or Volume

Sieve Size US (SI)	Type A Coarse Base	Type B Fine Base	Type C Coarse Surface	Type D Fine Surface	Type F Fine Mixture
1½" (37.5 mm)	100				
1¼" (31 mm)	95—100				
1" (25 mm)		100			
7/8" (22 mm)	70—90	95—100	100		
5/8" (15.5 mm)		75—95	95—100		
½" (12.5 mm)	50—70			100	
3/8" (9.5 mm)		60—80	70—85	85—100	100
¼" (6.25 mm)					95—100
No. 4 (4.75 mm)	30—50	40—60	43—63	50—70	
No. 10 (2.00 mm)	20—34	27—40	30—40	32—42	32—42
No. 40 (425 µm)	5—20	10—25	10—25	11—26	9—24
No. 80 (187.5 µm)	2—12	3—13	3—13	4—14	3—13
No. 200 (75 µm)	1—6*	1—6*	1—6*	1—6*	1—6*

μm)					
VMA % minimum	11	12	13	14	15
Rec. Min. Lift	3" (75 mm)	2" (50 mm)	1¾" (70 mm)	1" (50 mm)	¾" (20 mm)

- C. Tolerances: Fluctuations in the aggregate gradation and asphalt content of the Job Mix Formula (JMF) shall not vary by more than the following criteria but the aggregate gradation shall be limited to the range of the master gradation as established by TEX-210-F.

SIEVES	Percent By Weight (Mass)
2" (50 mm) Sieve through No. 10" (2.00 mm) Sieve	±5.0
No. 40 (425 μm) through No. 200 (75 μm) Sieve	±3.0
Asphalt Content	±0.5

- D. Stability and Density: The mixture shall be designed at or near optimum density, as indicated on the Drawings, to conform to the following percent of Maximum Theoretical Density as measured by TxDOT Test Method TEX-227-F and Stability conforming to TxDOT Test Method TEX-208-F. The laboratory mixture shall be molded in accordance with TxDOT Test Method TEX-206-F and the Bulk Specific Gravity determined in accordance with TxDOT Test Method TEX-207-F.

	Optimum Laboratory Density (%)		Laboratory Density (%)		Stability
			Min.	Max.	
Local Streets Surface Courses	96	94.5	97.5	35 Min.	
Collectors & Arterials Surface Courses	96	94.5	97.5	40—60	
All Base Courses	96	94.5	97.5	35 Min.	

- E. Job Mix Formula Field Adjustments: The Contractor shall produce a mixture of uniform composition closely conforming to the reviewed JMF, that falls within the limits of the tolerances given above and the Acceptance Plan.

If it is determined by the City of Austin that adjustments to the JMF are necessary to achieve the specified requirements, the Engineer or designated representative may allow adjustments of the JMF within the following limits without a laboratory redesign of the mixture. The adjusted JMF shall not exceed the master grading criteria for the type of mixture specified. The proposed JMF adjustments shall not exceed 5 percent on any one sieve, ½-inch (12.5 mm) size and larger, or 3 percent on the sieve size below the ½-inch (12.5 mm) sieve of the JMF (Plant Corrected) reviewed for the Project.

When the proposed adjustments exceed either the 5 or 3 percent limits, and the Engineer or designated representative determines that the impact of these changes may adversely affect pavement performance, a new laboratory mixture design will be required.

The asphalt content may be adjusted with the concurrence of the Engineer or designated representative to maintain desirable laboratory density near the optimum value while achieving other mix requirements. However, increasing the asphalt content of the mixture in order to reduce pavement air voids will not be allowed. Also, if the percent air voids is determined to be less than 4 percent, adjustments shall be made to the plant production by the Contractor, within the tolerances as outlined above, so that an adequate air void level is attained.

340S.5 - Equipment

The trucks that deliver the hot mix asphalt concrete material to the project shall be of sufficient number to insure a continuous paving operation. All equipment used for the production, placement and compaction of the mixture shall be maintained in good repair and operating conditions to the satisfaction of the Engineer or designated representative. All equipment shall be made available for inspection. If the Engineer or designated representative expresses concern about the condition of any equipment, it shall not be used until it is repaired to the satisfaction of the Engineer or designated representative.

- A. Mixing Plants: Plants may be of the weigh-batch type, the modified weigh-batch type or drum-mix type equipped with suitable material conveyers, power units, mixing equipment, aggregate proportioning devices, dryers, bins, dust collectors and sensing and recording devices as appropriate for the mixing plant type. The mixing plants shall meet the requirements specified in Section 340.4, 'Equipment' of TxDOT Specification Item No. 340, "Hot Mix Asphaltic Concrete Pavement".
- B. Spreading and Finishing Paving Machine: The paving machine shall be self-propelled and equipped with a heated compacting screed capable of producing a finish surface meeting the requirements of the street cross-section indicated on the Drawings and all surface criteria. Extensions to the screed shall have the same heating and compacting capabilities as the primary unit, except for use on variable depth tapered areas and/or as approved by the Engineer or designated representative.

The paving machine shall be equipped with an approved automatic dual longitudinal screed control system and an automatic transverse screed control system. The longitudinal controls shall be capable of operating from any longitudinal grade reference including a string line, ski, mobile string line or matching shoe. Unless indicated otherwise on the Drawings, the Contractor may use any one of these grade references. The selected grade reference equipment shall be maintained in good operating condition by personnel trained in the use of the specific type of equipment.

The Contractor shall furnish all labor and equipment required for establishing and maintaining appropriate grade reference.

- C. Rollers: The Contractor shall select rollers conforming to Item 230S, "Rolling (Flat Wheel)" and Item 232S, "Rolling (Pneumatic Tire)". Rollers that do not conform to these requirements shall be immediately removed from the Project.

- D. **Motor Grader:** A self-propelled power motor grader may only be used when its use is approved by the Engineer or designated representative. It shall have a blade of not less than 12 feet (3.66 meters) and a wheelbase of not less than 16 feet (4.88 meters). Smaller graders may be used for small irregular areas when approved by the Engineer or designated representative.
- E. **Material Transfer Equipment:** Equipment for transferring the HMA mixture from the hauling units or the roadbed to the spreading and finishing machine will be allowed unless indicated otherwise on the Drawings.
- Windrow pick-up equipment, if permitted by the Engineer or designated representative, shall be constructed in such a manner that substantially all of the HMA mixture deposited on the roadbed is picked up and loaded into the spreading and finishing machine. The HMA mixture shall not be contaminated with foreign material. The loading equipment shall be designed so that it does not interfere with the spreading and finishing machine in obtaining the required line, grade and surface without resorting to hand finishing.
- F. **Straightedges and Templates:** The Contractor shall provide a ten-foot (3.05 meter) straightedge acceptable to the Engineer or designated representative for surface testing. Satisfactory templates shall be provided as required by the Engineer or designated representative.

340S.6 - Stockpiling Aggregates

Aggregates shall be stockpiled to facilitate blending. When the aggregate is not stockpiled on a hard, non-contaminant base, the bottom six-inch (150 mm) depth of the stockpiles shall not be used in asphaltic mixtures. Where space is limited at the plant site, the aggregate stockpiles shall be separated by walls or other appropriate barriers.

Aggregates shall be stockpiled and handled in a manner that will insure minimization of segregation and contamination. Aggregate and RAP stockpiles shall only contain material from a single source.

340S.7 - Mixture Temperature

The Contractor shall select a target temperature for discharge of the HMA mixture from the mixer between 250°F (120°C) and 350°F (176°C) that is suitable to weather and Project conditions. The target temperature shall be reported to the Engineer or designated representative daily and recorded in the Daily Progress Report. The HMA mixture temperature shall not vary by more than 25°F (14°C) from the target temperature for discharge from the mixer. HMA mixtures that are discharged from the mixer at a temperature exceeding 360°F (182°C) or a temperature more than 50°F (28°C) below the target temperature shall not be accepted and shall not be placed on the Project.

340S.8 - Mixture Storage

A surge-storage system may be used to minimize production interruptions during a normal day of operation. When approved by the Engineer or designated representative, overnight storage of HMA mixture in insulated storage bins may be used provided that material temperature and physical properties of the HMA mixture are not adversely affected. HMA mixtures that include hardened lumps shall not be used. Stored HMA mixtures shall not be exempt from any requirements provided in this specification.

When a surge-storage system is used, it shall be equipped with a device such as a gob hopper or other device approved by the Engineer or designated representative to prevent segregation in the surge-storage bin.

340S.9 - Mixture Moisture Content

Hot mix asphalt (HMA) mixtures produced from any plant shall not have a moisture content in excess of 1 percent by weight (mass) when discharged from the mixer. The moisture content shall be determined in

accordance with TxDOT Test Method Tex-212-F, Part II, except that the sample shall be left in the oven a total of not less than four (4) hours.

340S.10 - Construction Methods

- A. General: The Contractor shall be responsible for the production, transportation, placement and compaction of the specified HMA paving mixture to the requirements of this specification. The Contractor shall also be responsible for providing a safe environment for inspection personnel to inspect the equipment and to acquire samples.

All hot mix asphalt concrete pavement surface courses shall be placed with a spreading and finishing (lay-down) machine only. All hot mix asphalt concrete pavement base layers with the possible exception of the first lift of the base layer shall also be placed with a spreading and finishing (lay-down) machine. Longitudinal pavement joints shall be located under the proposed lane lines. Density tests shall be taken prior to opening to traffic.

The first lift of a base layer may be placed with a motor grader if approved in advance by the Engineer or designated representative. The loose measure thickness of this first lift shall not exceed 6 inches (150 mm). If placed with a motor grader, the first lift shall achieve a minimum in-place relative density of 89% as determined by TxDOT test procedures TEX-207-F and TEX-227-F. All subsequent lifts should be placed with a spreading and finishing (lay-down) machine and shall be subject to the requirements of Section 340S.12, "Acceptance Plan". Density tests will be taken randomly to confirm compliance with the specification requirements.

For hot mix asphalt overlays, an automatic screed shall be used with outriggers.

Any material delivered to the Project that by visual inspection can reasonably be expected not to meet specification requirements (i.e. segregated or burned material, deficient or excess asphalt, low mixing temperature, visible contaminants, etc.), as determined by the Engineer or designated representative, shall not be used or left in place.

Equipment shall be inspected prior to use and, if found to be defective or in an operating condition that could potentially affect the quality of the finished pavement, as determined by the Engineer or designated representative, its use shall not be allowed. Leakage of fuels, oils, grease, hydraulic or brake fluids or other contaminants onto the prepared surface or newly-laid HMA layer will not be allowed and may require replacement of the affected pavement area.

The HMA paving mixture, when placed with a spreading and finishing machine, shall not be placed when the air temperature is below 50°F (10°C) and is falling, but it may be placed when the air temperature is above 40°F (4°C) and is rising.

The paving mixture, when used as a level-up course or when spread with a motor grader, shall not be placed when the air temperature is below 60°F (15°C) and is falling, but it may be placed when the air temperature is 50°F (10°C) and is rising. An HMA layer with a thickness of 1½ inches (37.5 mm) and less shall not be placed when the temperature of the surface on which the layer is to be placed is below 50°F (10°C). The temperature shall be taken in a shaded area away from artificial heat.

Additional surface temperature requirements may be included in the Contract Documents or indicated on the Drawings.

Surfaces to be paved shall be finished, primed, cured, broomed and tacked, as appropriate, to the satisfaction of the Engineer or designated representative. If the surface on which the first course of the paving mixture is to be placed is a flexible base course, and a cut-back asphalt is to be used as a prime coat, the flexible base shall have been primed and cured a minimum of 24 hours before the paving mixture may be placed. The 24-hour restriction will not apply to a flexible base that has been

primed with material other than a cutback. However, the surface on which the tack coat and/or paving mixture are to be placed shall be in a dry condition.

Pavement shall be opened to traffic as soon as possible after temporary pavement markings or permanent markings are in place as indicated on the Drawings) or as directed by the Engineer or designated representative. Construction traffic allowed on pavements open to the public will be subject to all laws governing traffic on streets and highways.

- B. Tack Coat: The surface upon which the tack is to be placed shall be cleaned thoroughly to the satisfaction of the Engineer or designated representative. The surface shall be given a uniform application of tack coat as governed by Standard Specification Item No. 307S, "Tack Coat". The tack coat shall be applied, as directed by the Engineer or designated representative, with an approved sprayer at a rate not to exceed 0.05 gallons per square yard. (0.225 liters per square meter) of surface area. Where the paving mixture will adhere to the surface on which it is to be placed without the use of a tack coat, the tack coat may be eliminated when approved by the Engineer or designated representative. All contact surfaces of curbs, castings and all structures and all joints shall be painted with a thin uniform application of tack coat.

During the application of tack coat, care shall be taken to prevent splattering of adjacent pavement, curb and gutter and structures. Before the Work can be accepted, all splatter shall be removed by the Contractor at the Contractor's expense.

- C. Transporting Hot Mix Asphaltic (HMA) Concrete: The HMA mixture shall be hauled to the Work site in tight vehicles that were previously cleaned of all foreign material. Dispatching of the vehicles shall normally be arranged so that all material delivered is placed and all rolling completed during daylight hours. Nighttime paving may be allowed, when approved in advance by the Engineer or designated representative.

In cool weather or for long hauls, truck bodies containing the HMA mixture shall be covered.

If necessary, to prevent the HMA mixture from adhering to the truck body, the inside of the truck may be given a light coating of a release agent satisfactory to the Engineer or designated representative.

- D. HMA Placement: The HMA mixture shall be dumped and spread on the approved prepared surface with the spreading and finishing machine. When properly compacted, the finished pavement shall be smooth, of uniform texture and density and shall meet the requirements of the typical cross sections and the surface tests. In addition the placement of the HMA mixture shall be done without tearing, shoving, gouging or segregating the mixture and without producing streaks in the HMA layer.

Discharge of the HMA mixture into the finishing machine shall be controlled so that the spreading and finishing machine is not bounced or jarred and the required lines and grades shall be obtained without resorting to hand finishing except as permitted below in this Section.

Unless indicated otherwise on the Drawings, dumping of the HMA material in a windrow and then placing the HMA mixture in the finishing machine with windrow pick-up equipment will be permitted provided the temperature of the HMA mixture does not drop more than 50°F (28°C) below the target temperature before being placed by the finishing machine.

Under no circumstances will the HMA material be permitted to be dumped on or near the job site and then reloaded for hauling to the site of placement. Exceptions may be allowed if approved by the Engineer or designated representative.

The windrow pick-up equipment shall be operated in such a manner that substantially all the mixture deposited on the roadbed or prepared surface is picked up and loaded into the finishing machine without contamination by foreign material. The windrow pick-up equipment will also be so operated that the finishing machine will obtain the required line, grade and surface without resorting to hand finishing. Any operation of the windrow pick-up equipment resulting in accumulation and subsequent shedding of accumulated material into the HMA mixture will not be permitted.

When approved by the Engineer or designated representative, level-up courses may be spread with a motor grader that meets the requirements of this specification item.

The spreading and finishing machine shall be operated at a uniform forward speed consistent with the plant production rate, hauling capability and roller train capacity to result in a continuous operation. Stopping of the spreading and finishing machine between trucks is to be held to a minimum. If, in the opinion of the Engineer or designated representative, delivery of material is adversely affecting the condition of the HMA layer (excessive stopping of the spreading and finishing machine, loss of mixture temperature, etc.), the Engineer or designated representative may require paving operations to cease until acceptable methods are provided to minimize starting and stopping of the spreading and finishing machine.

The hopper gates of the spreading and finishing machine shall be adjusted to provide an adequate and consistent flow of material. This shall result in enough material being delivered to the augers so that they are operating approximately 85 percent of the time or more. The augers shall provide means to supply adequate flow of material to the center of the paver. Augers shall supply an adequate flow of material for the full width of the mat being placed, as approved by the Engineer or designated representative. Augers should be kept approximately one-half to three-quarters full of HMA mixture at all times during the paving operation.

When the HMA mixture is placed in a narrow strip along the edge of an existing pavement, or is used to level up small areas of an existing pavement or is placed in small irregular areas where the use of a finishing machine is not practical, the finishing machine may be eliminated when permitted by the Engineer or designated representative.

The paving material adjacent to castings and flush curb and gutter and structures shall be finished uniformly high so that when compacted, it will be slightly above but not more than 1/8 inch (3 mm) above the edge of the casting or gutter lip.

Construction joints of successive courses of HMA material shall be offset at least 6 inches (150 mm). Longitudinal joints in the layer shall be placed to coincide with lane lines as directed the Engineer or designated representative. Transverse joints shall be offset a minimum of 5 feet (1.5 meters).

- E. Compaction: The pavement layers/lifts shall be compacted thoroughly and uniformly to obtain the compaction and cross section meeting the requirements indicated on the Drawings and this specification item.

Regardless of the method used for compaction, all rolling to achieve specified density shall cease before the temperature of the HMA mixture drops below 175°F (80°C).

Rolling with a pneumatic tire roller shall be used to seal the surface. Rolling with a tandem or other steel-wheel roller shall be provided if required to iron out any roller marks. Surface sealing and removal of roller marks may be accomplished at HMA temperatures below 175°F (80°C).

Vibratory rollers shall not be allowed in the vibrating mode on layers with a plan thickness less than 1½ inches (37.5 mm).

The motion of the rollers shall be slow enough to avoid other than usual initial displacement. If any displacement occurs, it shall be corrected to the satisfaction of the Engineer or designated representative.

The roller shall not be allowed to stand on pavement, which has not been compacted to minimum density requirements. In order to prevent adhesion of the surface mixture to the steel-wheel rollers, the wheels shall be thoroughly moistened with water; however an excess of water will not be allowed. Necessary precautions shall be taken to prevent the dropping of diesel, gasoline, oil, grease or other foreign matter on the pavement, either when the rollers are in operation or when standing.

The edges of the pavement along curbs, headers and similar structures, and all places not accessible to the roller, or in such positions as will not allow thorough compaction with the rollers, shall be thoroughly compacted with lightly oiled tamps.

Rolling with a trench roller will be required on widened areas, in trenches and other limited areas where satisfactory density cannot be obtained with the approved rollers.

340S.11 - Sampling and Testing

The HMA mixture shall be tested daily at the Project site for conformance to specification requirements. The Engineer or designated representative shall utilize a random selection method to determine sample locations based on the Contractor's anticipated production. Each day's anticipated production shall be divided into three (3) essentially equal single-pass, sub-area lots. Each day's sample locations shall be equally distributed over the three (3) sub-areas. If, due to the weather or plant malfunctions, the Contractor's daily-anticipated production is not attained, the random locations will not be recalculated. Also, no more than one location of the three (3) sub-areas shall be located in an irregular shaped area such as a cul-de-sac.

Unless directed otherwise by the Engineer or designated representative, a minimum of three bag samples and three correlating 6-inch (150-mm) cores will be obtained from each day's production.

Bag samples shall be taken during lay-down operations. The primary sampling point for the bag samples shall be from the windrow if a windrow elevator is used. If a windrow elevator is not used, the sample shall be taken from the middle of the paving machine hopper. This sampling location will require a stoppage in the paving operation in order for the Inspector to safely secure a sample from the hopper. One core shall be taken for every 2,000 single-pass square yards (1,675 single-pass square meters) with a minimum of three (3) cores for all projects. One core shall be taken at the same station and pass sampled for each of the bag samples. Cores shall be taken by the City's laboratory within 48 hours of pavement laydown unless otherwise directed by the Engineer or designated representative.

For total areas of less than 500 square yards (420 square meters), a total of only two bag samples and two correlating cores will be obtained. If the Contractor desires additional testing, it shall be at its own entire expense.

The Engineer or designated representative may alter, increase or waive the testing schedule to ensure that the Work performed and the material used meet specification requirements. Acceptability of the completed pavement shall be based on the average of test results for the Project as defined in Section 340S.12, "Acceptance Plan" of this item.

Gradation, asphalt content and stability value of the HMA mixture shall be reported for each of the bag samples. The stability value reported for each of the bag samples shall be the average of three (3) tests per bag.

Pavement thickness and density shall be determined from 6-inch (150 mm) field cores. For each day's placement, density of cores for which no corresponding bag samples were taken shall be determined by using the average Maximum Theoretical Density of the day's three (3) bag samples or as may otherwise be determined by the Engineer or designated representative.

When, in the opinion of the Engineer or designated representative, test results appear unrepresentative, additional testing may be authorized. The retesting will be at the expense of the Contractor and the results of the retesting shall be averaged with the results of the original testing. If the results of retesting indicate that the original test results were erroneous, the original test results will be discarded. In the instance of erroneous original test results the subsequent first set of retests will be at the expense of the City of Austin.

Pavements with low-density results may be recored; but the pavement shall not receive any additional compactive effort.

Pavements that will not or cannot be cored within 48 hours shall be closed to both public and construction traffic.

340S.12 - Acceptance Plan

For the purpose of the Acceptance Plan only, the "Paving Project" of each of the specified mixture types shall be defined by the Engineer or designated representative before the paving operation begins

Considerations for defining the Paving Project shall include paving operations staged due to traffic considerations, pavement structural section (i.e. with varying layer thicknesses), time required for paving, changes to the Job Mix Formula, phasing of large projects, or other factors affecting the consistency in the production, lay-down/compaction, use of completed portions, and/or aging of in-place material.

Acceptability of the completed pavement structure for a Paving Project shall be based on all daily averages of three test results and when approved by the Engineer or designated representative the overall average of all test results for each of the mixture/layer types specified on the Drawings.

Pay adjustments for two or more acceptance factors shall be accumulative. Pay adjustments of 100% unit price reduction shall require removal and replacement of the Work. Replacement materials shall be subject to all requirements of this specification. Alternatively, the Engineer or designated representative may allow the Work to remain in place without payment provided that the Work is warranted for an extended period under conditions as determined by the Engineer or designated representative. The decision of the Engineer or designated representative related to the removal and replacement of the Work shall be the final authority.

A. Non-Pay-Adjustment Acceptance Factors:

1. Surface Characteristics: Unless otherwise directed by the Engineer or designated representative, all pavements shall be tested for smoothness. Surfaces shall be tested with a 10-foot (3.05 meter) straightedge parallel to the roadway centerline and perpendicular to the centerline on flat, cross-slope sections. Maximum allowable deviation in 10 feet shall be 1/8 inch (1-mm per meter) parallel to the centerline and 1/4 inch (2-mm per meter) perpendicular to the centerline. Sections exceeding these maximums shall be corrected to the satisfaction of the Engineer or designated representative. The completed surface must meet the approval of the Engineer or designated representative for surface smoothness, finish and appearance.

If the surface ravels, ruts or deteriorates in any manner prior to the end of the warranty period, it will be the Contractor's responsibility to correct this condition at its own entire expense to the satisfaction of the Engineer or designated representative in conformance with the requirements of this specification.

For HMAC rehabilitation and overlay projects, if cracks develop in the pavement surface within the one-year warranty period, the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)".

For new HMAC roadways constructed in accordance with the Drawings and specifications, if cracks less than 1/4 inch (6 mm) in width develop in the pavement surface within the one year warranty period the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)".

If cracks equal to or greater than 1/4 inch (6 mm) in width develop in the pavement surface within the one-year warranty period, the cracking shall be reviewed and evaluated by the Engineer or designated representative before corrective action is taken.

2. Stability: Stability test results shall be used as indicators of potential problems. Where stability test results fall below the range specified in this specification, additional tests shall be taken as directed by the Engineer or designated representative for further evaluation and monitoring of

the paving mixture. This additional stability testing will be at the expense of the Contractor. When, in the opinion of the Engineer or designated representative, the stability is deemed unacceptable for the intended use of the pavement, the paving mixture shall be removed and replaced to the limits indicated by test results or may be left in place on conditions acceptable to the Engineer or designated representative. When the paving mixture is removed and replaced, it shall be at the sole expense of the Contractor.

3. Laboratory Density: Laboratory density results as determined by TxDOT Test Method Tex-207-F shall be used as indicators of potential problems. Where laboratory density test results are less than 94.5% or more than 97.5% of mix design maximum density, additional tests shall be taken as directed by the Engineer or designated representative for further evaluation and monitoring of the paving mixture. This additional laboratory density testing will be at the expense of the Contractor. When, in the opinion of the Engineer or designated representative, the laboratory density is deemed unacceptable for the intended use of the pavement, the paving mixture shall be removed and replaced to the limits indicated by test results.

The removal and replacement of the paving mixture shall be at the sole expense of the Contractor.

4. Limited Areas: Irrespective of an acceptable overall Paving Project average for any or all of the Pay-Adjustment Acceptance Factors, limited substandard portions of the Work, as determined by the Engineer or designated representative, shall be remedied or removed and replaced to the satisfaction of the Engineer or designated representative at the sole expense of the Contractor.

- B. Pay-Adjustment Acceptance Factors: Contract unit prices shall be adjusted for paving mixtures that fail to meet acceptance criteria for gradation, asphalt content, density and mat thickness in accordance with the following:

Gradation Acceptance Schedule (TEX-210-F)

Sieve	Deviation From Job Mix Formula		Percent Contract Unit Price Reduction
	Daily Average	Overall Average	
Total retained on No. 10 (2.00 mm)	±6.5	±5.0	0
	6.6±	5.1±	10
Passing No. 200 (75 µm)	±3.9	±3.0	0
	4.0±	3.1±	5

Asphalt Content Acceptance Schedule (TEX-210-F, Part II)

Deviation from the Job Mix Formula		Percent Contract Unit Price Reduction	
Daily Average	Overall Average	Local Streets*	All Others

±0.5	±0.4	0	0
±0.51 to ±0.60	±0.41 to ±0.50	15	25
+0.61 to +0.70	+0.51 to +0.60	25**	100; Remove and Replace
-0.61 to -0.70	-0.51 to -0.60	100: Remove and Replace	100; Remove and Replace
Over ±0.70	Over ±0.60	100: Remove and Replace	100; Remove and Replace
*A local or residential street that serves as access to residence or other abutting property.			
**If the street has an ADT of 500, or less, with 1%, or less, of truck traffic, plus a 2 year warranty; otherwise, Remove and Replace			

Density Acceptance Schedule (TEX-207-F/TEX-227-F)

*Percent Density		Percent Contract Unit Price Reduction	
Daily Average	Overall Average	1½" (38 mm) Thickness or Greater	Less than 1½" (38 mm) Thickness
Above 96.5	Above 96	100; Remove and Replace	100; Remove and Replace
90.5 to 96.5	91 to 96	0	0
90.5 to 87.6	90.9 to 88.1	0.625 per 0.10% deficiency in density	0.50 per 0.10% deficiency in density
Less than 87.6	Less than 88.1	100: Remove and Replace	100; Remove and Replace
*Core bulk density divided by max. theoretical density			

Thickness Acceptance Schedule

Variance Percent of Thickness		Percent Contract Unit Price Reduction
Daily Average	Overall Average	
0—15.0	0—10	0
15.1—20.0	10.1—16	20
20.1—30.0	16.1—25	50
Over 30.0	Over 25	100; Remove and Replace or mill/overlay 1" (25 mm) minimum

The Density Acceptance Schedule For Irregularly Shaped Areas; Hike And Bike Trails And Utility Trenches (see following table) will apply to utility trenches of widths less than 4 feet (1.2 meter) and to irregular shaped areas and hike and bike trails in which an appropriate rolling pattern cannot be established making it difficult to achieve compaction.

Density Acceptance Schedule For Irregularly Shaped Areas; Hike And Bike Trails and Utility Trenches (TEX-207-F/TEX-227-F)

*Percent Density	Percent Contract Unit Price Reduction	
Daily Average	1½" (38 mm) Thickness or Greater	Less than 1½" (38 mm) Thickness
Above 96.5	100; Remove and Replace	100; Remove and Replace
96.5 to 89.0	0	0
89.0 to 86.1	0.625 per 0.10% deficiency in density	0.50 per 0.10% deficiency in density
Less than 86.1	100; Remove and Replace	100; Remove and Replace
*Core bulk density divided by maximum theoretical density		

The Density Acceptance Schedule will apply to utility trenches 4 feet (1.2 meter) or wider.

Core thicknesses greater than Drawing requirements shall be factored into the average thickness calculation as the Drawing required thickness. If total thickness of lift(s) proves to be less than required, the Contractor may remove and replace the overlay deficient areas as agreed to by the Engineer or designated representative. Overlays to correct thickness deficiencies shall be not less than one (1) inch (25-mm) thick. Overlays shall require milling of the asphalt in order to prevent a "featheredge" of the overlaying pavement.

The extent of the area to be overlaid or removed and replaced shall be determined by additional cores with thicknesses greater than or equal to the required thickness. All additional coring that is necessary to determine the area shall be paid for by the Contractor.

340S.13 - Measurement

Work performed and material placed shall be measured under one of the following methods. When Drawing quantity measurement is specified, adjustment of quantity may be made as follows. If the quantity measured as outlined vary from those shown on the Drawings by more than 5%, either party to the Contract may request in writing and adjustment of the quantity by each separate bid item. The party to the Contract which requests the adjustment shall present to the other party one copy of measurements and calculations showing the revised quantity in question. This revised quantity, when approved by the Engineer or designated representative, shall constitute the final quantity for which payment will be made. However, no adjustment will be made for any quantity, which exceeds the Drawing required thickness.

- A. Method A: Asphaltic concrete pavement shall be measured by the ton (2,000 pounds) of the type actually used in completed and accepted Work in accordance with the Drawings and specifications.

The measurement shall be made on approved truck scales that meet the requirements of the National Institute of Standards and Technology Handbooks 44 and 112 except that the required accuracy shall be 0.4 percent of the load being weighed. The Contractor shall furnish a report of calibration from a scale mechanic licensed by the Texas Department of Agriculture certifying that the scales meet this requirement.

- B. Method B: Asphaltic concrete pavement shall be measured by the square yard of specified total thickness of the type of paving mixture actually used in completed and accepted Work in accordance with Drawings and specifications. Multiple lifts of the same type shall be considered as one for square yard measurement purposes.
- C. Method C: Asphaltic concrete pavement shall be measured by the lineal foot of specified total thickness of the type of paving mixture actually used in completed and accepted Work in accordance with Drawings and specifications. Multiple lifts of the same type shall be considered as one for linear foot measurement purposes.

340S.14 - Payment

Work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid prices or pay adjusted unit price for Hot Mix Asphaltic Concrete Pavement, of the types and thicknesses specified. The unit bid prices shall include full compensation for furnishing all labor, equipment, time, materials and incidentals necessary to complete the Work.

Removal of existing hot mix asphalt concrete transition areas prior to overlay, tack coat, saw cutting and temporary pavement markings will not be measured or paid for directly but shall be included in the unit price bid for Standard Specification Item No. 340S, "Hot Mix Asphaltic Concrete Pavement."

Payment for Work meeting these specifications will be made under one of the following:

Pay Item No. 340S-A:	Hot Mix Asphaltic Concrete Pavement, Type ___,	Per Ton
Pay Item No. 340S-B:	Hot Mix Asphaltic Concrete Pavement, ___ inches, Type ___.	Per Square Yard.
Pay Item No. 340S-C:	Hot Mix Asphaltic Concrete Pavement, ___ Inches, Type ___.	Per Lineal Foot.
Pay Item No. 340S-PQ:	Hot Mix Asphaltic Concrete Pavement, ___ Inches, Type ___, Plan Quantity	Per Ton.
Pay Item No. 340S-L:	Hot Mix Asphaltic Concrete Pavement, ___ in., Type ___, Level-up Course.	Lump Sum
Pay Item No. 340S-M:	Crack Sealing Mobilization,	Lump Sum

Pay Item No. 340S-S:	Crack Sealing,	per Lineal Foot
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Special Specification Item 340S, "Hot Mix Asphaltic Concrete Pavement"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 301S	Asphalts, Oils and Emulsions
Item No. 307S	Tack Coat
Item No. 313S	Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-106E	Method of Calculating the Plasticity Index of Soils
Tex-107E	Determination of Bar Linear Shrinkage of Soils
Tex-200-F	Sieve Analysis of Fine and Coarse Aggregates
Tex-203-F	Sand Equivalent Test

Tex-204-F	Design of Bituminous Mixtures
Tex-207-F	Determination of Density of Compacted Bituminous Mixtures
Tex-208-F	Test for Stabilometer Value of Bituminous Mixtures
Tex-210-F	Determination of Asphalt Content of Bituminous Mixtures by Extraction
Tex-212-F, Part II	Determination of Moisture Content of Bituminous Mixtures (by oven drying)
Tex-217-F	Determination of Deleterious Material and Decantation Test For Coarse Aggregates
Tex-227-F	Theoretical Maximum Specific Gravity of Bituminous Mixtures
Tex-410-A	Abrasion of Coarse Aggregate Using the Los Angeles Machine
Tex-460-A	Determination of Crushed Face Particle
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 340	Hot Mix Asphalt Concrete Pavement

RELATED CROSS REFERENCE MATERIALSSpecial Specification Item 340S, "Hot Mix Asphaltic Concrete Pavement"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 206S	Asphalt Stabilized Base

Item No. 210S	Flexible Base
Item No. 306S	Prime Coat
Item No. 310S	Emulsified Asphalt Treatment
Item No. 311S	Emulsified Asphalt Repaving
Item No. 320S	Two Course Surface Treatment
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-215-F	Determination of Asphalt Content of Rock Asphalt By Hot Solvent Method
Tex-224-F	Determination of Flakiness
Tex-400-A	Method of Sampling Stone, Gravel, Sand and Mineral Aggregates
Tex-411-A	Soundness of Aggregate by Use of Sodium Sulfate or magnesium Sulfate
Tex-438-A	Accelerated Polish Test for Aggregate

ITEM NO. 360S - CONCRETE PAVEMENT 9-26-12**360S.1 - Description**

This item shall consist of a pavement and/or base of Portland Cement concrete, with or without reinforcement as indicated on the Drawings, with or without monolithic curbs, constructed as herein specified, on prepared subgrade or base course in conformity with the thickness and typical cross sections indicated on the Drawings. Concrete to be considered of satisfactory quality provided it is made (a) of materials accepted for job, (b) in the proportions established by the Contractor and (c) mixed, placed, finished and cured in accordance with the requirements of this specification.

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

P360S.2 - Submittals

The submittal requirements of this specification item may include:

- A. Mix design option(s) of the class of concrete required on the project,
- B. The supplier of the concrete mix design(s) and type of mixing equipment, and
- C. Type of admixtures to be used with the concrete mixes.

360S.3 - Materials**A. Cementitious Materials**

Portland cement shall conform to ASTM C 150, Type I (General Purpose) and Type III (High Early Strength). Type III cement shall be used when high early strength concrete is indicated on the Drawings. If the use of high early cement is not specified and the Contractor desires to use it, the Contractor shall obtain written permission from the Engineer or designated representative prior to its use and shall assume all additional costs incurred by the use of such cement. All cement shall be of the same type and from the same source for a project unless written permission is 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 than 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 or project manual. Fly ash shall conform to the requirements of Item No. 405S, "Concrete Admixtures."

B. Admixtures

Concrete admixtures conforming to Item No. 405S, "Concrete Admixtures" may be used when approved by the Engineer or designated representative to minimize segregation, improve workability, reduce the amount of mixing water and to provide normal hot weather concreting provisions. The use of admixtures shall not alter the approved mix designs, except for water content.

C. Coarse Aggregate

Coarse aggregate shall consist of durable particles of gravel, crushed blast furnace slag and/or crushed stone of reasonably uniform quality throughout, free from injurious amounts of salt, alkali, vegetable matter or other objectionable material, either free or as an adherent coating on the aggregate. It shall not contain more than 0.25 percent by weight of clay lumps nor more than 1.0 percent by weight of shale nor more than 5.0 percent by weight of laminated and/or friable particles when tested in accordance with TxDOT Test Method Tex-413-A.

Coarse aggregate shall have a wear of not more than 45 percent when tested according to TxDOT Test Method Tex-410-A and when tested by standard laboratory methods shall meet the following grading requirements:

Retained on 1¾ inch (43.75 mm) sieve	0%
Retained on 1½ inch (37.5 mm) sieve	0 to 5%
Retained on ¾ inch (19.0 mm) sieve	30 to 65%
Retained on 3/8 inch (9.5 mm) sieve	70 to 90%
Retained on No. 4 (4.75 mm) sieve	95 to 100%

Loss by Decantation TxDOT Test Method *Tex-406-A. 1.0% Maximum

* In the case of aggregate made primarily from crushing of stone. If the material finer than the 200 sieve is definitely established to be the dust of fracture essentially free from clay or shale as established by Part III of TxDOT Test Method Tex-406-A, the percent may be increased to 1.5.

When the plans do not require a monolithic pour of curb or curb and gutter, the Contractor may elect to use the following gradation of coarse aggregate for curb or curb and gutter:

Retained on 1½ inch (37.5 mm) sieve	0%
Retained on 3/8 inch (9.5 mm) sieve	5 to 30%
Retained on No. 4 (4.75 mm) sieve	75 to 100%

Where the coarse aggregate is delivered on the job in 2 or more sizes or types, each type and/or size shall be batched and weighed separately.

All aggregates shall be handled and stored in such a manner as to prevent size segregation and contamination by foreign substances and maintain as nearly as possible in a uniform condition of moisture. When segregation is apparent, the aggregate shall be remixed with suitable equipment as required. At time of its use, the aggregate shall be free from frozen material and aggregate containing foreign materials will be rejected. Coarse aggregate that contains more than 0.5 percent free moisture by weight shall be stockpiled for at least 24 hours prior to use.

Adequate storage facilities shall be provided for approved materials. The intermixing of non-approved materials with approved materials either in stockpiles or in bins will not be permitted. Aggregates from different sources shall be stored in different stockpiles unless otherwise approved by the Engineer or designated representative.

D. Fine Aggregate

Fine aggregate shall be free from injurious materials of salt, alkali or vegetable matter. It shall not contain more than 0.5 percent by weight of clay lumps. When subjected to the color test for organic impurities, TxDOT Test Method Tex-408-A, the fine aggregate shall not show a color darker than standard.

Unless shown otherwise on the drawings, fine aggregate shall have an acid insoluble residue of at least 60% by weight when tested in accordance with Tex 612-J.

Unless specified otherwise, fine aggregate shall meet the following grading requirements:

Retained on 3/8 inch (9.5 mm) sieve	0%
Retained on No. 4 (4.75 mm) sieve	0 to 5%
Retained on No. 8 (2.36 mm) sieve	0 to 20%
Retained on No. 16 (1.185 mm) sieve	15 to 30%
Retained on No. 30 (600 μ m) sieve	35 to 75%
Retained on No. 50 (300 μ m) sieve	70 to 90%
Retained on No. 100 (150 μ m) sieve	90 to 100%
Retained on No. 200 (75 μ m) 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 μ m) sieve	0%
Retained on No. 200 (75 μ m) sieve	0 to 35%

Where fine aggregate is delivered to the job in 2 or more sizes or types, each type and/or size of material shall be batched and weighed separately. Where mineral filler is used, it shall be batched and weighed separately. At the time of its use the fine aggregate shall be free from frozen material and aggregate containing foreign material will be rejected.

All fine aggregate shall be stockpiled for at least 24 hours prior to use.

F. Mixing Water

Water for use in concrete and for curing shall be free from oils, acids, organic matter or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl nor more than 1,000 parts per million of sulfates as SO₄.

Water from municipal supplies approved by the State Health Department will not require testing. Contractor shall sample and test water from other sources and submit test results to the Engineer or designated representative for approval 10 days prior to proposed use.

Tests shall be made in accordance with "Standard Method of Test for Quality of Water to be used in Concrete," AASHTO Method T-26.

G. Transit-mixed Concrete

The use of transit-mixed (ready-mixed) concrete will be permitted by the Engineer or designated representative provided the batching plant and mixer trucks meet requirements of quality specified herein.

When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the drum of the mixer or agitator truck. Delivery of concrete to the site of the work and its discharge from the truck mixer, agitator or non-agitating equipment shall be in accordance with the requirements of Item No. 410S, "Concrete Structures."

Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

1. A ticket system will be used that includes a copy for the construction inspector. The ticket will have machine stamped time/date of the concrete batch, weight of cement, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on the ticket may be cause for rejection of the concrete.
2. Sufficient trucks will be available to support continuous slab placements. The Contractor will satisfy the Engineer or designated representative that adequate standby trucks are available to support monolithic placement requirements.
3. A portion of the mixing water, required by the batch design to produce the specified slump, may be withheld and added at the job site but only with the permission of the Engineer or designated

representative and under the Inspector's observation. When water is added under these conditions, it will be thoroughly mixed before any slump or strength samples are taken.

H. Joint Sealer

Unless otherwise shown on the plans, joint sealant for concrete pavement used on airport runways and/or taxiways shall be TxDOT Class 5. All other joint sealant shall be TxDOT Class 2.

As a minimum, the joint sealant shall comply with the following. The manufacturer of the joint sealant shall furnish certification that the product to be supplied meets or exceeds the specification.

1. Class 2 (Hot Poured Rubber-Asphalt). This sealer shall conform to Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)". The sealer must be compatible with asphaltic concrete.
2. Class 5 (Low Modulus Silicone Sealant for Concrete Pavement). This material shall conform to Item 413S, "Cleaning and/or Sealing Joints and Cracks (PCC)" and shall be furnished in a one-part silicone formulation, which does not require a primer for bond to concrete. A backer rod shall be required which will be compatible with the sealant. No bond or reaction shall occur between the rod and sealant. The sealant shall adhere to the sides of the concrete joint. It shall not crack or break when exposed to temperatures below 32°F (0°C).

The sealant material shall have the following properties:

Color	Gray
Flow, MIL-2-8802D, Sec 4.8.4, max	0.2
Working time, minutes	10
Tack-free time at 77°F ±2°F (25°C ±1.1°C), MIL-2-8802D	
Sec 4.8.7, minutes	60
Cure time at 77°F (25°C), days	7—14
Full Adhesion, days	14—21

As Cured - after 7 days at 77°F (25°C) and 40% Relative Humidity

Elongation, minimum percent	1200
Durometer Hardness, Shore A, ASTM D 2240, min	15
Joint movement capability, percent	+100/-50

Tensile Strength, maximum elongation, percent	100
Peal strength, psi	25 (172 kPa)

I. Backer Rod

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

J. Joint Filler

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

Board shall be obtained from Redwood, Cypress, Gum, Southern Yellow Pine or Douglas Fir timber. They shall be solid heartwood and shall be free from sapwood, knots, clustered birdseye, checks and splits. Occasional sound or hollow birdseye, when not in clusters, will be permitted provided the board is free from any other defects that will impair its usefulness as a joint filler. With the exception of Redwood and Cypress, all boards shall have a creosote or pentachlorophenol treatment of 6 pounds per cubic foot (96 kg/m³). When oven dried at 230°F (110°C) to a constant weight, the weight of the board per cubic foot (minus treatment), shall not be less than 20 pounds nor more than 35 pounds (not less than 320 nor more than 561 kgs per cubic meter).

K. Asphalt Board

Asphalt board when used as indicated shall be of required size, full depth of concrete placement and uniform thickness. When used in transverse joints, it shall conform approximately to shape of the pavement crown as indicated. Asphalt board shall consist of 2 liners of 0.016-inch (0.4 mm) asphalt impregnated paper filled with a mastic mixture of asphalt and vegetable fiber and/or mineral filler. Boards shall be smooth, flat and straight throughout and shall be sufficiently rigid to permit easy installation. Boards that crack or shatter during installing and finishing operations will not be acceptable. Board shall be furnished in lengths equal to ½ the pavement width or in lengths equal to the width between longitudinal joints and may be furnished in strips or scored sheets of the required shape. When tested in accordance with TxDOT Test Method Tex-524-C the asphalt boards shall not deflect from the horizontal more than ¾ inch in 3½ inches (19.3 cm in 90 cm). The asphalt board shall be placed such that they will not interfere with the bonding of the joint sealer.

L. Load Transmission Devices for Expansion and Contraction Joints

Approved load transmission devices, when indicated, shall meet the requirements specified herein:

Smooth steel bar dowels, used when indicated, shall be of the size and type indicated and shall be open-hearth, basic oxygen or electric-furnace steel conforming to the properties specified for grade 60 in ASTM A 615. The free end of dowel bars shall be smooth and free of shearing burrs.

When indicated, one end of each dowel bar shall be encased in an approved cap having an inside diameter of 1/16 inch (16 mm) greater than the diameter of the dowel bar. The cap shall be of such strength, durability and design as to provide free movement of the dowel bar and shall be approved by the Engineer or designated representative prior to use. One end of the cap shall be filled with a soft felt plug or shall be void in order to permit free movement of the dowel bar for a distance equivalent to 150 percent of the width of the expansion joint used. The dowel caps and dowel bars shall be held securely in place by bar ties as indicated on the drawings. Mechanical methods of

implanting dowel bars in the plastic concrete may be used when approved by the Engineer or designated representative.

Where required, dowel bars shall be coated with a plastic material meeting the requirements indicated.

Where red lead and oil bar coating is indicated, the red lead may be of any standard commercial grade and the oil shall be clean and no lighter than Standard No. 30 SAE grade. Approved thinner and dryer may be added to the red lead, but the material upon application shall be of such consistency that will provide a uniform and heavy coating on the bar. Where asphalt bar coating is indicated, the material may be any standard grade of oil asphalt and shall be applied hot. Cutback asphalt will not be permitted for bar coating.

M. Metal Installing Devices for Joint Assembly

Metal installing devices for expansion and contraction joint assemblies (such as welded wire bar chairs, bar stakes and marker channels, channel caps, etc.) shall be as indicated or may be similar devices of equivalent or greater strength, approved by the Engineer or designated representative, that will secure joint assembly in correct position during the placing and finishing of concrete. Load transmission devices used in joint assemblies shall be secured in position by a transverse metal brace of the type and design indicated or may be secured in position by other approved devices of equivalent or greater strength that will provide positive mechanical connection between the brace and each unit (or than by wire tie) and prevent transverse movement of each load transmission device.

N. Steel Reinforcement

Steel reinforcing bars as required including tie bars shall be open-hearth, basic oxygen or electric-furnace new billet steel of Grade 60 or Grade 40 for concrete reinforcement as indicated. Bars that require bending shall be Grade 40 conforming to the requirements of ASTM A 615.

High yield reinforcing steel shall be either (a) open-hearth, basic oxygen or electric-furnace new billet steel conforming to ASTM A 615 Grade 60 or (b) rail steel bars for concrete reinforcement, conforming to ASTM A 616 Grade 60. Bars produced by piling method will not be accepted. High yield reinforcing steel bars shall be further identified by a special marking rolled into each bar. All reinforcing steel shall be deformed bars conforming to the requirements of pertinent ASTM Specifications.

Where prefabricated deformed wire mats are indicated or permitted, the wire shall be cold worked deformed steel wire conforming to the requirements of ASTM A 496, except that steel shall be made by open-hearth, electric-furnace or basic oxygen processes. The prefabricated deformed wire mats shall conform to the requirements of ASTM A 497, except that wires used shall be deformed and transverse wires shall project beyond the centerline of each edge longitudinal wire as indicated. Mats that have been bent or wires dislocated or parted during shipping or project handling shall be realigned to within ½ inch (13 mm) of original horizontal plane of the mat. Mats with any portion of the wires out of vertical alignment more than ½ inch (13 mm) after realignment and/or wires dislocated or mutilated so that, in the opinion of the Engineer, they do not represent the original mat, shall be rejected. The reinforcement may be clamped or wired so that the reinforcement will retain the horizontal and vertical alignment as indicated or as approved by the Engineer or designated representative. Deformed wire may be used for tie bars and load transfer bars that require bending. The nominal size, area and theoretical weight of reinforcing steel wires covered by this provision are as listed in Table II. When fabricated steel bars or rod mats are indicated, the mats shall meet requirements of ASTM A 184.

Steel wire fabric reinforcement shall be of the gage and spacing indicated and shall conform to the requirements of ASTM A 82. Longitudinal and transverse wires shall be electrically welded together at all points of intersection and the welds shall be of sufficient strength that they will not be broken

during handling or placing. All welding and fabrication of fabric sheets shall conform to the requirements of ASTM A 185. Welded steel wire fabric shall be furnished in sheets as indicated and steel having been previously bundled into rolls will not be accepted. An approved hinge will be permitted in each sheet to provide for each sheet longitudinally. When wire fabric is used, it will replace only the longitudinal and transverse bars. The tie bars and load transmission units at joints will not be affected.

Table II: DIMENSIONAL REQUIREMENTS FOR DEFORMED STEEL WIRE FOR CONCRETE REINFORCEMENT

Deformed Wire Size No.	Unit Weight Pounds Per Ft. (Kgs per Meter)	Diameter Inches (Centimeters)	Cross-Sectional Area, Sq. Inches (Sq. Centimeters)	Perimeter Inches (Centimeters)
Column 1	Column 2	Column 3	Column 4	Column 5
D-1	0.034 (.051)	0.113 (.287)	0.01 (.06)	0.355 (.902)
D-2	0.068 (.101)	0.159 (.404)	0.02 (.13)	0.499 (1.267)
D-3	0.102 (.152)	0.195 (.495)	0.03 (.19)	0.612 (1.554)
D-4	0.136 (.202)	0.225 (.572)	0.04 (.26)	0.706 (1.793)
D-5	0.170 (.253)	0.252 (.640)	0.05 (.32)	0.791 (2.009)
D-6	0.204 (.304)	0.276 (.701)	0.06 (.39)	0.867 (2.202)
D-7	0.238 (.354)	0.296 (.752)	0.07 (.45)	0.936 (2.377)
D-8	0.272 (.405)	0.319 (.810)	0.08 (.52)	1.002 (2.545)
D-9	0.306 (.455)	0.338 (.859)	0.09 (.58)	1.061 (2.695)
D-10	0.340 (.506)	0.356 (.904)	0.10 (.65)	1.118 (2.840)
D-11	0.374 (.557)	0.374 (.950)	0.11 (.71)	1.174 (2.982)
D-12	0.408 (.607)	0.390 (.991)	0.12 (.77)	1.225 (3.112)
D-13	0.442 (.658)	0.406 (1.031)	0.13 (.84)	1.275 (3.239)

D-14	0.476 (.708)	0.422 (1.072)	0.14 (.90)	1.325 (3.366)
D-15	0.510 (.759)	0.437 (1.110)	0.15 (.97)	1.372 (3.485)
D-16	0.544 (.810)	0.451 (1.146)	0.16 (1.03)	1.416 (3.600)
D-17	0.578 (.860)	0.465 (1.181)	0.17 (1.10)	1.460 (3.708)
D-18	0.612 (.911)	0.478 (1.214)	0.18 (1.16)	1.501 (3.813)
D-19	0.646 (.961)	0.491 (1.247)	0.19 (1.23)	1.542 (3.917)
D-20	0.680 (1.012)	0.504 (1.280)	0.20 (1.29)	1.583 (4.021)
D-21	0.714 (1.063)	0.517 (1.313)	0.21 (1.35)	1.624 (4.125)
D-22	0.748 (1.113)	0.529 (1.344)	0.22 (1.42)	1.662 (4.221)
D-23	0.782 (1.164)	0.541 (1.375)	0.23 (1.48)	1.700 (4.318)
D-24	0.816 (1.214)	0.553 (1.405)	0.24 (1.55)	1.737 (4.412)
D-25	0.850 (1.265)	0.564 (1.433)	0.25 (1.61)	1.772 (4.500)
D-26	0.884 (1.316)	0.575 (1.461)	0.26 (1.68)	1.806 (4.587)
D-27	0.918 (1.366)	0.586 (1.488)	0.27 (1.74)	1.841 (4.676)
D-28	0.952 (1.417)	0.597 (1.516)	0.28 (1.81)	1.876 (4.765)
D-29	0.986 (1.467)	0.608 (1.544)	0.29 (1.87)	1.910 (4.851)
D-30	1.020 (1.518)	0.618 (1.570)	0.30 (1.94)	1.942 (4.933)
D-31	1.054 (1.569)	0.628 (1.595)	0.31 (2.00)	1.973 (5.011)

O. Polyethylene Film

Polyethylene film shall be opaque pigmented white in color and shall be manufactured from virgin resin without additives or scrap. It shall be sufficiently strong and tough to permit its use under the conditions existing on street paving work without being torn or otherwise rendered unfit for the purpose during the curing period. The film shall have a minimum thickness of 4 mils (0.004 inch), shall have a minimum tensile strength of 1,700 psi at 77°F (11,720 kPa at 25°C) in the longitudinal direction and 1,200 psi at 77°F (8,275 kPa at 25°C) in the transverse direction and shall have a minimum elongation of 200 percent at 77°F (25°C) in the longitudinal direction and 150 percent at 77°F (25°C) in the transverse direction. The permissible percent moisture loss shall not exceed 2 percent after 24 hours and 4 percent after 72 hours. Tests for tensile strength and elongation will be conducted in accordance with ASTM Designation: D 882, Method A. Tests for moisture retention will be conducted in accordance with ASTM Designation: C 156.

P. Membrane Curing Compound

Membrane curing compound shall conform to Item No. 409S, "Membrane Curing," Type 2 white pigmented.

Q. Asphalt Curing

Where asphalt is to be placed on a concrete base, asphalt shall be used for curing concrete base, the material shall conform to Item No. 301S, "Asphalts, Oils and Emulsions" for RS-2 or RS-2h or as indicated on the drawings.

360S.4 - Equipment

A. General

All equipment necessary for construction of this item shall be on the Project and shall be approved by Engineer or designated representative as to conditions before the Contractor will be permitted to begin construction operations on which the equipment is to be used. When approved by the Engineer or designated representative in writing, a commercial or independently operated batching plant for measuring materials outside limits of the project may be used.

B. Mixer

The mixer furnished may be either a paving mixer (operated at site of construction or centrally located), a stationary mixer (central mixer) or a paving mixer (truck mounted) that will produce adequately mixed concrete meeting the specified requirements. The mixer, or mixers, shall conform to the following requirements:

1. Each mixer shall have attached in a prominent place a manufacturer's plate showing rated capacity of the drum in terms of volume of mixed concrete and the recommended speed of rotation of the mixing drum or blades.
2. The stationary mixer (central mixer) or truck mounted paving mixer shall be operated at the manufacturer's recommended speed.
3. The size of the paving mixer shall not be less than that of a 27-E paver, as established by the Mixer Manufacturer's Bureau of Associated General Contractors. The paving mixer shall be operated at a drum speed of not less than 16 revolutions per minute and not more than 22 revolutions per minute. Pickup and throw over blades in the drum of the mixer shall be replaced when worn down 3/4 inch (19 mm) or more.
4. Each truck mounted paving mixer shall be approved by the Engineer or designated representative prior to use on the project. It shall be classified as a "paving mixer" by the manufacturer and shall be so designed that a uniform and low slump concrete (approximately 1½ inch [38 mm] slump) can be mixed without aggregate size segregation. The mixer shall be capable of discharging the low slump concrete at a speed of 10 seconds per cubic yard (13 seconds per cubic meter) or faster.

5. Each mixer shall be equipped with an approved automatic device for satisfactorily timing the mix and locking the discharging device in order to prevent the discharging of the mixer before the end of the required mixing period. This timing device shall operate a sounding device to signal plainly the completion of the mixing time. When permitted by the Engineer a light signal device may be used.
6. Multiple drum mixers will be permitted provided their operation is properly synchronized. The mixing time shall be determined exclusive of the time required to transfer concrete from one drum to the next drum.
7. Each mixer shall be equipped with a water-measuring device so constructed that it will measure the water within 1 percent of the total amount required for each batch. Unless the water is to be weighed, the water measuring equipment shall include an auxiliary tank with a capacity greater than that of the measuring tank and from which the measuring tank will be filled by gravity flow. The measuring tank shall be open to the atmosphere and shall be so placed and constructed that the water for a batch can be discharged into a calibrated tank or weighing device for checking the accuracy of water measurement without seriously delaying the paving operations. The Contractor shall have a calibrated tank or weighing device available at all times at a location satisfactory to the Engineer or designated representative.
8. If a paving mixer is furnished and operated at the site of construction, it shall be equipped with a power controlled boom and bucket, so designed as to permit uniform distribution of the concrete for the full width between pavement forms. Alternate equipment for distributing concrete may be substituted when approved by the Engineer in writing, provided uniform distribution is obtained without segregation.
9. If central mixed concrete is used on the project, the Contractor shall provide equipment designed to provide uniform distribution for the concrete for the full width between pavement forms without segregation.

C. Transit-mix Trucks

When transit-mix (ready-mix) concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to the batch to coat the drum of the mixer or agitator truck. This shall be required for every load of concrete. The mixing speed shall be attained as soon as all ingredients are in the mixer. Each complete batch (containing all the required ingredients) shall be mixed not less than 70 nor more than 100 revolutions of the drum at mixing speed.

A portion of the mixing water, required by the batch design to produce the desired slump, may be withheld and added at the job site, but only with permission of the Engineer and under the Engineer's supervision. When water is added at the job site, 25 revolutions (minimum) at mixing speed, will be required to flush down the blades after charging shall be accurately measured and included in the quantity of mixing water. The introduction of the initial mixing water, except blade wash down water and that permitted in this Article shall be prior to or simultaneous with the charging of the aggregates and cementitious material.

Mixing and agitating speed shall be as designated by the mixer manufacturer. All revolutions after prescribed mixing shall be at agitating speed. Except for short periods of time during discharge, the drum shall be kept in continuous motion from the time the mixing is started until the discharge is completed.

Additional mortar, consisting of 1 sack cement, 3 parts sand and sufficient water, shall be added to the batch to coat the drum of the transit mixer or agitator truck. This shall be required for every load of concrete.

The loading of transit-mixers shall not exceed 63 percent of the drum volume. When used as an agitator only, the loading of truck mixers shall not exceed 80 percent of the drum volume.

The batching plant and transit-mix trucks shall operate under the following system:

1. A ticket system will be used that includes a copy for the construction inspector. The ticket will have machine stamped time/date of water/cement batch; weight of cement, fly ash (if applicable), water, sand and aggregates; exact nomenclature and quantities of admixture. Any item missing or incomplete on the ticket will be cause for rejection. Coded readouts may be used if approved in advance by the Engineer.
2. Sufficient trucks will be available to support continuous placements. The Contractor will satisfy the Engineer that adequate standby trucks are available to support monolithic placement when required.
3. A portion of the mixing water, required by the batch design to produce the desired slump, may be withheld and added at the job site, but only with the permission of the Engineer and under the Inspector's observation. When water is added under these conditions, it will be thoroughly mixed before any slump or strength samples are taken.

D. Hauling Equipment

Batch hauling equipment for the transportation of measured materials from the batching plant to the mixer shall be equipped with tight covers, which shall be used to prevent excessive evaporation of moisture or any loss of material.

If a central mixer is used, concrete may be transported to the point of delivery in truck agitators or non-agitating trucks.

If a truck mounted paving mixer is used, it may be used to transport the concrete after mixing is complete.

If non-agitator trucks are used they shall conform to the following requirements:

The bed of non-agitating hauling equipment shall be a smooth, mortar-tight, metal container. The hauling equipment shall be capable of delivering the concrete to the work site in a thoroughly mixed and uniform mass and capable of discharging the concrete at a satisfactory controlled rate without segregation. If in the opinion of the Engineer any appreciable segregation or accumulation of excess water and/or mortar occurs on the surface of the concrete, this may be cause for rejection and this method of transporting the concrete to the point of delivery shall be suspended as directed by the Engineer.

E. Subgrade or Subbase Planer and Templates

Unless a stabilized subbase is provided, an approved subbase planer shall be provided, mounted on visible rollers riding on the forms and having adjustable cutting blades which shall trim the subgrade to the exact section as indicated. The planer frame shall be heavy enough to remain on the forms at all times and shall be of such strength and rigidity that, under a test made by changing the support from the wheels to the center, it shall not develop a deflection for more than 1/8 inch (3 mm). Tractive power equipment used to pull the planer shall not be such as to produce ruts or indentations in the subgrade.

When the slip form method of paving is to be used, the subgrade planer will be operated on a prepared track grade or controlled by an electronic sensor system operated from a string line that establishes the horizontal alignment and the elevation of the subbase.

A template for checking the contour of the subbase shall be provided and operated by the Contractor. The template shall rest upon the side forms and shall be of such strength and rigidity that, under a test made by changing the support to the center, it shall not show a deflection of more than 1/8 inch (3 mm). It shall be provided with accurately adjustable rods projecting downward to the subgrade at 1-foot (30 cm) intervals and these rods shall be adjusted to the required cross section of the bottom of the slab when the template is resting upon the side forms. Where stabilized subbase is provided, use of a scratch template will be required.

F. Forms

Side forms shall be of metal of approved cross section. The preferred depth of the form shall be equal to the required edge thickness of the pavement. Forms with depth greater than the required edge thickness of the pavement will be permitted.

The length of form sections shall not be less than 10 feet (0.3 meters) and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200-foot (61 meter) radius or less. Forms shall be of ample strength and shall be provided with adequate devices for secure setting so that when in place they will withstand, without visible springing or settlement, the impact and vibration of the spreading and finishing machinery. In no case shall the base be less than 6 inches (15.2 cm) for a form 6 inches (15.2 cm) or more in height. The forms shall be free from warps, bends or kinks and shall be sufficiently true to provide a reasonably straight edge on the concrete. The top of each form section, when tested with a straightedge shall conform to the requirements specified for the surface of the completed pavement. Sufficient forms shall be provided for satisfactory prosecution of the work.

Outside curb forms shall be of wood or metal of a section satisfactory to the Engineer or designated representative, straight, free of warp and shall be in a depth at least equal to the depth of the curb. They shall be mounted on the paving forms and securely attached thereto and maintained in true position during the placing of the concrete. Inside curb forms, if required, shall be of approved material and of such design as to provide the curb required and shall be rigidly attached to the outside forms.

G. Concrete Spreader

Use of concrete spreader shall be required and it shall be a self-propelled machine having sufficient power and traction to spread and strike off concrete without slippage on the forms. It shall be equipped with a power driven device for spreading the concrete uniformly between the forms. The spreading device may be either a reciprocating blade, a screw conveyer or a belt conveyer. The spreader shall be capable of striking off the surface of the concrete between the forms in the longitudinal direction of the slab at any required elevation.

Mechanically operated concrete spreaders of other designs, which uniformly distribute the concrete with a minimum of segregation, may be used when approved by the Engineer.

H. Slipform Paver

With prior approval, the Contractor may place concrete with slip form paver. This paver shall be equipped with a longitudinal transangular finishing float adjustable to crown and grade and be satisfactory to the Engineer or designated representative. The float shall extend across the pavement practically to the side forms and/or the edge of slab. A "string line" shall be used to provide grade control for the paver.

I. Mechanical Vibratory Equipment

All concrete placed for pavement shall be consolidated by approved mechanical vibrators operated ahead of the transverse finishing machine and designed to vibrate the concrete internally and/or from the surface. Vibratory members shall extend across the pavement practically to, but shall not come in contact with the side forms. Mechanically operated vibrators shall be mounted in such manner as not to interfere with transverse or longitudinal joints. The internal-type vibrators shall be spaced at not more than 24 inches (61 cm) and shall be equipped with synchronized vibratory units. Separate vibratory units shall be spaced at sufficiently close intervals to provide uniform vibration and consolidation to the entire width of the pavement. The frequency in air of the interval spud type vibratory units shall be not less than 8,000 cycles per minute and not less than 5,000 cycles per minute for tube types and the method of operation shall be as directed by the Engineer or designated representative. The Contractor shall have a satisfactory tachometer available for checking vibratory the elements.

The pavement vibrators shall not be used to level or spread the concrete but shall be used only for purposes of consolidation. The vibrators will not be operated where the surface of the concrete, as spread, is below the elevation of the finished surface of the pavement, except for the first lift of concrete where double strike off method of placement is employed and the vibrators shall not be operated for more than 15 seconds while the machine upon which they are installed is standing still.

The pan type vibratory units shall apply the vibrating impulses directly to the surface of the concrete. The operating frequency shall be not less than 3,500 cycles nor more than 4,200 cycles per minute in air. The Contractor shall have a satisfactory tachometer available for checking the speed of the vibratory elements.

Approved hand manipulated mechanical vibrators shall be furnished in the number required for provision of proper consolidation of the concrete along forms, at joints and in areas not covered by mechanically controlled vibrators. These vibrators shall be sufficiently rigid to insure control of the operating position of the vibrating head.

Complete and satisfactory consolidation of the concrete pavement is a most important requirement of this specification. Cores taken shall be carefully examined for voids, honeycombing or other evidence of incomplete consolidation. If such evidence is present, changes in the consolidation procedures and/or equipment will be made to insure satisfactory consolidation.

J. Finishing Equipment

1. Transverse Finishing Machine

The Transverse finishing machine shall be provided with 2 screeds accurately adjusted to the crown of the pavement, shall be self-propelled and mounted in a substantial frame equipped to ride on the forms, or may be slip form finished, and shall be so designed and operated as to strike off and consolidate the concrete.

2. Longitudinal Finishing

A transverse drag float may be used in lieu of the longitudinal finishing machine with the Engineer's approval. Finishing machines shall be maintained in a tight and good operating condition, accurately adjusted to the required crown or profile and free from deflection, wobble or vibration tending to affect the precision of finish. Machines failing to meet these requirements will be rejected by the Engineer or designated representative and the Contractor shall provide approved equipment.

Where hand finishing is permitted under this specification, the Contractor shall provide a strike template and a tamping template both of 4 by 10 inch (10 by 25 cm) lumber or equivalent metal section and at least 2 feet longer than the width of the pavement. Both templates to conform to the crown section of the pavement and the tamp, if of wood, shall have a steel face not less than 3/8 inch (9.5 mm) in thickness. The Contractor shall also provide a longitudinal float of approved design and not less than 14 feet (4.25 meters) in length.

The Contractor shall furnish and maintain at least two standard 10-foot (3.05 meter) steel straightedges on the work site at all times during the paving operations. The Contractor shall operate same in the presence of the Engineer or designated representative.

The Contractor shall furnish a sufficient number of bridges to ride on the forms and span the pavement for finishing operations and for the installation and finishing of joints. All necessary finishing and edging tools shall be furnished as may be required to complete the pavement as indicated.

360S.5 - Proportioning of Concrete

A. Proportions

Concrete shall be composed of Cementitious Materials, fine aggregate, coarse aggregate, mineral filler and/or admixture if used and water, mixed in the proportions designated by the approved Mix Design and in the manner set forth in this specification. On the basis of job and laboratory investigations of the proposed materials, the Contractor will fix proportions by weight of water, coarse aggregate, fine aggregate, cementitious materials, admixture and mineral filler where required, in order to produce concrete of the specified strength and workability for the actual delivery time and site conditions to be encountered. Where curbs are placed separately, the Engineer or designated representative may allow aggregate gradation conforming to Class A Concrete, Item No. 403, "Concrete for Structures."

B. Concrete Strength

The concrete mix to be designed to produce a concrete with the following requirements:

Table 1: CONCRETE PAVEMENT		
Item	Test	Value
Entrained Air	Tex-416-A	3 to 6 percent
Water-Cement Ratio gal. (liter)/sack, Maximum		6.25 (23.66)
Sacks Cement, Minimum, 94 pounds (42.6 KG) ea		6 per cubic yard (7.85 per cubic meter)
Coarse Aggregate Factor		0.65 min—0.85 max.
Compressive Strength after 7 Days, psi (kPa)	Tex-418-A	4000 (27,600)
Compressive Strength after 28 Days, psi (kPa)	Tex-418-A	4500 (31,000)
Maximum Concrete Mix Temperature °F (°C)		95 (35)
Retarder: Regular Concrete increase in time over 360S.7(3), minutes, Maximum	60	

Table 2: HIGH EARLY STRENGTH CONCRETE

Item	Test	Value
Cement Type		III
Entrained Air	Tex-416-A	3 to 6 percent
Water-Cement Ratio gal. (liter)/sack, Maximum		6.25 (23.66)
Sacks Cement, Minimum, 94 pounds (42.6 KG) ea		7 per cubic yard (9.16 per cubic meter)
Coarse Aggregate Factor		0.65 min-0.85 max
Slump, inches (Centimeters)	Tex-415-A	½ to 2 (1.25 to 5.0)
Compressive Strength, after 24 hours, psi (kPa)	Tex-418-A	2,100 (14,500)
Compressive Strength, after 3 Days, psi (kPa)	Tex-418-A	2,750 (19,000)
Compressive Strength, after 7 Days, psi (kPa)	Tex-418-A	4,500 (31,000)
Compressive Strength, after 28 Days, psi (kPa)	Tex-418-A	4,925 (34,000)
Maximum Concrete Mix, Temperature °F (°C)		95 (35)

The Contractor may submit a mix design using high range water reducing admixtures conforming to Item No. 405S, "Concrete Admixtures" in lieu of the concrete pavement mix specified and shall meet the following requirements:

Table 3: HIGH RANGE WATER REDUCING ADMIXTURES: SUPERPLASTERSIZER CONFORMING TO SPECIFICATION ITEM NO. 405S, "CONCRETE ADMIXTURES"

Item	Test	Value
Entrained Air	Tex-416-A	3 to 6 percent
Water-Cement Ratio, gal. (liter)/sack, Maximum		6.25

Sacks Cement, Minimum, 94 pounds (42.6 KG) ea		6 per cubic yard (7.85 per cubic meter)
Coarse Aggregate Factor		0.65 min.—0.85 max.
Slump, inches (cms) before Admixture	Tex-415-A	½ to 2 (1.25 to 5)
Slump, Inches (cms) after Admixture	Tex-415-A	4 to 10 (2.5 to 25)
Compressive Strength, after 3 Days, psi (kPa)	Tex-418-A	3,125 (21,500)
Compressive Strength, after 7 Days, psi (kPa)	Tex-418-A	4,500 (31,000)
Compressive Strength, after 28 Days, psi (kPa)	Tex-418-A	4,925 (34,000)
Maximum Concrete Mix, Temperature, °F (°C)		100 (37.8)
Retarder, Regular Concrete Over 360S.7C, Minutes, Maximum	120	

Table 4: Over Design Required to Meet Compressive Strength Requirements ¹

Number of Tests ^{2, 3}	Standard Deviation, psi (mPa)				
	300 (20.6)	400 (2.75)	500 (3.44)	600 (4.13)	700 (4.82)
15	470 (3.24)	620 (4.27)	850 (5.85)	1,120 (7.71)	1,390 (9.57)
20	430 (2.96)	580 (3.99)	760 (5.23)	1,010 (6.95)	1,260 (8.67)
30 or more	400 (2.75)	530 (3.65)	670 (4.61)	900 (6.20)	1,130 (7.78)

Notes:

1. When designing the mix, add the tabulated amounts to the minimum design strength in Tables 1, 2 or 3. Maximum water-cement or water-cementitious ratio by weight

2. Number of tests of a concrete mixture used to estimate the standard deviation of a concrete production facility. Test of another mix within 1,000 psi (6.88 MPa) of the specified strength may be used.
3. If less than 15 prior tests are available, the overdesign should be 1,200 psi (8.26 MPa) for specified strengths from 3,000 to 5,000 psi (20.65 to 34.42 MPa) and 1,400 psi (9.64 MPa) for specified strengths greater than 5,000 psi (34.42 MPa).

High range water reducing admixtures shall be capable of maintaining the original slump until placement and screeding, which may be 2 hours, without the addition of water, additional admixture or other retempering or remixing techniques.

C. Workability of Concrete

Concrete shall be uniformly plastic, cohesive and workable. Workable concrete is defined as concrete which can be placed without honeycomb and without voids in the surface of the pavement after the specified finishing machine has been over a given area twice. Workability shall be obtained without producing a condition such that free water appears on the surface of the slab when being finished as specified. Where water appears on the surface of the concrete after finishing and this condition cannot be corrected by reasonable adjustment in the batch design, the bleeding to be immediately corrected by one of the following measures or a combination of two or more of the following listed measures:

1. Redesign of the batch;
2. Addition of mineral filler to fine aggregates;
3. Increase of cement content; or
4. Use of an approved air entraining agent or approved admixture.

In the event that the measures taken do not eliminate the bleeding immediately, concrete placement operations will be suspended, as directed by the Engineer or designated representative, by placing a bulkhead or "header" as indicated and according to applicable requirements for intentional stoppage of placement of concrete under Item No. 360S, "Concrete Pavement" and will remain suspended until such time as additional trial mixes demonstrate that a non-bleeding batch design has been achieved. Failing to achieve a satisfactory laboratory batch design the Contractor will be required to use different materials and to submit samples thereof for additional trial mixes and pilot cylinders.

The mix will be designed with the intention of producing concrete, which will have a slump of 1½ inches (3.8 cms). The slump shall not be less than ½ inch (1.25 cms) nor more than 2 inches (5 cms).

D. Mix Design

The Contractor shall perform at the Contractor's own expense and be responsible for the design of the concrete mix. The mix design shall be prepared and sealed by a person qualified and experienced in such work. Establish proportions on the basis either of laboratory trial batches or of field experience with the materials to be employed.

When ice is used to lower the concrete temperature during hot weather, concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures"), the Contractor shall furnish a mix design (Section 6 of Standard Specification Item No. 403S, "Concrete for Structures") acceptable to the Engineer or designated representative for class of concrete specified. The addition of ice shall not exceed 50 percent of the total mix water weight.

Complete concrete mix design data shall be submitted to the Engineer or designated representative for approval at least 10 days before concrete placement begins. Submittal of the mix shall be accompanied by such test data and certifications as may be necessary to demonstrate compliance

with specification requirements. Approval of this mix design shall in no way relieve the Contractor of responsibility for the quality of the concrete.

It shall also be the responsibility of the Contractor to determine and measure batch quantity of each ingredient, including water, not only for batch designs but for all concrete produced for the project, so that the mix conforms to these specifications.

Trial batches shall be made and tested using all the proposed ingredients prior to the placing of concrete and also when the aggregate and/or type, brand or source of cement or admixture is changed. When the brand and/or source of cement only is changed, the Engineer or designated representative may waive trial batches only if a prior record of satisfactory performance of the cement has been established.

Mix designs used successfully on previous or concurrent jobs may be approved by the Engineer or designated representative without trial batches if it is shown that there is no substantial change in any of the proposed ingredients.

The Contractor shall prepare a minimum of four concrete test cylinders of each mix design, cure and test two each at the age of 7 and 28 days. From these preliminary tests the water-cement ratio required to produce concrete of the specified strength will be selected by the Contractor for approval by the Engineer or designated representative. The Contractor may at any time present in writing a suggested mix design and if the Engineer or designated representative concurs with the suggested design, the Contractor shall conduct trial batches necessary to determine its acceptability under these specification requirements.

The Contractor shall furnish and operate the mixer approved for use on this project unless the concrete is to be furnished from a transit mix (ready-mix) plant. For mixing the concrete to be used in making the preliminary test specimens, a minimum 1 cubic yard (1 cubic meter) batch shall be mixed or a batch of sufficient size to afford proper mixing, whichever is the greater. In lieu of the above mixer and procedure, the Contractor may furnish a portable mixer of sufficient rated capacity to mix a minimum 3-sack batch; in which case, the batch mixed for the preliminary test not to be less than the rated capacity of the mixer furnished. A coating batch will be mixed prior to mixing for test cylinders.

No additional compensation to be allowed for equipment, materials or labor involved in making job mix design test specimens.

After the mix proportions and water-cement ratio required to produce concrete of the specified strength have been determined, placing of the concrete may be started. The strength of the concrete in the completed pavement will be determined by a minimum of four compressive strength test specimens made, cured with a minimum of two each tested at 7 and 28 days as provided in TxDOT Bulletin C-11. Modifications of the mix design may be requested by the Contractor on basis of conformity of the strength of these test specimens with the requirements and intent of this specification.

Changes in the water-cement ratio and the mix design, including an increase in cement factor if necessary, will be made when the average 7 day and/or 28 day compressive strength of the concrete, as indicated by the last 10 compressive strength values obtained from tests of cylinders made from concrete of the same water-cement ratio, departs from the desired minimum average strength by more than 4 percent.

E. Construction Testing

Straightedge surface testing to be carried out as prescribed above.

The Engineer shall take test cylinders for compressive strength values on a random basis. The comparative results shall consist of the average of 2 cylinders each at 7 and 28 days for regular concrete, high early strength concrete and high range water reducing admixture concrete. Tests shall

be made for each 500 square yards constructed, in accordance with TxDOT Bulletin C-11. Additional tests may be taken as determined by the concrete placement conditions or for adequately determining the strength of concrete where the early opening of the pavement to traffic is dependent upon concrete strength tests. No extra compensation will be allowed for materials and work involved in fulfilling these requirements.

360S.6 - Construction Methods

A. Preparation of Subgrade

Where stabilized subbase is not provided, the subgrade shall be excavated as required, all unstable or otherwise objectionable material removed and all holes, ruts and depressions filled with approved material and compacted. Rolling and sprinkling shall be performed when and to the extent required and the roadbed shall be completed to or above the plane of the typical sections, lines and grades indicated or as established by the Engineer or designated representative. The subgrade shall be proof rolled and any soft areas shall be repaired before the forms are placed. In the event that the proof rolled subgrade is exposed to rainfall or other conditions, which may soften the subgrade, corrective measures shall be taken and the subgrade shall be proof rolled again.

The subgrade planer shall be operated from approved forms immediately ahead of paving operations and the subgrade shall be finished to the exact section of the bottom of the pavement as indicated. Where traveling form pavers are used, the subgrade planer shall operate on a prepared track grade or be controlled by electronic sensors operating from a stringline that establishes line and grade. It shall be tested with the approved template, operated and maintained by the Contractor. The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the pavement is placed and shall be kept thoroughly wetted down sufficiently in advance of placing any pavement to insure its being in a firm and moist condition for at least 2 inches (5 cms) below the prepared surface. Sufficient subgrade shall always be prepared in advance to insure satisfactory prosecution of the work.

No equipment or hauling shall be permitted on the prepared subgrade, except by special permission of the Engineer or designated representative, which will be granted only in exceptional cases and only where suitable protection in the form of 2-ply timber mats or other approved material is provided.

B. Placing and Removing Forms

The subgrade under the forms shall be firm and cut true to grade so that each form section when placed will be firmly in contact for its whole length and base width and exactly at the established grade. Any subgrade under the forms below established grade shall be corrected, using suitable material, placed, sprinkled and rolled as directed. Forms shall be staked with at least 3 pins for each 10-foot (3-meter) section. A pin shall be placed at each side of every joint. Form sections shall be tightly joined and keyed to prevent relative displacement. Forms shall be cleaned and oiled each time they are used.

Forms shall be set for a sufficient distance in advance of the point where concrete is being placed to permit a finished and approved subgrade length of not less than 300 feet (90 meters) ahead of the mixer. Conformity of the grade and alignment of forms shall be checked immediately prior to placing concrete and necessary corrections made by the Contractor. Where any form has been disturbed or any subgrade becomes unstable, the form shall be reset and rechecked. In exceptional cases, the Engineer or designated representative may require suitable stakes driven to the grade of the bottom of the forms to afford additional support. Sufficient stability of forms to support the equipment operated and to withstand its vibration without springing or settlement shall be required. If forms settle and/or deflect over 1/8 inch (3 mm) under finishing operations, paving operations shall be stopped and the forms shall be reset to line and grade.

Forms shall be leveled using cement-stabilized material containing not less than 1½ sacks of cement per ton (1 2/3 sacks of cement per MG) of mix as placed. The aggregate gradation and water content shall be determined by the Contractor. The cement-stabilized material shall be sufficiently plastic to insure filling voids underneath the paving forms. Paving equipment will not be permitted on the forms until the cement-stabilized material has cured for at least 12 hours.

Forms shall remain in place for not less than 8 hours after the concrete has been placed. Forms shall be carefully removed in such a manner that little or no damage will be done to the edge of the pavement. Any damage resulting from this operation shall be immediately repaired. After the forms have been removed, the ends of all joints shall be cleaned and any honeycombed areas pointed up with approved mortar and the surfaces protected with curing material conforming to Item No. 409S, "Membrane Curing."

Immediately after pointing is complete, the form trench, if used, shall be filled with granular material or earth from the shoulders in such manner as to shed water from rainfall and prevent curing material from washing away from the edge of pavement. On completion of the required curing, the subgrade or shoulders adjacent to the pavement shall be placed and compacted in condition to maintain drainage.

360S.7 - Concrete Mixing and Placing

A. Mixing Methods

The concrete shall be mixed in a mixer conforming to the requirements of this item.

B. Mixing

The aggregates, mineral filler if required, cementitious materials and water shall be measured separately, introduced into the mixer and mixed for a period of not less than 50 seconds nor more than 90 seconds, measured from the time the last aggregate enters the drum to the time discharge of the concrete begins. The required water shall be introduced into the mixing drum during the first 15 seconds of mixing. The entire contents of the drum shall be discharged before any materials of the succeeding batch are introduced.

The Engineer or designated representative may increase the minimum mixing time to that necessary to produce thoroughly mixed concrete based on inspection or appropriate uniformity tests. The mixing time may be varied at any time as necessary to produce acceptable concrete.

If a central mixer is used, the concrete shall be discharged into the specified hauling equipment and delivered to the road site. If truck agitators are used, the concrete shall be continuously agitated at not less than 1 nor more than 6 rpm as directed by the Engineer or designated representative.

The maximum size of the concrete batch, absolute volume, shall not exceed 120 percent of the rated size of the mixer (40.8 cubic feet maximum batch for 34 cubic foot paver - 1.2 cubic meter maximum batch for 1 cubic meter paver). Spilling of material from the mixer drum shall be corrected by reducing the size of the batch. Retempering or remixing of concrete will not be permitted.

The initial batch of concrete mixed after each time the mixer is washed out shall be enriched by additional mortar. The additional mortar shall be 1 sack of cement and 3 parts of sand.

When transit-mix (ready-mix) concrete is permitted, the batching plant shall meet the requirements of Item No. 403S, "Concrete for Structures."

C. Placement

Unless otherwise indicated, the concrete may be placed by using forms or by use of a slipform paver. Any concrete not placed as herein prescribed within 30 minutes after mixing shall be rejected and disposed of as directed except as provided otherwise herein. If in the opinion of the Engineer or

designated representative, the temperature, wind and/or humidity conditions are such that the quality of concrete will not be adversely affected, the specified placing time may be extended by a maximum of 45 minutes. Concrete with high range water reducing admixture shall not be placed after the slump has dropped by 3 inches (7.5 cms) or more. Except by specific written authorization of the Engineer or designated representative, concrete shall not be placed when the temperature is below 40°F (4.5°C) and falling but may be placed when the temperature is above 35°F (1.7°C) and rising, the temperature being taken in the shade and away from artificial heat.

When the temperature of the air is above 85°F (29.4°C), an approved retarding agent will be required in concrete. The maximum temperature of all regular concrete placed shall not exceed 95°F (35.0°C), unless otherwise specified.

When concrete is being placed in cold weather, the Contractor shall have available a sufficient supply of an approved covering material to immediately protect concrete if the air temperature falls to 32°F (0°C) or below, before concrete has been placed 4 hours. Such protection shall remain in place during the period the temperature continues below 32°F (0°C) or for a period of not more than 5 days. Neither salt nor other chemical admixtures shall be added to the concrete to prevent freezing. The Contractor shall be responsible for the quality and strength of concrete under cold weather conditions and any concrete damaged by freezing shall be removed and replaced at the Contractor's expense. Concrete shall not be placed before sunrise and shall not be placed later than will permit finishing of the pavement during sufficient natural light.

Concrete shall be placed only on approved subgrade or subbase and unless otherwise indicated on the drawings, the full width of the pavement shall be constructed monolithically. The concrete shall be deposited on the subgrade or subbase in such manner as to require as little rehandling as possible. Where hand spreading is necessary, concrete shall be distributed to the required depth by use of shovels. The use of rakes will not be permitted. Workers will not be permitted to walk in the concrete with any earth or foreign material on their boots or shoes. The placing of concrete shall be rapid and continuous.

When the concrete is to be placed in separate lanes, the junction line shall not deviate from the true line more than ½ inch (1.25 cm) at any point and shall be finished as indicated on the drawings.

The mixer shall not be located on completed pavement, except as herein provided, but may be located on the subgrade of that lane of the pavement being constructed, as provided under "Preparation of Subgrade." When limited space, in the opinion of the Engineer or designated representative, requires operation of the mixer on completed pavement, the mixer may be so operated provided the concrete has attained the minimum average compressive strength required and provided suitable protection to the pavement in the form of 2 ply timber mats or otherwise approved material is provided.

Concrete shall be distributed to such depth that when consolidated and finished, the slab thickness indicated will be obtained at all points and the surface shall not, at any point, be below established grade. Special care shall be exercised in placing and spading concrete against forms and at all joints to prevent the forming of honeycombs and voids.

Concrete for the monolithic curbs shall be the same as for the pavement and if carried back from the paving mixer shall be placed within 20 minutes after being mixed. It may be placed from the separate mixer, if desired, but in any case must be placed while the pavement concrete is still plastic. When sawed joints are used, curbs shall be doweled as indicated and poured after sawing. Curbs doweled on and placed separately may be placed with an extrusion machine.

If a central mixer or batcher is used, the Contractor shall provide a system satisfactory to the Engineer or designated representative for determining that concrete delivered to the road meets the specified requirements for mixing and time of placing.

Unless otherwise indicated, 2 mixers or transit mixers will be required where the double strike off method is employed.

D. Reinforcing Steel and Joint Assemblies

All reinforcing steel, including steel, welded wire fabric reinforcement, tie bars, dowel bars and load transmission devices used in accordance with plan provisions shall be accurately placed and secured in position in accordance with details indicated on the drawings. Reinforcing bars shall be securely wired together at alternate intersections, following a pattern approved by the Engineer or designated representative and at all splices and shall be securely wired to each dowel intersected. When wire fabric is used, it shall replace only the longitudinal and transverse bars and shall be securely wired together at all splices and to each dowel intersected. When welded wire fabric is selected, the Contractor shall pour the lower half of the slab, place the welded wire fabric and place the remaining concrete. Tie bars shall be installed in the required position by the method and device indicated. Bar coating indicated and of material specified, shall be completed and the bars and coating shall be free of dirt or other foreign matter at the time of installation in the concrete.

Tightly adhered scale or rust which resists removal by vigorous wire brushing need not be removed except that excessive loss of section to the reinforcement due to rust shall be cause for rejection. Excessive loss of section shall be defined as loss of section to the extent that the reinforcement will no longer meet the physical requirements for the size and grade of steel specified.

Where indicated on the drawings, an assembly of parts at pavement joints, the assembly shall be completed, placed at required location and elevated and all parts rigidly secured in required position by the method and devices indicated on the drawings. Dowel bars shall be accurately installed in joint assemblies as indicated on the drawings, each parallel to the pavement surface and to the center line of the pavement and shall be rigidly secured in the required position by such means as indicated that will prevent their displacement during placing and finishing of the concrete. Unless specifically authorized by the Engineer or designated representative in writing, the load transmission devices shall be accurately installed in joint assemblies indicated, each unit vertical with its length parallel to the center line of the pavement and all units shall be rigidly secured in required position by such means as indicated that will prevent their displacement during placing and finishing of the concrete. Header boards, joint filler and other material used for forming joints shall be accurately notched to receive each load transmission device. All load transmission devices shall be free of rust and clean when installed in the concrete.

The Contractor has the option of substituting welded wire fabric in place of reinforcement bars. The welded wire fabric selected shall have an area and distribution of steel at least equal to the plan requirements. The Contractor shall submit their proposed design to the Engineer for approval before any material is ordered.

If welded wire fabric is used, the entire width of the bottom layer of concrete shall be struck off to conform to the cross section and elevation indicated on the drawings. The reinforcement shall then be placed immediately upon the concrete, after which the top layer of concrete shall be placed, struck off and screeded. Any portion of the bottom layer of concrete which has been placed more than 15 minutes without being covered with the top layer of concrete shall be removed and replaced with freshly mixed concrete at the Contractor's expense.

E. Joints

1. General

All transverse and longitudinal joints when required in the pavement shall be of the types indicated and shall be at required location, on required alignment, in required relationship to tie bars and joint assemblies and in accordance with details indicated. When no transverse joints are indicated, joints shall not exceed 40 feet (13.1 meters). Such stakes, braces, brackets or other devices shall be used as necessary to keep the entire joint assembly in true vertical and

horizontal position. Where concrete base is overlaid by asphaltic concrete, the joints to be prepared as specified herein, but joint sealing will not be required unless indicated.

If necessary for proper installation of the sealer, excessive spalling of the joint groove shall be repaired to the satisfaction of the Engineer.

Care shall be exercised during the construction of all joints to insure that the concrete sections are completely separated by an open joint or by the joint materials and to insure that the joints will be true to the outline indicated on the drawings. The Contractor shall install joint materials, which will function as a compatible system. Joint sealer shall not be placed where a bond breaker is present.

Green concrete or wet sawed joints are permitted provided the Contractor cleans the joint within 5 minutes after cutting with a 3,000 psi (20.7 mPa) water blast followed by a minimum of 7 day cure and sand blast the saw cut immediately prior to placing joint sealer.

Dry sawed joints are permitted provided the Contractor sand blasts the saw cut immediately prior to placing joint sealer.

2. Expansion Joints

Transverse expansion joints shall be formed perpendicular to the centerline and surface of pavement and shall be constructed in accordance with the sequence of operations indicated on the drawings. After the transverse finishing machine and before the longitudinal finishing machine have passed over the joint, the Contractor shall test the joint filler for correctness of position and make any required adjustment in the position of the filler and shall install the joint seal space form as indicated on the drawings. After removal of the joint seal form as indicated on the drawings, the joint seal space above the joint filler shall be thoroughly sandblasted or machine routed to remove all projecting concrete, laitance, dirt or foreign matter. The concrete faces of the joint seal space shall be left true to line and section throughout the entire length of the joint. On completion of curing of the pavement, the joint sealing filler of the type specified shall be placed as indicated. The faces of the joint seal space shall be clean and surface dry at the time joint sealing filler is placed. On completion of the joint seal, the pavement adjacent to the joint shall be left free of joint sealing material. The joint seal space shall be exactly above and not narrower than the joint filler with no concrete overhangings.

3. Weakened Plane Joints

Weakened plane joints shall consist of transverse contraction joints and longitudinal joints and shall be formed or sawed as indicated on the drawings. When the joints are sawed, the saw shall be power driven, shall be manufactured especially for the purpose of sawing concrete and shall be capable of performing the work. Saw blades shall be as indicated. Tracks adequately anchored, the chalk, string line or other approved methods shall be used to provide true alignment of the joints. The concrete saw shall be maintained in good operating condition and the Contractor shall keep a standby power saw on the project at all times when concrete operations are under way.

If membrane curing is used, the portion of the seal, which has been disturbed by sawing operations, shall be restored by the Contractor by spraying the areas with additional curing seal.

Forming, finishing and sealing of the joint seal space shall conform to this item, described above and details indicated on the drawings.

4. Contraction Joints

Transverse contraction joints shall be formed or sawed joints perpendicular to the centerline and surface of the pavement and shall be constructed by the method and in the sequence of operations as indicated. Where sawed joints are used, contraction joints at intervals indicated

shall be sawed as soon as sawing can be accomplished without damage to the pavement and before 24 hours after the concrete has been placed, the exact time to be approved by the Engineer or designated representative. The remaining contraction joints shall be sawed in a uniform pattern as directed by the Engineer or designated representative and they shall be completed before uncontrolled cracking of the pavement takes place. All joints shall be completed before placing concrete in succeeding lanes and before permitting traffic to use the pavement.

5. Longitudinal Joints

Longitudinal joints shall be of the type or alternate types indicated and shall be constructed of specified materials in accordance with provisions indicated on the drawings. Longitudinal joints shall be constructed accurately to required lines, shall be perpendicular to the pavement surface at the joint and the pavement surface over and adjacent to the joint shall be finished as specified on the drawings.

Longitudinal joints shall be sawed as soon as sawing can be accomplished without damage to the pavement. Sawing shall not cause damage to the pavement and the groove shall be cut with a minimum of spalling. No traffic (including construction traffic) shall be permitted on pavement until the longitudinal joint is cut.

6. Construction Joints

Intentional stoppage of the placing of the concrete shall be at either an expansion joint or at a weakened plane joint. The following provisions shall govern for each type of joint at which the placing of concrete is stopped:

- a) When the placing of concrete is stopped at an expansion joint, the complete joint assembly shall be installed and rigidly secured in required position as indicated. A bulkhead of sufficient cross sectional area to prevent deflection, accurately notched to receive the load transmission devices or dowels, as the case may be, and shaped accurately to the cross section of the pavement shall be provided and installed as a back-up for the joint filler and rigidly secured in required position to permit accurate finishing of the concrete up to the joint. After the concrete has been finished to the joint, formation of the joint seal space and finishing of the joint shall be executed as specified herein and as indicated. The backup bulkhead shall remain in place until immediately prior to the time when concrete placement is resumed, then it shall be carefully removed in such manner that no element of the joint assembly will be disturbed. The exposed portion of the joint assembly shall be free of adherent concrete, dirt or other material at the time placing of concrete is resumed.
- b) When placing of concrete is stopped at a weakened plane joint, all applicable provisions of paragraph (a) above shall apply in addition to the following requirement:

The face of the bulkhead adjoining the slab end shall be notched and grooved to fit the exposed half section of the joint assembly and shall be shaped to form the slab end at the center of the joint as indicated on the drawings. The $\frac{1}{2}$ 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 $\frac{1}{2}$ 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 $\frac{1}{4}$ inch (6.3 mm) nor more than $\frac{1}{2}$ 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 180°F (82.2°C). Blankets shall be placed to secure an overlap of at least 12 inches (30.5 cms) and this lap securely weighted to form a closed joint.

The waterproofed paper blankets shall be adequately weighted to prevent displacement or billowing due to wind and the paper folded down over the side of the pavement shall be secured by a continuous bank of earth. Plowing of this windrow into place will not be permitted.

All tears or holes appearing in the paper during the curing period shall be immediately repaired by cementing patches over such defects. It shall be the Contractor's responsibility to prevent damage to paper blankets, which would affect their serviceability and effectiveness as a concrete curing method. Blankets may be rejected by the Engineer or designated representative at any time if it appears they do not provide an airtight covering.

Paper blankets rejected on account of pinholes or minor tears may be continued in service by folding the blanket over lengthwise, first thoroughly spraying $\frac{1}{2}$ 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 (6,350 KGs). Such opening, however, shall in no manner relieve the Contractor from responsibility for the Contractor's work. On those sections of the pavement thus opened to traffic, all joints shall first be sealed, the pavement cleaned and topsoil placed against the pavement edges or behind the curb where turf or vegetation is to be established before permitting vehicles thereon.

After the concrete in any section is 14 days old or as long thereafter as ordered by the Engineer, such section of pavement may be opened to all traffic indicated on the drawings or when so directed by the Engineer or designated representative. On those sections of the pavement thus opened to traffic, all joints shall first be sealed, the pavement cleaned and 4 inches (10 cms) of top soil placed against the pavement edges and all other work performed as required for the safety of traffic. Such opening, however, shall in no manner relieve the Contractor from responsibility for the Contractor's work performed.

When High Early Strength Concrete, resulting from the use of Type III cement as indicated on the drawings is used, the pavement may be opened to all traffic after the concrete is 7 days old or as long thereafter as ordered by the Engineer or designated representative, subject to the same provisions governing the opening after 14 days as above indicated.

Where the Contractor desires to move any equipment not licensed for operation on public streets, on or across any pavement opened to traffic, the Contractor shall protect the pavement from damage by means of 2 ply timber mats of 2 inch (5 cm) stock or runways of heavier material laid on a layer of earth, all as approved by the Engineer or designated representative.

1. Emergency Opening to Traffic

The Engineer or designated representative may require the opening of pavement to traffic prior to the minimum time specified above under conditions of emergency, which in the Engineer's or designated representative's opinion require such action in the interest of the public. In no case will the Engineer or designated representative order opening of the pavement to traffic within less than 72 hours after the last concrete in the section is placed. The Contractor shall remove all obstructing materials, place earth against pavement edges and perform other work involved in providing for the safety of traffic as required by the Engineer or designated representative in

ordering emergency opening. Orders for emergency opening of the pavement to traffic will be issued by the Engineer or designated representative in writing.

360S.8 - Penalty for Deficient Pavement Thickness or Strength

The adjustment in unit prices provided for in this item will apply only when measurement for payment is by the square yard.

It is the intent of this specification that the pavement be constructed in strict conformity with the thickness, strength and typical sections indicated on the drawings. Where any pavement is found not so constructed, the following rules relative to adjustment of payment for acceptable pavement and to replacement of faulty pavement shall govern.

A. Pavement

The pavement will be core drilled after any grinding operations have been completed for surface corrections prior to final acceptance. Locations of core tests may be selected by the Engineer or designated representative; however, spacing interval for core tests, as specified herein, shall be maintained. The thickness of the pavement will be determined by measurement of the cores in accordance with TxDOT Test Method Tex-424-A.

For the purpose of establishing an adjusted unit price for pavement, units to be considered separately are defined as 1,000 linear feet of pavement in each traffic lane starting at the end of the pavement bearing the smaller station number. The last unit in each lane shall be 1,000 feet plus the fractional part of 1,000 feet remaining. Traffic lane width will be as shown on typical sections and pavement design standards.

For the purpose of establishing an adjusted unit price for ramps, widening, acceleration and deceleration lanes that are machine placed, isolated pavements of traffic lane width but less than 1,000 feet in length and other areas designated by the Engineer or designated representative, units will be considered separately and are defined as 1,000 square yards of pavement or fraction thereof.

One core will be taken at the location selected by the Engineer or designated representative or at random in each unit. When the measurement of the core from any unit is not deficient more than 0.2 inches from the plan thickness, full payment will be made. When the measurement of the core from any unit is deficient more than 0.2 inch but not more than 0.75 inch from the plan thickness, 2 additional cores will be taken from the unit and the average of the 3 cores determined. The 2 additional cores from any 1,000-foot unit will be taken at intervals of not less than 300 feet. The 2 additional cores from any 1,000 square yard unit will be taken at locations such that the pavement in the unit will be well represented. If the average measurement of these 3 cores is not deficient more than 0.2 inches from the plan thickness, full payment will be made. If the average thickness of the 3 cores is deficient by more than 0.2 inch but not more than 0.75 inch from the indicated thickness, an adjusted unit price as provided below will be paid for the areas represented by these cores.

In calculating the average thickness of the pavement, measurements which are in excess of the specified thickness by more than 0.2 inch will be considered as the specified thickness plus 0.2 inch and measurements which are less than the specified thickness by more than 0.75 inch will be considered as the specified thickness less 0.75 inch.

When the measurement of any core is less than the specified thickness by more than 0.75 inch, the actual thickness of pavement in this area will be determined by taking additional cores at 10 foot intervals parallel to the center line in each direction from the deficient core until, in each direction, a core is taken which is not deficient by more than 0.75 inch. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine the length of pavement in a unit that is to be left in place without pay and/or removed and replaced as provided herein.

For new Concrete Pavement roadways, and for Concrete Pavement rehabilitation and overlay projects, if cracks develop in the pavement surface within the one year warranty period, the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)", or perform other corrective measures as directed by the Engineer. Payment for this work will be considered subsidiary to Concrete Pavement, unless included as a separate pay item in the Contract.

For new Concrete Pavement roadways, and for Concrete Pavement rehabilitation and overlay projects, if cracks develop in the pavement surface within the one year warranty period, the Contractor shall seal the cracks in accordance with Standard Specification Item No. 313S, "Cleaning and/or Sealing Joints and Cracks (Asphaltic Concrete)", or perform other corrective measures as directed by the Engineer. Payment for this work will be included in the unit price bid for Concrete Pavement, unless included as a separate pay item in the Contract.

Irrespective of an acceptable overall project average for any or all of the Pay-Adjustment Acceptance Factors, limited substandard portions of the work, as determined by the Engineer or designated representative, shall be remedied or removed and replaced to the satisfaction thereof.

B. Price Adjustments

After any grinding or milling operations have been completed to meet the surface-testing requirement of this specification, if average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than 0.75 inch, payment will be made at an adjusted price as specified in the following table:

Concrete Pavement Deficiency	
Deficiency in Thickness Determined by Cores, Inches	Proportional Part of Contract Price Allowed
0.00 to 0.20	100 percent
0.21 to 0.30	80 percent
0.31 to 0.40	72 percent
0.41 to 0.50	68 percent
0.51 to 0.75	57 percent

Any area of pavement found deficient in thickness by more than 0.75 inch but not more than 1 inch or 1/8 of the indicated thickness, whichever is greater, shall be evaluated by the Engineer. If, in the judgment of the Engineer, the area of such deficiency should not be removed and replaced, there will be no payment for the area retained. If, in the judgment of the Engineer, the area of such deficiency warrants removal, the area shall be removed and replaced at the Contractor's entire expense, with concrete of the thickness indicated on the drawings.

Any area of pavement found deficient in thickness by more than 1 inch or more than 1/8 of the indicated thickness, whichever is greater, shall be removed and replaced, at the Contractor's entire expense, with concrete of the thickness indicated on the drawings.

No additional payment over the Contract unit price will be made for any pavement of a thickness exceeding that indicated on the drawings.

If the average compressive strength based on concrete test cylinders at 28 days is less than the specified minimum strength of the concrete, then payment will be made at an adjusted price as specified in the following table.

Pay Adjustment Factor for Deficient Compressive Strength	
Ratio of Average Strength from Test Cylinders to Specified Minimum Compressive Strength both at 28 Days	Proportional Part of Contract Price Allowed
More than 0.95	100 percent
0.90 to 0.95	85 percent
0.85 to 0.90	70 percent
0.80 to 0.85	60 percent
Less than 0.80	0 percent (Remove & Replace)

When, in the opinion of the Engineer or designated representative, the compressive strength test results appear unrepresentative, additional testing of field cores may be authorized. To be considered acceptable for consideration the field cores shall be acquired, properly handled and tested in accordance with ASTM C 42/C 42M, "Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete" within 45 days of the original concrete placement date. The retesting will be at the expense of the Contractor and the results of the retesting shall be averaged with the results of the original testing. If the results of retesting indicate that the original test results were erroneous in the opinion of the Engineer or designated representative, the original test results will be discarded. In the instance of erroneous original test results the subsequent first set of retests will be at the expense of the City of Austin.

When, in the opinion of the Engineer or designated representative, the concrete compressive strength is deemed unacceptable for the intended use of the pavement, the concrete shall be removed and replaced to the limits indicated by test results.

360S.9 - Measurement

- A. When indicated, concrete pavement will be measured by the square yard of surface area of completed and accepted work. The surface area shall be so measured to also include that portion of pavement slab extending beneath the curb. When concrete pavement is to be measured by the square yard and monolithic curb is required, measurements for "Monolithic Curb" will be by the linear foot complete in place.
- B. When indicated on the drawings, concrete pavement, including monolithic curb when required, will be measured by the cubic yard of absolute volume of materials entering the mixture.

360S.10 - Payment

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Pavement," of the depth indicated on the drawings, "Concrete Pavement (High Early Strength)" of the depth indicated on the drawings and "Monolithic Curb" of the type indicated on the drawings (when pavement is measured by the square yard), as required or adjusted unit price for pavement of deficient thickness as provided under "Deficient Pavement Thickness", which price shall be full compensation for shaping and fine grading the roadbed, including furnishing and applying all water required; for furnishing, loading and unloading, storing, hauling and handling all concrete ingredients, including all freight and royalty involved; for placing and adjusting forms, including supporting material or preparing track grade; for mixing, placing, finishing, sawing, cleaning and sealing joints and curing all concrete; for furnishing and installing all reinforcing steel; for furnishing all materials for sealing joints and placing longitudinal, expansion and weakened plane joints, including all steel dowel caps and load transmission devices required and wire and devices for placing, holding and supporting steel bars, load transmission devices and joint filler material in proper position, for coating steel bars where complete the work.

Excavation required by this item in the preparation of the subgrade and for completion of the parkway will be measured and paid for in accordance with provisions governing the Items of "Street Excavation" and "Borrow," respectively, with provision that yardage to be measured and paid for once only, regardless of manipulations involved. Measurement of subgrade excavation for payment shall be limited to a total width of that of pavement plus 1 foot on each side.

Sprinkling and rolling required for the compaction of the rough subgrade in advance of fine grading will be measured and paid for as indicated in the governing items of excavation. Maintenance of a moist condition of the subgrade in advance of fine grading and concrete placing will not be paid for directly but shall be included in the unit price bid, as provided above.

Payment will be made under one of the following:

Pay Item No. 360S-A:	In. Concrete Pavement	Per Square Yard.
Pay Item No. 360S-AH:	In. Concrete Pavement (High Early Strength)	Per Square Yard.
Pay Item No. 360S-AS:	In. Concrete Pavement (High Range Water Reducing Admixture)	Per Square Yard.
Pay Item No. 360S-B:	Monolithic Curb	Per Linear Foot.
Pay Item No. 360S-C:	Concrete Pavement Including Monolithic Curb	Per Cubic Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item 360S, "Concrete Pavement"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
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)
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>
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

<u>Designation</u>	<u>Description</u>
Bulletin C-11	Construction Bulletin

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
TEX-203-F	Sand Equivalent Test
TEX-401-A	Sieve Analysis of Fine and Coarse Aggregate
TEX-406-A	Mineral Finer than 75 μm (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)
TEX-408-A	Organic Impurities in Fine Aggregate for Concrete

TEX-410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
TEX-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
TEX-413-A	Determination of Deleterious Materials in Mineral Aggregate
TEX-415-A	Slump of Portland Cement Concrete
TEX-416-A	Air Content of Freshly-Mixed Concrete by the Pressure Method
Tex-418-A	Compressive Strength of Cylindrical Concrete
Tex-424-A	Obtaining and Testing Drilled Cores of Concrete
Tex-436-A	Measurement of Texture Depth by the Sand Patch Method
Tex-524-C	Testing Premolded Joint Filler for Concrete
Tex-612	Acid Insoluble Residue
<u>Texas Department of Transportation: Departmental Material Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS 8900	Fly Ash
<u>American Association of State Highway & Transportation Officials, AASHTO Standard</u>	
<u>Designation</u>	<u>Description</u>
Method T 26	Quality of Water to be Used in Concrete

RELATED CROSS REFERENCE MATERIALS

<u>Standard Specification Item 360S, "Concrete Pavement"</u>	
Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges	
<u>Designation</u>	<u>Description</u>
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
<u>Texas Department of Transportation: Departmental Material Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants"
DMS-6100	Epoxy and Adhesives
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>
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
<u>American Concrete Institute, ACI</u>	
<u>Designation</u>	<u>Description</u>
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
TEX-418-A	Compressive Strength of Cylindrical Concrete Specimens

ITEM NO. 401S - STRUCTURAL EXCAVATION AND BACKFILL 9-26-12**401S.1 - Description**

This item shall govern the excavation for placement of structures, except pipe sewers, the disposal of such excavated material and the backfill around completed structures to the level of the original ground or grade indicated on the Drawings. The work shall include all necessary pumping or bailing, sheathing, drainage, and the construction and removal of any required cofferdams. Unless otherwise indicated on the Drawings, the work included hereunder shall provide for the removal of old structures or portions thereof (abutments, buildings, foundations, wingwalls, piers, etc.), trees and all other obstructions necessary to the proposed construction.

Where excavation is not classified, it will be grouped under "Unclassified Structural Excavation", which shall include the removal of all materials encountered regardless of their nature or the manner in which they are removed.

Where excavation is classified, it shall be classed as "Common Structural Excavation" or "Rock Structural Excavation" in accordance with the following criteria:

"Common Structural Excavation" shall include the removal of all materials other than rock.

"Rock Structural Excavation" shall include the removal of firm and compact materials that cannot be excavated with power equipment, without first being loosened or broken by blasting, slogging or drilling.

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.

401S.2 - Submittals

The submittal requirements of this specification item may include:

Supplier and certified test results for fine aggregate/sand material

Supplier and certified test results for flexible base material

Mix design and test results for lime stabilized subgrade material

Mix design and test results for Class J Concrete Base

Supplier and certified test results for granular material (coarse aggregate, foundation rock and pea gravel)

Mix design and test results for cement-stabilized backfill

Mix design and test results for controlled low strength material (CLSM)

Excavation Safety System Plan for proposed cofferdams, trench excavation and special shoring installations

401S.3 - Materials**A. Sand**

1. Fine aggregate sand shall be Grade 1 conforming to Standard Specification Item No. 302S, "Aggregates for Surface Treatments".
2. Native Sand shall be local material obtained from approved sources and subject to the approval of the Engineer or designated representative.

B. Flexible Base

Flexible base shall conform to the requirements of Standard Specification Item No. 210S, "Flexible Base".

C. Lime Stabilized Base

Lime stabilized base shall conform to the requirements of Standard Specification Item No. 202S, "Hydrated Lime and Lime Slurry" and Item No. 203S, "Lime Treatment for Materials in Place".

D. Concrete Base

Concrete base shall conform to a Class J Concrete as defined in Standard Specification Item No. 403S, "Concrete for Structures".

E. Granular Material

1. Coarse aggregate shall conform to the requirements of section 403S.3.C of Standard Specification Item No. 403S "Concrete for Structures".

2. Foundation Rock

Foundation rock shall be well graded, hard, durable coarse aggregate ranging in size from 2 to 6 inches (50 to 150 mm).

3. Pea Gravel

Pea gravel shall consist of hard, durable, opaque gravel, free of clay, loam, sand or other foreign substances, ranging in size from 1/4 inch to 3/8 inch (6.4 to 9.5 mm) conforming to ASTM C 33.

F. Cement Stabilized Backfill

Cement stabilized backfill shall contain aggregate, water and a minimum of 7% hydraulic cement based on the dry weight of the aggregate in accordance with TxDOT Test Method Tex-120-E, "Soil-Cement Testing. Unless directed otherwise on the Drawings, the aggregate shall be clean sand approved by the Engineer or designated representative.

G. Controlled Low Strength Material

Controlled low strength material (CLSM) shall conform to Standard Specification Item No. 402S, "Controlled Low Strength Material" and shall be approved by the Engineer or designated representative.

401S.4 - Construction Methods**A. Erosion Control and Tree Protection**

Prior to commencement of this work, all required erosion control and tree protection measures indicated on the Drawings shall be in place. The existing utilities shall be located and protected as specified in the Standard Contract Documents, Section 00700, "General Conditions" and/or indicated on the Drawings. A permit shall be required when utility adjustments are to be made in preparation for construction in the right-of-way, as specified in Section 5.2.0 of the City of Austin Utilities Criteria Manual.

Areas within the construction limits indicated on the Drawings shall be cleared of all trees, stumps, brush, etc., except trees or shrubs scheduled for preservation which shall be carefully trimmed as directed by the Engineer or designated representative, in accordance with Standard Specification Item No. 610S, "Preservation of Trees and Other Vegetation" and shall be protected from scarring, barking or other injuries during construction operations. All exposed cuts over 2 inches (50

millimeters) in diameter, exposed ends of pruned limbs or scarred bark shall be treated with an approved asphalt material within 24 hours of the pruning or injury.

Construction equipment shall not be operated nor construction materials stockpiled under the canopies of trees, unless otherwise indicated on the Drawings and/or specified in the Contract Documents. Excavation or embankment materials shall not be placed within the drip line of trees until tree wells are constructed.

Within the construction limits or areas indicated, all obstructions, stumps, roots, vegetation, abandoned structures, rubbish and objectionable material shall be removed to the following depths:

1. In areas to receive 6 inches (150 mm) or more embankment, a minimum of 12 inches (300 mm) below natural ground.
2. In areas to receive embankment less than 6 inches (150 mm), a minimum of 18 inches (450 mm) below the lower elevation of embankment, structure or excavation.
3. In areas to be excavated a minimum of 18 inches (450 mm) below the lower elevation of the embankment, structure or excavation.
4. In all other areas a minimum of 12 inches (300 mm) below natural ground.

When abandoned storm drains, sewers or other drainage systems are encountered they shall be removed as required to clear the new structure and plugged in a manner approved by the Engineer or designated representative.

Holes remaining after removal of all obstructions, objectionable material, trees, stumps, etc. shall be backfilled with select embankment material and compacted by approved methods. All cleared and grubbed material shall be disposed of in a manner satisfactory to the Engineer or designated representative. Unless otherwise provided, all materials as described above shall become the property of the Contractor and removed from the site and disposed of at a permitted disposal site.

Burning materials at the site shall conform to Standard Contract Document Section 01550, "Public Safety and Convenience".

B. Excavation

1. Excavation shall be done in accordance with the lines and depths indicated on the Drawings or as established by the Engineer or designated representative. Unless otherwise indicated on the Drawings or permitted by the Engineer or designated representative no excavation shall be made outside a vertical plane 3 feet (0.9 meter) from the footing lines and parallel thereto.

When structures are installed in streets, highways or other paved areas, the pavement and base shall be cut to neat lines. After completion of the excavation and backfilling, the pavement structure shall be restored to the satisfaction of the Engineer or designated representative.

2. Slopes, benching, sheeting, bracing, pumping and bailing shall be provided as necessary to maintain the stability and safety of excavations up to 5 feet (1.5 meters) deep. Excavation protection for excavations deeper than 5 feet (1.5 meters) shall be governed by Standard Specification Item No. 509S, "Excavation Safety Systems".
3. Excavation shall conform to elevations indicated on the Drawing or raised or lowered by written order of the Engineer or designated representative, when such alterations are judged proper. When it is deemed necessary to increase or decrease the plan depth of footings, the alterations in the details of the structure shall be as directed by the Engineer or designated representative. The Engineer or designated representative shall have the right to substitute revised details resulting from consideration of changes in the design conditions.
4. When a structure is to rest on an excavated surface other than rock, special care shall be taken not to disturb the bottom of the excavation and the final excavation to grade shall not be

performed until just before the footing is placed. Equipment selected and used by the Contractor for excavation which results in disturbance of what was otherwise stable subgrade material, as shown by laboratory tests, will not be used as a justification for payment for excavating to extra depth or for payment for stabilizing materials which may be ordered by the Engineer or designated representative.

5. Excavated material required to be used for backfill may be deposited by the Contractor in storage piles as indicated on the Drawing or at points convenient for its rehandling during the backfilling operations, subject to the approval of the Engineer or designated representative, who may require that the survey center line of the structure and the transverse or hub line of any unit of the structure be kept free of any obstruction. The Contractor shall adjust any stockpiles, to facilitate surveying and the work of other Contractors working in the immediate proximity, as directed by the Engineer or designated representative.
6. Excavated material required to be wasted shall be disposed of as directed by the Engineer or designated representative, in a manner which will not obstruct the stream or otherwise impair the efficiency or appearance of the structure or other part of the work.
7. For all single and multiple box culverts, pipe culverts, pipe arch culverts and box sewers of all types, where the soil encountered at established footing grade is a quicksand, muck or similar unstable material, the following procedure shall be used unless other methods are indicated:
 - a) The depth to which unstable material is removed will be determined by the Engineer or designated representative. It will not exceed 2 feet (0.6 meter) below the footing of culverts that are 2 feet (0.6 meter) or more in height and will not exceed the height of culverts for those less than 2 feet (0.6 meter) high. Excavation shall be carried at least 1 foot (0.3 meter) horizontally beyond the limits of the structure on all sides. All unstable soil removed shall be replaced with suitable stable material, in uniform layers of suitable depth for compaction as directed by the Engineer or designated representative. Each layer shall be wetted, if necessary and compacted by rolling or tamping as required to provide a stable foundation for the structure. Soil, which has sufficient stability to properly sustain the adjacent sections of the roadway embankment, will be considered a suitable foundation material.
 - b) When, in the opinion of the Engineer or designated representative, it is not feasible to construct a stable footing as outlined above, the Contractor shall construct it by the use of special materials, such as flexible base, cement stabilized base, cement stabilized rockfill or other material, as directed by the Engineer or designated representative. This work will be paid for as provided in Section 401S.9, "Payment".
8. When the material encountered at footing grade of a culvert is found to be partially rock or incompressible material and partially a compressible soil which is satisfactory for the foundation, the incompressible material shall be removed for a depth of 6 inches (150 mm) below the footing grade and backfilled with a compressible material similar to that used for the rest of the structure.
9. When the material encountered at footing grade of a bridge bent or pier is found to be partially of rock or incompressible material, and partially of a compressible material, the foundation shall not be placed until the Engineer or designated representative has inspected the footing and authorized such changes found necessary to provide an adequate foundation.

401S.5 - Bridge Foundations and Retaining Walls

The material below the bottom of the footing grade shall not be disturbed. Backfill material shall not be used to compensate for excavation that is extended below the proposed footing grade. When excavation is carried below the proposed footing grade, the over excavated area shall be filled with concrete at the time the footing is placed. The additional concrete placement shall be at the Contractor's sole expense.

When required by the Engineer or designated representative, cores shall be taken to determine the character of the supporting material(s). The cores shall be taken when the excavation is nearing completion and shall be an intact sample adequate to judge the character of the founding material. The cores shall be acquired at a minimum depth of 5 feet (1.5 meters) below the proposed footing founding grade.

When the founding stratum is rock or other hard material, all loose material shall be removed and the founding grade cleaned and cut to a firm surface that is level, stepped or serrated as directed by the Engineer or designated representative. All soft seams shall be cleaned and filled with concrete at the time the footing is placed.

When the material at the footing grade of a retaining wall, bridge bent or pier is a mixture of compressible and incompressible material, the foundation shall not be placed until the Engineer or designated representative has inspected the excavation and authorized changes to provide a uniform bearing condition.

401S.6 - Cofferdams

The term cofferdams, whenever used in this specification, designates any temporary or removable structure constructed to hold the surrounding earth, water or both, out of the excavation, whether the structure is formed of earth, timber, steel, concrete or a combination of these. It includes earthen dikes, timber cribs, any type of sheet piling, removable steel shells and the like and all necessary bracing and it shall be understood also to include the use of pumping wells or well points for de-watering. The cost of cofferdams, when required, shall be included as a part of the bid price for excavation.

It is the intent of this specification to require that a suitable cofferdam be provided, when necessary, to insure that the foundation may be placed in a dry condition, as to preclude sliding and caving of the walls of the excavation. The cofferdam shall conform with the requirements of Standard Specification Item No. 509S, "Excavation Safety Systems" and shall provide a safe work area with sufficient clearance for the construction, inspection and removal of required forms and, if necessary, sufficient room to allow pumping outside the forms. Where no ground or surface water is encountered, the cofferdam need be sufficient only to protect the workers and to avoid cave-ins or slides beyond the excavation limits.

Unless otherwise indicated on the Drawings, cofferdams shall be removed by the Contractor after the completion of the substructure without disturbing or marring the structure.

401S.7 - De-Watering

Structures shall not be constructed or placed in the presence of water unless otherwise approved by the Engineer or designated representative. Precast members, pipe and concrete shall only be placed on a dry, firm surface. Water shall be removed by bailing, pumping, well-point installation, deep wells, underdrains or other approved method.

When structures are approved for placement in the presence of water, standing water shall be removed in a manner that shall preclude the possibility of the movement of water through or alongside any concrete being placed. Pumping or bailing will not be permitted during the placing of concrete or for a period of at least 36 hours thereafter, unless from a suitable sump separated from the concrete work by a water-tight wall.

Pumping or bailing during placement of seal concrete shall only be allowed to the extent necessary to maintain a static head of water within the cofferdam. De-watering inside a sealed cofferdam shall not commence until the seal has aged a minimum of 36 hours.

When the bottom of an excavation cannot be de-watered to the point that the subgrade is free of mud or it is difficult to keep the reinforcing steel clean a stabilizing material (e.g. flexible base, cement-stabilized-backfill or lean concrete) shall be placed in the bottom of the excavation. When a lean concrete is used,

the concrete shall include a minimum of 275 Pounds of cement per cubic yard (163 kilograms of cement per cubic meter) and be placed to a minimum depth of 3 inches (75 mm). Stabilizing material that is placed for the convenience of the Contractor will be at the Contractor's own expense.

401S.8 - Backfilling

A. General

As soon as practicable, all portions of excavation not occupied by the permanent structure shall be backfilled. Back-fill material shall be free from stones large enough to interfere with compaction, large or frozen lumps that will not break down readily under compaction, wood or other extraneous material. Backfill material shall be approved by the Engineer or designated representative.

That portion of backfill which will support any portion of completed roadbed, retaining wall or embankment shall be placed in layers not more than 8 inches (200 mm) in depth (loose measurement) and shall be compacted to meet the density requirements of the roadbed, retaining wall, embankment material, or as indicated on the Drawings.

That portion of backfill which will not support any portion of completed roadbed or embankment shall be placed in layers not more than 10 inches (250 mm) in depth (loose measurement) and shall be compacted to a minimum of 95 percent of maximum density as determined by TxDoT Test Method Tex-114-E and the re-excavated to the proper grade and dimensions.

If the excavation has been made through a hard material resistant to erosion, the backfill around piers and in front of abutments and wings may be ordered by the Engineer or designated representative to be of stone or lean concrete. Unless otherwise indicated on the Drawings, such backfill shall be paid for as extra work.

That portion of the backfill which will support any portion of the roadbed, retaining wall or embankment shall be placed in uniform layers not more than 8 inches (200 mm) in depth (loose measurement) and shall be compacted to a minimum of 95 percent of maximum density, as determined by TxDoT Test Method Tex-114-E and then re-excavated to the proper grade and wetted uniformly to the moisture content required to obtain the specified density and shall be compacted to that density by means of mechanical tampers or rammers, except that the use of rolling equipment of the type generally used in compaction embankments will be permitted on portions which are accessible to such equipment.

All portions of embankment too close to any portion of a structure to permit compaction by the use of the blading and rolling equipment used on adjoining sections of embankment, shall be placed and compacted with mechanical tamps and rammers to avoid damage to the structure.

These provisions require mechanical compaction by means of either rolling equipment or mechanical tampers or rammers, of all backfill and embankment adjoining the barrels and wingwalls or culverts and adjoining all sides of bridge abutments and retaining walls, regardless of whether or not such embankment or backfill is above or below the original surface of the ground and regardless of whether the excavation at structure site was performed conforming to Standard Specification Item No. 111S, "Excavation", this item 401S, "Structural Excavation", Standard Specification Item No. 110S, "Street Excavation" or Standard Specification Item No. 120S, "Channel Excavation". Unless otherwise indicated on the Drawings, hand tamping will not be accepted as an alternate for mechanical compaction.

As a general rule, material used in filling or backfilling the portions described in this paragraph shall be an earth, free of any appreciable amount of gravel or stone particles larger than 4 inches (100 mm) in greater dimension and of a gradation that permits thorough compaction. When, in the opinion of the Engineer or designated representative, such material is not readily available, the use of rock or gravel mixed with earth will be permitted, provided that no particles larger than 12 inches (300 mm) or smaller than 6 inches (150 mm) may be used. The percentage of fines shall be sufficient to fill all

voids and insure a uniform and thoroughly compacted mass of proper density. When required by the Drawings or by written order of the Engineer or designated representative, cement-stabilized-backfill material shall be used for backfilling.

All portions of fill and backfill described in the preceding paragraph shall be compacted to the same density requirements specified for the adjoining sections of embankment in accordance with the governing specifications. Where no embankment is involved on the project and no relevant specifications are included in the contract, all backfill shall be compacted to a density comparable with the adjacent undisturbed material.

No backfill shall be placed against any abutment or retaining wall until such structure has been in place at least 7 days. No backfill shall be placed adjacent to or over single and multiple boxes until the top slab has attained 500 psi (3450 kPa) flexural strength. Backfill placed around abutments and piers shall be deposited on both sides to approximately the same elevation at the same time.

Care shall be taken to prevent any wedging action of backfill against the structure and the slopes bounding the excavation shall be stepped or serrated to prevent such action. Backfill shall be uniformly placed around bridge foundations.

B. Pipe Culverts

The following requirements shall apply to the backfilling of pipe culverts in addition to the pertinent portions of the general requirements given in the preceding section.

Selected materials from excavation, borrow or other approved material shall be wetted, if required and placed along both sides of the pipe equally, in uniform layers not exceeding 8 inches (200 mm) in depth (loose measurement) and thoroughly compacted so that there shall be a berm of thoroughly compacted material on each side of the pipe. The method and degree of compaction shall be the same as specified above for portions of backfill within the limits of embankment or roadbed.

Filling and/or backfilling shall be continued in this manner to the elevation of the top of the pipe. Special care shall be taken to secure thorough compaction of the material placed under the haunches of the pipe to prevent damage or displacement of the pipe. All fill or backfill below the top of pipe shall be compacted mechanically in the manner and to the density prescribed above, regardless of whether or not such material is placed within the limits of the embankment or roadbed. In the case of pipe placed in trenches, that portion of the backfill above the top of the pipe which supports embankment or the roadbed shall receive mechanical compaction as specified above and the portion which will not support any portion of embankment or roadbed shall be placed in layers not more than 8 inches (200 mm) in depth (loose measurement) and shall be compacted by whatever means the Contractor chooses, to a density comparable with the adjacent, undisturbed material. Embankments above the top of pipe shall be placed conforming to Item No. 132S, "Embankment". During construction adequate cover must be provided to protect the structure from damage.

The Engineer or designated representative may reject backfill material that contains more than 20% by weight of material retained on a 3-in (75 mm) sieve, with large lumps not easily broken down, or that cannot be spread in loose layers. Material excavated by a trenching machine will generally meet the requirements of this Section as long as large stones are not present.

Where pipe extends beyond the toe of slope of the embankment and the depth of cover provided by backfill to the original ground level is less than the minimum required by the specifications for the type of pipe involved, additional material shall be placed and compacted until the minimum cover has been provided.

Whenever excavation is made for installing pipe culverts or box sewers across private property or beyond the limits of the embankment, the top soil removed in excavating the trench shall be kept separate and replaced as nearly as feasible in its original position and the entire area involved in the construction operations shall be restored to a presentable condition.

C. Cement Stabilized Backfill

When indicated on the Drawings, trenches shall be backfilled to the elevations shown with cement stabilized backfill. The cement-stabilized backfill shall be placed equally along the sides of structures to prevent strain on or displacement of the structure.

Cement stabilized backfill below the spring line of pipe culverts shall be sufficiently plastic to completely fill all voids in the trench. Hand operated tampers may be used if necessary to fill the voids. The pipe shall be held in alignment by jacks or other suitable means to prevent the mortared joints from cracking due to displacement caused by placing the backfill material.

Cement stabilized backfill above the spring line of pipe culverts may be dry enough to be transported without special mixing equipment.

On structures other than pipe culverts, special mixing equipment will not be required to transport the cement stabilized backfill unless otherwise indicated on the Drawings.

D. Controlled Low Strength Material (CLSM)

When indicated on the Drawings the excavation shall be backfilled with CLSM to the elevations shown. The structure shall be prevented from being displaced or "floated out" during the placement of CLSM. The CLSM shall be prevented from entering culverts and drainage structures.

401S.9 - Measurement

Unless otherwise indicated on the Drawings, structural excavation for pipe headwalls, inlets, manholes, culvert widening (extensions), bridge abutments and side road and private entrance pipe culverts will not be measured in the field but shall be included in the Plan Quantity unit price bid by the cubic yard (cubic meters: 1 cubic meter is equal to 1.308 cubic yards) Determination of plan quantities for structural excavation shall be made by the method of average end-areas using the following limits to establish templates for measurement.

- A. For all structures requiring measurement, except the barrels of pipe culverts, no material outside of vertical planes 1 foot (300 mm) beyond the edges of the footings and parallel thereto will be included.
- B. For the barrels of pipe culverts of 42 inches (1.09 meters) or less nominal or equivalent diameter, no material outside of vertical planes 1 foot (300 mm) beyond the horizontal projection of the outside surfaces of the pipe and parallel thereto will be included. For the barrels of pipe culverts more than 42 inches (1.09 meters) in nominal or equivalent diameter, no material outside of vertical planes located 2 feet (600 mm) beyond the horizontal projection of the outside surfaces of the pipe and parallel thereto will be included.
- C. If a cofferdam, as herein defined, is used, the limitations indicated above shall apply just as if no cofferdams were used.
- D. Where excavation in addition to that allowed for the footings is required for other portions of the structure, such as for the cap, cross strut or tie beam of a pier or bent or for the superstructure, measurements for such additional excavation will be limited laterally by vertical planes 1 foot (300 mm) beyond the face of the member and parallel thereto and vertically to a depth of 1 foot (300 mm) below the bottom of such member.
- E. Except as allowed by the above conditions, no account will be taken of any excavation necessary for placing forms or falsework.
- F. Except at side road culverts, all street excavation called for on the contract drawings at all structure sites shall be assumed to be completed before starting the structural excavation and the measurement of structural excavation will include only material below or outside the limits of the

completed street excavation. Excavation for side road and private entrance pipe culverts will not be measured for payment but shall be included in the unit price bid for this specification item.

- G. On all structures of bridge classification where the contract drawings call for channel excavation at the structure site, it shall be assumed to have been completed before starting the structural excavation and the measurement of structural excavation will include only material below or outside the limits of the completed channel section. The method of measurement for payment will be in accordance with this procedure regardless of the actual construction methods followed.
- H. Where excavation diagrams are indicated on the Drawings, they shall take precedence over these provisions.
- I. Measurement will not include materials removed below footing grades to compensate for anticipated swellage due to pile driving and it will not include material required to be removed due to swellage beyond the specified limits during pile driving operations.
- J. Measurement will not include additional yardage caused by slips, slides, cave-ins, siltings or fillings due to the action of the elements or the carelessness of the Contractor. Water will not be classed as excavated material.
- K. Where rock, other incompressible or unstable material is undercut to provide suitable foundation for pipe or box culverts, such material below grade, ordered by the Engineer or designated representative to be removed, will be measured for payment.
- L. Except for any required undercut, quantities for "Structural Excavation", as indicated on the Drawings, shall be considered as final quantities and no further measurement will be required, unless the alignment, grades or structure locations are revised by the Engineer or designated representative during construction. Final determination of quantities for individual structures will be made, if in the opinion of the Engineer or designated representative or upon evidence furnished by the Contractor, substantial variations exist between quantities indicated on the Drawings and actual quantities due to changes in cross sections or apparent errors. Excavation quantities for foundations indicated on the Drawings where cofferdams are required shall be considered as final quantities and no further measurement will be made.
- M. For any footing, foundation or other structure unit within the scope of this specification, additional measurement will be made of the volume of excavation involved in the lowering or raising of the elevation of a footing, foundation or structure unit, when such grade change is authorized by the Engineer or designated representative. Measurement will be made by the addition to or the deduction from, the original quantities for the volume of excavation involved in the authorized grade change.
- N. Cement stabilized backfill shall be measured by the backfill diagram as indicated on the Drawings. The quantity of "Cement Stabilized Backfill" as indicated on the Drawings shall be considered as final quantities and no further measurement will be required, unless alignment or grade elevations as indicated are revised by the Engineer or designated representative. If such revisions result in an increase or decrease in this quantity, the final quantity will be revised by the amount represented by the changes in alignment or grade elevations.

401S.10 - Payment

Payment for all work prescribed under this item and measured as provided above will be made at the unit bid price per cubic yard for the particular class of excavation specified on the Drawings in the amount shown on the Drawings and in the proposal. Payment for revised quantities will be made as specified above and for the removal of unstable and incompressible material as noted below.

Payment for removal and replacement of unstable or incompressible material below the footing grades of culverts and box sewers as indicated above will be made as follows:

When indicated on the Drawings or the Engineer or designated representative directs the use of special materials such as flexible base, concretebase, cement stabilized backfill, controlled low strength material

or other special material, payment for excavation below the footing grades shall be made at the unit bid price for "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation", as the case may be. Payment for furnishing, hauling, placing and compacting the flexible base, concrete base, cement stabilized backfill, controlled low strength material or other special material will be made at the unit bid price for these items in the bid or in accordance with pertinent provisions for extra work.

Where special materials are not required or specified, the removal and replacement of the unstable material will be performed as described above. Payment therefore will be made at a price equal to 200 percent of the unit bid price per cubic yard for "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation", as the case may be. The unit bid price shall include full compensation for removing the unstable or incompressible material, for furnishing, hauling, placing and compacting suitable material required to replace it and for all labor, equipment, tools and incidentals necessary to complete the work.

Payment for "Concrete Base", "Cement Stabilized Backfill" and "Controlled Low Strength Material" measured as prescribed above shall be made at the unit bid price per cubic yard. The unit bid price shall include full compensation for furnishing all materials, tools, labor, equipment, sheathing and incidentals required to perform the applicable work prescribed herein.

When the Engineer or designated representative judges it necessary to lower the structure footings to an elevation below the grade indicated on the Drawings, payment for the "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation" as the case may be, required below plan grade down to and including an elevation 5 feet (1.525 meters) below drawing grade for any individual footing will be made at a unit price equal to 115 percent of the contract unit bid price. Payment for the excavation from an elevation over 5 feet (1.525 meters) below plan grade down to and including an elevation 10 feet (3.05 meters) below plan grade will be made at a unit price equal to 125 percent of the contract unit bid price for "Unclassified Structural Excavation", "Common Structural Excavation" or "Rock Structural Excavation" as the case may be. No increase in unit price will be allowed for other bid items of the contract and no additional compensation will be allowed for any required cofferdam adjustments made necessary by such lowering of footings. These provisions shall not apply to the lowering of culverts, except when the flow line grade is lowered 1 foot (300 mm) or more below plan grade.

In cases where the extra depths required for any footing or footings exceeds 10 feet (3.05 meters), a supplemental agreement shall be made covering the quantities removed from depths in excess of 10 feet (3.05 meters) below plan grade.

No direct payment will be made for filling or backfilling around structures. Payment for the backfilling and compacting of areas, which were removed as structural excavation shall be included in the unit bid prices for the various classes of structural excavation.

At the end of each estimate period, the Engineer or designated representative shall determine the completed portion of the total work under Standard Specification Item No. 401S "Structural Excavation and Backfill" and payment shall be made accordingly.

Filling or backfilling of areas above the natural ground level or above the limits of street excavation or channel excavation sections shall be considered as Standard Specification Item No. 132S, "Embankment" and payment therefore shall be included in the unit prices bid for the various classes of Standard Specification Item No. 110S, "Street Excavation", Standard Specification Item No. 120S, "Channel Excavation" or Standard Specification Item No. 130S, "Borrow".

Where no channel excavation is provided for at culvert sites and where it is necessary to excavate beyond the limits of structural excavation, as herein described in order that the culvert may function properly, such excavation shall be included with structural excavation as may be indicated on the Drawings.

Payment for all work prescribed under this item shall include full compensation for all excavation and backfill including compaction, all soundings, construction of all cofferdams, all dewatering and for furnishing all materials, labor, equipment, tools, sheathing, bracing, cofferdams, pumps, drills, explosives and incidentals necessary to complete the work, except for specific allowances stated above.

Special materials used or additional excavation made for the Contractor's convenience to expedite the work will not be paid for directly, but shall be included in the unit price bid for this specification item. In addition, if the Contractor's construction methods and equipment creates conditions necessitating usage of special materials or additional excavation, the work and materials will not be paid for directly, but shall be included in the unit price bid for this specification item.

When specified in the contract bid form as a separate pay item(s), the item(s) will be paid for at the contract unit price(s) for "Flexible Base", "Lime Stabilized Base" and "Controlled Low Strength Material". The bid prices shall include full compensation for all Work herein, specified, including the disposal of all material not required in the Work, the furnishing of all material, equipment, tools, labor and incidentals necessary to complete the Work.

Payment will be made under one of the following:

Pay Item No. 401S-A:	Unclassified Structural Excavation, Plan Quantity	Per Cubic Yard.
Pay Item No. 401S-B:	Common Structural Excavation	Per Cubic Yard.
Pay Item No. 401S-C:	Rock Structural Excavation	Per Cubic Yard.
Pay Item No. 401S-D:	Concrete Base	Per Cubic Yard.
Pay Item No. 401S-E:	Cement Stabilized Backfill	Per Cubic Yard.
Pay Item No. 401S-F:	Flexible Base	Per Cubic Yard.
Pay Item No. 401S-G:	Lime Stabilized Base	Per Square Yard.
Pay Item No. 401S-H:	Controlled Low Strength Material	Per Cubic Yard.
Pay Item No. 401S-I:	Cofferdams, type	Per Cubic Yard.
Pay Item No. 401S-J:	Dewatering	Per Cubic Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>
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<u>Standard Specification Item 401S, "Structural Excavation and Backfill"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
Section 00700	General Conditions
Section 01550	Public Safety and Convenience
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 5.2.0	Permit Information and Format
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 130S	Borrow
Item No.	Embankments

132S	
Item No. 202S	Hydrated Lime and Lime Slurry
Item No. 203S	Lime Treatment for Materials in Place
Item No. 210S	Flexible Base
Item No. 302S	Aggregates for Surface Treatments
Item No. 402S	Controlled Low Strength Material
Item No. 403S	Concrete for Structures
Item No. 509S	Excavation Safety Systems
Item No. 610S	Preservation of Trees and Other Vegetation
<u>Texas Department of Transportation: Departmental Material Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS-4640	Chemical Admixtures for Concrete
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>

ASTM C 33	Specification For Concrete Aggregates
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-114-E	Laboratory Compaction Characteristics & Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-120-E	Soil-Cement Testing

RELATED CROSS REFERENCE MATERIALSStandard Specification Item 401S, "Structural Excavation and Backfill"Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item 110	Excavation
Item 132	Embankment
Item 400	Excavation and Backfill for Structures
Item 401	Flowable Backfill
Item 402	Trench Excavation Protection
Item 403	Temporary Special Shoring
Item 421	Hydraulic Cement Concrete

ITEM NO. 402S - CONTROLLED LOW STRENGTH MATERIAL 11-13-07**402S.1 - Description**

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

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

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

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

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

402S.2 - Submittals

The submittal requirements of this specification item include:

- A. A mix design submittal including the results of unconfined compressive strength tests, air entrainment (if applicable), flow consistency, hardened unit weight, and timed Ball Drop and corresponding Penetrometer tests.
- B. Certifications and test results for the cement fly ash, and admixtures.
- C. Particle-size gradation and specific gravity tests on the filler aggregate.

402S.3 - Materials**A. Cement.**

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

Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

B. Fly Ash

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

C. Filler Aggregate.

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

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

D. Mixing Water.

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

E. Settlement Compensator

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

402S.4 - Mix Design

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

The Mix Design submittal must include:

- A. Test results for unconfined compressive strength, air entrainment (if applicable), flow consistency, hardened unit weight, and timed Ball Drop (ASTM C-360) and corresponding Penetrometer tests (with a concrete pocket penetrometer),
- B. Certifications and test results for the cement, fly ash, and admixtures, and
- C. Results of particle-size gradation and specific gravity tests on the filler aggregate. The submittal shall include Penetrometer tests performed every thirty minutes until the Ball Drop test shows a 2-inch (50 mm) indentation, as well as the predicted Penetrometer reading that corresponds to a 3-inch (75 mm) Ball Drop indentation. Particle-size gradation shall be determined using a series of sieves that gives no fewer than five uniformly spaced points for graphing the entire range of particle sizes larger than a No. 200 sieve (75-µm).

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

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

- A. field tests of the CLSM during the year have been satisfactory,
- B. there have been no changes in type or source of the materials of the mix, and

C. the characteristics of the materials have not changed significantly since the original submittal.

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

402S.5 - Strength

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

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

402S.6 - Flow Consistency

Flow consistency shall be established in tests involving the use of a six-inch (150 mm) length by three-inch (75 mm) diameter open-ended straight tubing made of steel, plastic or other non-absorbent material that is non-reactive with cement or fly ash. The tube shall be placed with one end on a horizontal flat surface and held in a vertical position. The tube shall then be filled to the top with CLSM. The top surface shall be struck off with a suitable straight edge and any spillage shall be removed from the base of the tube. Within five seconds thereafter the tube shall be raised carefully, using a steady upward lift with no lateral or torsional motion. The entire test, from the start of filling until removal of the tube, shall be completed within 1½ minutes without interruption.

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

402S.7 - Air Entrainment

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

402S.8 - Field Strength Tests

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

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

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

402S.9 - Construction Methods**A. General**

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

B. Utility Line Backfill

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

C. Culvert Backfill

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

D. Other Backfill

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

E. Filling Abandoned Culverts, Pipe, or other Enclosures

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

402S.10 - Acceptance Testing During Construction

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

402S.11 - Measurement and Payment

The work and materials presented herein will generally not be paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used.

When specified in the contract bid form as a separate pay item, the item will be paid for at the contract unit bid price(s) for "Controlled Low Strength Material". The bid prices shall include full compensation for all Work herein specified, including the furnishing of all materials, equipment, tools, labor and incidentals necessary to complete the Work.

Payment will be made under the following:

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

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item 402S, "Controlled Low Strength Material"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
430S-4	Concrete Backfill Under Curb & Gutter
506S-14	Control or Mini Manhole
511S-13A	Water Valve Box Adjustment to Grade W/Full Depth Concrete
511S-13B	Water Valve Box Adjustment to Grade W/Concrete and H.M.A.C.
1100S-6A	Narrow Excavation Next to C&G - Trench Width 0.3 M (12") & Less
1100S-6B	Narrow Excavations - Trench Width 0.3 M (12") & Less
1100S-6C	Excavation Next to C&G - Trench Width Greater than 0.3 M (12")
1100S-6D	Excavations - Trench Width Greater than 0.3 M (12")
<u>City of Austin Standard Specification Items</u>	

<u>Designation</u>	<u>Description</u>
Item No 403S	Concrete for Structures
Item No 405S	Concrete Admixtures
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 334	Hot Mix-Cold Laid Asphaltic Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Portland Cement Concrete
Item No. 437	Concrete Admixtures

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 402S, "Controlled Low Strength Material"

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
Tex-106-E	Method Of Calculating the Plasticity Index of Soils
Tex-416-A	Air Content of Freshly Mixed Concrete By The Pressure Method
Tex-418-A	Compressive Strength of Cylindrical Concrete
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>

ASTM C 150	Portland Cement
ASTM C 360	Ball Penetration in Fresh Portland Cement Concrete
ASTM C 403	Time of Setting of Concrete Mixtures by Penetration Resistance
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 504S	Adjusting Structures
Item No. 506S	Manholes
Item No. 508S	Miscellaneous Structures and Appurtenances
Item No. 510	Pipe

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ITEM NO. 403S - CONCRETE FOR STRUCTURES 9-26-12**403S.1 - Description**

This item shall govern quality, storage, handling, proportioning and mixing of materials for hydraulic cement concrete construction of buildings, bridges, culverts, slabs, prestressed concrete and incidental appurtenances.

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

403S.2 - Submittals

The submittal requirements of this specification item may include:

- A. Mix design option(s) of the class of concrete required on the project,
- B. The supplier of the concrete mix design(s) and type of mixing equipment, and
- C. Type of admixtures to be used with the concrete mixes.

403S.3 - Materials

Concrete shall be composed of hydraulic cement or hydraulic cement and supplementary cementing materials, water, aggregates (fine and coarse), and admixtures proportioned and mixed as hereinafter provided to achieve specified results.

A. Cementitious Materials

Hydraulic cement shall conform to ASTM C 150, Type I (General Purpose), Type II (General Purpose with Moderate Sulfate Resistance) and Type III (High Early Strength). Type I shall be used when none is specified or indicated on the drawings. Type I and Type III cements shall not be used when a Type II cement is specified or indicated on the drawings. Type III cement may be used in lieu of a Type I cement, when the anticipated air temperature for the succeeding 12 hours will not exceed 60°F (15.6°C). A Type III cement shall only be used in precast concrete or when otherwise specified or allowed. All cement shall be of the same type and from the same source for a monolithic placement.

Unless otherwise specified the cementitious material content shall be limited to no more than 700 lbs. per cubic yard (417 kg per cubic meter). When supplementary cementing materials are used, cement is defined as "cement plus supplementary cementing material." Supplementary cementing materials include fly ash (DMS 4610), ultra-fine fly ash (DMS-4610), ground granulated blast furnace slag grade 100 or 120 (DMS-4620), silica fume (DMS-4630) and metakaolin (DMS-4635).

Supplementary cementing materials shall not be used when white hydraulic cement is specified.

Class C flyash shall not be used in sulfate-resistant concrete.

Hydraulic cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

When sulfate-resistant concrete is required for a project, mix design options 1, 2, 3 or 4 presented in Section 403S.8, "Mix Design Options" shall be used to develop appropriate mix design utilizing Type I/II, II, V, IP or IS cement.

B. Mixing Water

Water for use in concrete and for curing shall be potable water free of oils, acids, organic matter or other deleterious substances and shall not contain more than 1,000 parts per million of chlorides as Cl or sulfates as SO₄.

Water from the City of Austin will not require testing. Contractor may request approval of water from other sources. Contractor shall arrange for samples to be taken from the source and tested at the Contractor's expense. When water from other sources is proposed, test reports shall be provided that indicates compliance with Table 1 before use.

Table 1: Chemical Limits for Mix Water		
Contaminant	Test Method	Maximum Concentration (ppm)
Chloride (CL)	ASTM D-512	
Prestressed concrete		500
Bridge decks & superstructure		500
All other concrete		1,000
Sulfate (SO ₄)	ASTM D-516	1,000
Alkalies (NA ₂ O + 0.658 K ₂ O)	ASTM D-4191 & D-4192	600
Total Solids	AASHTO T-26	50,000

Water that has an adverse effect on the air-entraining agent or any other chemical admixture or on strength or time of set of the concrete shall not be used. Water used in white Portland cement concrete shall be free from iron and other impurities, which may cause staining, or discoloration.

C. Coarse Aggregate

Coarse aggregate shall consist of durable particles of crushed or uncrushed gravel, crushed blast furnace slag, crushed stone or combinations thereof; free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material either free or as an adherent coating. When white hydraulic cement is specified, the coarse aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout.

The coarse aggregate from each source shall not contain more than 0.25 percent by weight of clay lumps, nor more than 1.0 percent by weight of shale nor more than 5 percent by weight of laminated and/or friable particles when tested in accordance with TXDOT Test Method TEX-413-A. The coarse aggregate from each source shall have a wear of not more than 40 percent when tested in accordance with TXDOT Test Method TEX-410-A.

Unless otherwise indicated on the drawings, the coarse aggregate from each source shall be subjected to 5 cycles of the soundness test conforming to TXDOT Test Method TEX-411-A. The loss shall not be greater than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

Coarse aggregate shall be washed. The Loss by Decantation (TXDOT Test Method TEX-406-A), plus allowable weight of clay lumps, shall not exceed 1 percent or the value indicated on the drawings or in the project manual, whichever is less. If material finer than the # 200 (75 micrometer) sieve is definitely established to be dust or fracture of aggregates made primarily from crushing of stone, essentially free from clay or shale as established by Part III of TXDOT Test Method TEX-406-A, the percent may be increased to 1.5. When crushed limestone coarse aggregate is used in concrete pavements, the decant may exceed 1% but not more than 3% if the material finer than the #200 (75 micrometer) sieve is determined to be at least 67% calcium carbonate in accordance with TxDoT Test Method Tex-406-A, Part III.

The coarse aggregate factor may not be more than 0.82; however, when voids in the coarse aggregate exceed 48 percent of the total rodded volume, the coarse aggregate factor shall not exceed 0.85. The coarse aggregate factor may not be less than 0.68 except for a Class I machine extruded mix that shall not have a coarse aggregate factor lower than 0.61.

When exposed aggregate surfaces are required, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable for exposed aggregate finishes.

When tested by approved methods, the coarse aggregate including combinations of aggregates when used, shall conform to the grading requirements shown in Table 2.

Table 2: Coarse Aggregate Gradation Chart (Percent Passing)

Grade	Nom. Size	2½" (62.5mm)	2" (50mm)	1½" (37.5mm)	1" (25mm)	¾" (19mm)	½" (12.5mm)	3/8" (9.5mm)	No. 4 (4.75mm)	No. 8 (2.36mm)
1	2" (50 mm)	100	80—100	50—85		20—40			0—5	
2 (467)*	1½" (37.5 mm)		100	95—100		35—70		10—30	0—5	
3	1" (50 mm)		100	95—100		60—90	25—60		0—5	
4 (57)*	1" (50 mm)			100	95—100		25—60		0—10	0—5
5 (67)*	¾" (19 mm)				100	90—100		20—55	0—10	0—5
6 (7)*	½" (12.5 mm)					100	90—100	40—70	0—15	0—5

7	3/8 " (9.5 mm)						100	70—95	0—25	
8	3/8 " (9.5 mm)						100	95—100	20—65	0—10

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.
 2. The use of recycled crushed hydraulic cement concrete as a coarse aggregate shall be limited to Concrete Classes A, B and D (see Table 5).
- D. Fine Aggregate

Fine aggregate shall be washed and consist of clean, hard, durable and uncoated particles of natural or manufactured sand or a combination thereof, with or without a mineral filler. When white hydraulic cement is specified, the fine aggregates used in the concrete shall be light colored. Quality shall be reasonably uniform throughout. It shall be free from frozen material or injurious amounts of salt, alkali, vegetable matter or other objectionable material and it shall not contain more than 0.5 percent by weight of clay lumps in accordance with TEX-413-A. When subjected to color test for organic impurities per TXDOT Test Method TEX-408-A, it shall not show a color darker than standard.

Unless indicated otherwise on the drawings the acid insoluble residue of fine aggregate used in slab concrete subject to direct traffic shall not be less than 60 percent by weight (mass) when tested conforming to TXDOT Test Method TEX-612-J.

Unless indicated otherwise on the Drawings, fine aggregate shall be blended, when necessary, to meet the acid insoluble residue requirement.

When blending the following equation shall be used:

$$\text{Acid Insoluble (\%)} = \{(A1)(P1) + (A2)(P2)\} / 100$$

Where:

A1 = acid insoluble (%) of aggregate 1,

A2 = acid insoluble (%) of aggregate 2,

P1 = % by weight of A1 of the fine aggregate blend, and

P2 = % by weight of A2 of the fine aggregate blend.

When tested in accordance with TxDoT Test Method Tex-401-A, the fine aggregate, including mineral filler and combinations of aggregates, when used, shall conform to the grading requirements shown in Table 3.

Table 3: Fine Aggregate Gradation Chart ¹ (Grade 1 - Percent Passing)

3/8 (9.5 mm)	No. 4 (4.75 mm)	No. 8 (2.36 mm)	No. 16 (1.18mm)	No. 30 (600 μm)	No. 50 (300 μm)	No. 100 (150 μm)	No. 200 (75 μm)
100	95—100	80—100	50—85	25—65	10—35	0—10	0—32

Notes:

1. Recycled crushed concrete fine aggregate shall be limited to a maximum of 20% of the fine aggregate.
2. The use of recycled crushed hydraulic cement concrete as a fine aggregate shall be limited to Concrete Classes A, B and D (see Table 5).
3. 6 to 35 when sand equivalent value is greater than 85.
4. 0 to 6 for manufactured sand.

Sand equivalent per TXDOT Test Method TEX-203-F shall not be less than 80 nor less than otherwise indicated on the drawings, whichever is greater.

The fineness modulus will be determined by adding the percentages by weight retained on sieve Nos. 4, 8, 16, 30, 50 and 100 (4.75 mm, 2.36 mm, 1.18mm, 600 μm, 300 μm, and 150 μm) and dividing the sum of the six sieves by 100. For all classes of concrete except K (see Table 5), the fineness modulus shall be between 2.30 and 3.10. For Class K concrete, the fineness modulus shall be between 2.40 and 2.90, unless indicated otherwise on the Drawings.

E. Mineral Filler

Mineral filler shall consist of stone dust, clean crushed sand or other approved inert material. When tested in accordance with TxDoT Test Method Tex-401-A, it shall conform to the following gradation:

Passing the No. 30 (600 μm) Sieve	100 percent
Passing the No. 200 (75 μm) Sieve	65 to 100 percent

F. Mortar and Grout

Unless otherwise specified, indicated on the drawings or approved by the Engineer or designated representative mortar and grout shall consist of 1 part cement, 2 parts finely graded sand and enough water to make the mixture plastic. When required to prevent color difference, white cement shall be added to produce color required. When required by the Engineer or designated representative, approved latex adhesive may be added to the mortar. Mortar shall be provided with a consistency such that the mortar can be easily handled and spread by trowel. Grout shall be provided of a consistency that will flow into and completely fill all voids.

G. Admixtures

All chemical admixtures including water reducing, plasticizers and air entrainment shall conform to TxDOT DMS-4640, "Chemical Admixtures for Concrete". Calcium chloride-based admixtures shall not be approved. Admixtures shall be included in the prequalified concrete admixtures list maintained by TxDOT's Construction Division. High-range water-reducing admixtures (TxDOT Type F or G) and accelerating admixtures (TxDOT Type C or E) shall not be used in bridge deck concrete.

H. Air Entrainment

Unless indicated otherwise on the drawings, all concrete classes with the exception of Class B shall be air entrained in accordance with Table 8. If the air content is more than 1½ percentage points below or 3 percentage points above the required air, the load of concrete will be rejected. If the air content is more than 1½ but less than 3 percentage points above the required air, the concrete may be accepted based on strength test results.

403S.4 - Storage of Materials**A. Cement, Supplementary Cementing Materials and Mineral Filler**

All cement, supplementary cementing materials and mineral filler shall be stored in separate and well ventilated, weatherproof buildings or approved bins, which will protect the material from dampness or absorption of moisture. Storage facilities shall be easily accessible and each shipment of packaged cement shall be kept separated to provide for identification and inspection. The Engineer or designated representative may permit small quantities of sacked cement to be stored in the open for a maximum of 48 hours on a raised platform and under waterproof covering.

B. Aggregates

The method of handling and storing concrete aggregates shall prevent contamination with foreign materials. If the aggregates are stored on the ground, the sites for the stockpiles shall be clear of all vegetation and shall be level. Aggregates shall be stockpiled in sizes to facilitate blending. If the aggregate is not stockpiled on a hard, non-contaminant base, the bottom 6-inch (150 mm) layer of the stockpile shall not be used without recleaning the aggregate.

When conditions require the use of 2 or more grades of coarse aggregates, separate stockpiles shall be maintained to prevent intermixing. Where space is limited, stockpiles shall be separated by walls or other appropriate barriers.

Aggregate shall be stockpiled and protected from the weather a minimum of 24 hours prior to use to minimize free moisture content. When stockpiles are too large to protect from the weather, accurate and continuous means acceptable to the Engineer or designated representative shall be provided to monitor aggregate temperature and moisture. Aggregates shall be stockpiled and handled such that segregation and contamination are minimized.

The stockpiles shall be sprinkled to control moisture and temperature as necessary. A reasonably uniform moisture content shall be maintained in aggregate stockpiles.

C. Admixtures

Admixtures shall be stored in accordance with manufacturer's recommendations and shall be protected against freezing.

D. Hot Weather Concrete Mixes

Ice may be used during hot weather concrete placement (Section 13 of Standard Specification Item No. 410S, "Concrete Structures") to lower the concrete temperature; however, the Contractor shall furnish a mix design acceptable to the Engineer or designated representative for class of concrete specified. The addition of ice shall not exceed 50% of the total mix water weight.

403S.5 - Measurement of Materials

Water shall be accurately metered. Fine and coarse aggregates, mineral filler, bulk cement and fly ash shall be weighed separately. Allowances shall be made in the water volume and aggregate weights during batching for moisture content of aggregates and admixtures. Volumetric and weight measuring devices shall be acceptable to the Engineer or designated representative. Measurement of materials in non-volumetric and volumetric mixers shall conform to Section 421.4.D of TxDot Specification Item 421, "Hydraulic Cement Concrete".

Batch weighing of sacked cement is not required; however, bags, individually and entire shipments, may not vary by more than 3 percent from the specified weight of 94 pounds (42.6 kilograms) per bag. The average bag weight of a shipment shall be determined by weighing 50 bags taken at random.

403S.6 - Mix Design

The Contractor shall furnish a mix design acceptable to the Engineer or designated representative for the class of concrete required in accordance with Table 5. The mix shall be designed by a qualified commercial laboratory and signed/sealed by a registered Professional Engineer, licensed in the state of Texas to conform with requirements contained herein, to ACI 211.1 or TXDOT Bulletin C-11 (and supplements thereto). The maximum water-to-cementitious material ratio identified in Table 5 for specific classes of concrete shall not be exceeded.

A higher-strength class of concrete with equal or lower water-to-cementitious-material ratio may be substituted for the specified class of concrete.

The mix design shall be over-designed in accordance with Table 5 in order to account for production variability and to ensure minimum compressive strength requirements are met.

Allowable mix design options are presented in Section 403S.8.

The Contractor shall perform, at the Contractor's expense, the work required to substantiate the design, including testing of strength specimens. Complete concrete design data shall be submitted to the Engineer or designated representative for approval. The mix design will be valid for a period of one (1) year provided that there are no changes to the component materials.

When there are changes in aggregates or in type, brand or source of cement, supplementary cementing material or chemical admixtures, the mix shall be evaluated as a new mix design. A change in vendor does not necessarily constitute a change in materials or source. When only the brand or source of cement is changed and there is a prior record of satisfactory performance of the cement with the ingredients, the submittal of new trial batches may be waived by the Engineer or designated representative.

At the end of one (1) year, a previously approved mix may be resubmitted for approval if it can be shown that no substantial change in the component materials has occurred and that test results confirming the adequacy of the mix designs have been acquired during the previous year. The resubmittal analysis must be reviewed, signed and sealed by a registered Professional Engineer, licensed in the state of Texas. This resubmittal shall include a reanalysis of specific gravity, absorption, fineness modulus, sand equivalent, soundness, wear and unit weights of the aggregates. Provided that the fineness modulus did not deviate by more than 0.20 or that the re-proportioned total mixing water, aggregate and cement (or cement plus fly ash) are within 1, 2, and 3 percent, respectively, of pre-approved quantities, a one-year extension on the approval of the mix may be granted by the Engineer or designated representative. Updated cement, fly ash, and admixture certifications shall accompany the resubmittal.

Approved admixtures that are included in the prequalified concrete admixtures list maintained by TxDot's Construction Division may be used with all classes of concrete at the option of the Contractor provided that specific requirements of the governing concrete structure specification are met. Water reducing and

retarding agents shall be required for hot weather, large mass, and continuous slab placements. Air entraining agents may be used in all mixes but must be used in the classes indicated on Table 5. Unless approved by the Engineer or designated representative, mix designs shall not exceed air contents for extreme exposure conditions as recommended by ACI 211.1 for the various aggregate grades.

403S.7 - Consistency and Quality of Concrete

Concrete shall be workable, cohesive, possess satisfactory finishing qualities and of stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements specified in Table 4 without the development of segregation or honeycombing. No concrete will be permitted with a slump in excess of the maximums shown unless water-reducing admixtures have been previously approved. Concrete that exceeds the maximum acceptable placement slump at time of delivery will be rejected. Slump values shall be conducted in accordance with TXDOT Test Method TEX-415-A.

Consistency and quality of concrete should allow efficient placement and completion of finishing operations before initial set. Re-tempering (i.e. addition of water and reworking concrete after initial set) shall not be allowed. When field conditions are such that additional moisture is needed for final concrete surface finishing operation, the required water shall be applied to surface by fog spray only and shall be held to a minimum. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder.

Table 4: Slump Requirements		
	Slump ¹, inches (mm)	
Type of Construction	Maximum	Minimum
Cased Drilled Shafts	4 (100)	3 (75)
Reinforced Foundation Caissons and Footings	3 (75)	1 (25)
Reinforced Footings and Substructure Walls	3 (75)	1 (25)
Uncased Drilled Shafts	6 (150)	5 (125)
Thin-walled Sections; 9 inches (225 mm) or less	6½ (165)	4 (100)
Prestressed Concrete Members ¹	6½ (165)	4 (100)
Precast Drainage Structures	6 (150)	4 (100)
Wall Sections over 9 inches (225 mm)	5 (125)	3 (75)
Reinforced Building Slabs, Beams, Columns and Walls	4 (100)	1 (25)

Bridge Decks	4 (100)	2 (50)
Pavements, Fixed-form	6½ (165)	4 (100)
Pavements, Slip-form	3 (75)	1½ (37.5)
Sidewalks, Driveways and Slabs on Ground	4 (100)	2 (50)
Curb & Gutter, Hand-vibrated	3 (75)	1 (25)
Curb & Gutter, Hand-tamped or spaded	4 (100)	2 (50)
Curb & Gutter, Slip-form/extrusion machine	2 (50)	½ (12.5)
Heavy Mass Construction	2 (50)	1 (25)
High Strength Concrete	4 (100)	3 (75)
Riprap and Other Miscellaneous Concrete	6 (150)	1 (25)
Under Water or Seal Concrete	8½ (213)	6 (150)

1. Slump values when a high range water reducer (HRWR) is not used.
2. When a high range water reducer (HRWR) is used, maximum acceptable placement slump will be 9 in (225 mm).

During progress of the work, the Engineer or designated representative shall cast test cylinders as a check on compressive strength of concrete actually placed. The Engineer or designated representative may also perform slump tests, entrained air tests and temperature checks to ensure compliance with specifications.

Proportioning of all material components shall be checked prior to discharging. Excluding mortar material for pre-coating of the mixer drum [see section 403S.8.B] and adjustment for moisture content of admixtures and aggregates, material components shall fall within the range of + 1% for water, + 2% for aggregates, + 3% for cement, +2% for fly ash and within manufacturer recommended dosage rates for admixtures except that air entrainment shall be within + 1½ percentage points of the mix design requirements.

Unless otherwise specified or indicated on the drawings, concrete mix temperature shall not exceed 90°F (32°C) except in mixes with high range water reducers where a maximum mix temperature of 100°F (38°C) will be allowed. Cooling an otherwise acceptable mix by addition of water or ice during agitation will not be allowed.

Test cylinders will be required for small placements such as manholes, inlets, culverts, wing walls, etc. The Engineer or designated representative may vary the number of tests to a minimum of 1 for each 25 cubic yards (1 for each 19 cubic meters) placed over a several day period.

Test cylinders shall be required for each monolithic placement of bridge decks or superstructures, top slabs of direct traffic culverts, cased drilled shafts, structural beams and as otherwise directed by Engineer or designated representative for design strength confirmation or early form removal. Test cylinders made for early form removal or for consideration of use of structure will be at Contractor's expense, except when required by Engineer or designated representative.

A strength test shall be defined as the average breaking strength of 2 cylinders. A minimum of four test cylinders shall be prepared; two each to be tested at 7 and 28 days. Specimens will be tested conforming to TXDOT Test Method TEX-418-A. If required strength or consistency of class of concrete being produced cannot be secured with minimum cementitious material specified or without exceeding maximum water/cementitious material ratio, Contractor will be required to furnish different aggregates, use a water reducing agent, an air entraining agent or increase the cement content in order to provide concrete meeting these specifications.

Slump tests will be performed in accordance with TxDOT Test Method Tex-415-A. Entrained air tests will be performed in accordance with TxDOT Test Method Tex-416-A.

Test specimens shall be cured using the same methods and under the same conditions as the concrete represented. Design strength cylinders shall be cured conforming to TXDOT Bulletin C-11 (and supplements thereto).

When control of concrete quality is by 28-day compressive tests, job control testing will be by 7-day compressive strength tests. The minimum strength requirement for seven (7) day test will be 70 percent of the specified minimum 28-day compressive strength. If the required 7-day strength is not secured with the quantity of cement specified in Table 4, changes in the mix design shall be made and resubmitted for approval. For an occasional failure of the seven-day compressive test, the concrete may be tested at 28 days for final evaluation.

Table 5: Classes of Concrete

Class	Cement Sks Per CY	Minimum Strength, psi (MPa)		Maximum W/C Ratio ¹	Coarse Aggr. Grade _{2,3,4}	Air Entrain.
		28 Days	7 Days			
A	5.0 (280 kg/m ³)	3000 (20.6)	2100 (14.5)	0.6	1,2,3,4,8	Yes
B	4.0 (225 kg/m ³)	2000 (13.8)	1400 (9.7)	0.6	2,3,4,5,6,7	No
C ⁵	6.0 (335 kg/m ³)	3600(24.8)	2520 (17.4)	0.45	1,2,3,4,5,6	Yes
D	4.5 (252 kg/m ³)	2500 (17.2)	1750 (12.1)	0.6	2,3,4,5,6,7	No

)					
H ⁵	6.0 (335 kg/m ³)	As indicated	As Indicated	0.45	3,4,5,6	Yes
I	5.5 (308 kg/m ³)	3500 (24.1)	2450 (16.9)	0.45	2,3,4,5	Yes
J	2.0 (112 kg/m ³)	800 (5.5)	560 (3.9)	N/A	2,3,4,5	No
S ⁵	6.0 (335 kg/m ³)	4000 (27.6)	2800 (19.3)	0.45	2,3,4,5	Yes

Notes:

1. Maximum water-cement or water-cementitious ratio by weight
2. Unless otherwise allowed, Grade 1 coarse aggregate shall only be used in massive foundations with 4-in (100-mm) minimum clear spacing between reinforcing steel bars.
3. Grade 1 coarse aggregate grading shall not be used in drilled shafts.
4. Unless otherwise allowed, Grade 8 coarse aggregate shall be used in extruded curbs.
5. Structural concrete classes.
6. When Type II cement is used in Class C, S or A concrete, the 7-day compressive strength requirement will be 2310 psi (15.9 MPa) for Class C, 2570 psi (17.7 MPa) for Class S and 1925 psi (13.3 MPa) for Class A minimum.

Table 6: Over Design Required to Meet Compressive Strength Requirements¹

Number Of Tests ^{2,3}	Standard Deviation, psi (MPa)				
	300 (2.06)	400 (2.75)	500 (3.44)	600 (4.13)	700 (4.82)
15	470 (3.24)	620 (4.27)	850 (5.85)	1,120 (7.71)	1,390 (9.57)
20	430 (2.96)	580 (3.99)	760 (5.23)	1,010 (6.95)	1,260 (8.67)
30 or more	400 (2.75)	530 (3.65)	670 (4.61)	900 (6.20)	1,130 (7.78)

Notes:

1. When designing the mix, add the tabulated amounts to the minimum design strength in Table 5. Maximum water-cement or water-cementitious ratio by weight
2. Number of tests of a concrete mixture used to estimate the standard deviation of a concrete production facility. Test of another mix within 1,000 psi (6.88 MPa) of the specified strength may be used.
3. If less than 15 prior tests are available, the overdesign should be 1,000 psi (6.88 MPa) for specified strength less than 3,000 psi (20.65 MPa), 1,200 psi (8.26 MPa) for specified strengths from 3,000 to 5,000 psi (20.65 to 34.42 MPa) and 1,400 psi (9.64 MPa) for specified strengths greater than 5,000 psi (34.42 MPa).

Table 7: Expected Usage of Concrete Classes

Class	General Usage
A	Inlets, manholes, curb, gutter, curb & gutter, concrete retards, sidewalks, driveways, backup walls and anchors
B	Riprap, small roadside signs and anchors
C ⁵	Drilled shafts, bridge substructure, bridge railing, culverts except top slab of direct traffic culverts, headwalls, wing walls, approach slabs, and cast-in-place concrete traffic barrier
D	Riprap
H ⁵	Prestressed concrete beams, boxes, piling and precast concrete traffic barrier
J	Utility trench repair
S ⁵	Bridge slabs and top slabs of direct traffic culverts

Table 8: Air Entrainment¹

Nominal Maximum Aggregate Size In (mm)	% Air Entrainment	
	Moderate Exposure	Severe Exposure
3/8 (9.5)- Grades 7 & 8	6	7½

½ (12.5)- Grades 6	5½	7
¾ (19)- Grades 5	5	6
1 (25)- Grades 4	4½	6
1½ (37.5)- Grades 2 & 3	4½	5½
2 (50)- Grades 2	4	5

1. For specified concrete strengths above 5,000 psi (34.42 MPa) a reduction of 1 percentage point is allowed.

403S.8 - Mix Design Options

For the structural concretes identified in Table 5 (Classes C, H and S) and any other class of concrete designed using more than 520 lbs. of cementitious material per cubic yard (310 kgs per cubic meter), one of the mix design options presented below shall be used.

For the non-structural concretes identified in Table 5 (Classes A, B, D and I) and any other class of concrete designed using less than 520 lbs. of cementitious material per cubic yard (310 kgs per cubic meter), one of the mix design options presented below will be used, except that Class C fly ash may be used instead of Class F fly ash for Options 1, 3 and 4 unless a sulfate-resistant concrete is required.

- A. Option 1: Twenty (20) to thirty-five (35) percent of the cement may be replaced with Class F fly ash.
- B. Option 2: Thirty-five (35) to fifty (50) percent of the cement may be replaced with ground granulated blast-furnace slag.
- C. Option 3: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class F fly ash, ground granulated blast-furnace slag or silica fume. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.
- D. Option 4: Type IP or Type IS will be used and up to ten (10) percent of the cement may be replaced with Class F fly ash, ground granulated blast-furnace slag or silica fume.
- E. Option 5: Thirty-five (35) to fifty (50) percent of the cement may be replaced with a combination of Class C fly ash and at least six (6) percent of silica fume, ultra fine fly ash or metakaolin. The combination may not include more than thirty-five (35) percent fly ash and no more than ten (10) percent silica fume.
- F. Option 6: A lithium nitrate admixture will be added at a minimum dosage of 0.55 gal. of thirty (30) percent lithium nitrate solution per pound of alkalis present in the hydraulic cement.
- G. Option 7: When hydraulic cement only is used in the design, the total alkali contribution from the cement in the concrete does not exceed 4.0 lbs. per cubic yard, when calculated as follows:

$$\text{alkali (lbs. per CY)} = .01 (\text{lbs cement/CY}) (\% \text{ Na}_2\text{O equivalent in cement})$$

where (% Na₂O equivalent in cement) is assumed to be the maximum cement alkali content reported on the cement mill certificate.

H. Option 8: When there are deviations from Options 1 through 7, the following shall be performed:

1. Conduct tests on both coarse and fine aggregate separately in accordance with ASTM C-1260, using 440 g of the proposed cementitious in the same proportions of hydraulic cement to supplementary cementing material to be used in the mix.
2. Prior to use of the mix, a certified test report signed and sealed by a Professional Engineer, licensed in the state of Texas shall be submitted that demonstrates that ASTM C 1260 test results for each aggregate do not exceed 0.10 percent expansion.

403S.9 - Mixing and Mixing Equipment

All equipment, tools and machinery used for hauling materials and performing any part of the work shall be maintained in such condition to insure completion of the work without excessive delays for repairs and replacement. Mixing shall be done in a mixer of approved type and size that will produce uniform distribution of material throughout the mass and shall be capable of producing concrete meeting requirements of ASTM C 94, Ready-mixed Concrete and these specifications. Mixing equipment shall be capable of producing sufficient concrete to provide required quantities. Entire contents of the drum shall be discharged before any materials are placed therein for a succeeding batch. Improperly mixed concrete shall not be placed in a structure. For all mixers an adequate water supply and an accurate method of measuring the water shall be provided.

The mixer may be batched by either volumetric or weight sensing equipment and shall be equipped with a suitable timing device that will lock the discharging mechanism and signal when specified time of mixing has elapsed.

A. Proportioning and Mixing Equipment

For all miscellaneous concrete placements, a mobile, continuous, volumetric mixer or a volumetric or weight batch mixer of the rotating paddle type may be used.

When approved by Engineer or designated representative in writing or when specified for use in other items, these mixers may be used for other types of concrete construction, including structural concrete, if the number of mixers furnished will supply the amount of concrete required for the particular operation in question.

These mixers shall be designed to receive all the concrete ingredients, including admixtures, required by the mix design in a continuous uniform rate and mix them to the required consistency before discharging.

For continuous volumetric mixers, the materials delivered during a revolution of the driving mechanism or in a selected interval, will be considered a batch and the proportion of each ingredient will be calculated in the same manner as for a batch type plant.

Mixing time shall conform to recommendations of manufacturer of mixer unless otherwise directed by Engineer or designated representative.

B. Ready-mixed Concrete

Use of ready-mixed concrete will be permitted provided the batching plant and mixer trucks meet quality requirements specified herein. When ready-mixed concrete is used, additional mortar (1 sack cement, 3 parts sand and sufficient water) shall be added to each batch to coat the mixer drum.

Ready-mixed concrete, batching plant and mixer truck operation shall include the following:

1. A ticket system will be used that includes a copy for the Inspector. Ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.

2. Sufficient trucks will be available to support continuous placements. The Contractor will satisfy the Engineer or designated representative that adequate standby trucks are available to support monolithic concrete placement requirements.
3. A portion of mixing water required by the mix design to produce the specified slump may be withheld and added at the job site, but only with permission of the Engineer or designated representative and under the Inspector's observation. When water is added under these conditions, the concrete batch will be thoroughly mixed before any slump or strength samples are taken. Additional cement shall not be added at the job site to otherwise unacceptable mixes.
4. A metal plate(s) shall be attached in a prominent place on each truck mixer plainly showing the various uses for which it was designed. The data shall include the drum's speed of rotation for mixing and for agitating and the capacity for complete mixing and/or agitating only. A copy of the manufacturer's design, showing dimensions of blades, shall be available for inspection at the plant at all times. Accumulations of hardened concrete shall be removed to the satisfaction of the Engineer or designated representative.
5. The loading of the transit mixers shall not exceed capacity as shown on the manufacturer's plate attached to the mixer or 63 percent of the drum volume, whichever is the lesser volume. The loading of transit mixers to the extent of causing spill-out en route to delivery will not be acceptable. Consistent spillage will be cause for disqualification of a supplier.
6. Excess concrete remaining in the drum after delivery and wash water after delivery shall not be dumped on the project site unless approval of the dump location is first secured from the Engineer or designated representative.

C. Volumetric Batching

Use of volumetric batched concrete will be permitted provided the batching and continuous mixing operations conform to ASTM C 685, "Concrete Made By Volumetric Batching and Continuous Mixing". This type concrete shall be made from materials continuously batched by volume, mixed in a continuous mixer and delivered to the site in a freshly mixed and unhardened state. Tests and criteria for batching accuracy and mixing efficiency shall be as specified in ASTM C 685.

1. A ticket system will be used that includes a copy for the Inspector. The ticket will have machine stamped time/date of concrete batch, a mix design designation, weight of cement, fly ash, sand and aggregates; exact nomenclature and written quantities of admixtures and water. Any item missing or incomplete on ticket may be cause for rejection of concrete.
2. Each batching or mixing unit, or both, shall carry in a prominent place a metal plate or plates on which are plainly marked the gross volume of the unit in terms of mixed concrete, discharge speed and the weight-calibrated constant of the machine in terms of a revolution counter or other output indicator. The mixer shall produce a thoroughly mixed and uniform concrete.
3. The batcher-mixer unit shall contain in separate compartments all the necessary ingredients needed for the manufacture of concrete. The unit shall be equipped with calibrated proportioning devices to vary the mix proportions and it shall produce concrete as required by the Work and ASTM C 685.

D. Truck-mixed Concrete

The concrete shall be mixed in a truck mixer from 70 to 100 revolutions at the mixing speed designated by the manufacturer that will produce a uniform concrete mix. The concrete shall be delivered to the project in a thoroughly mixed and uniform mass and shall be discharged with a satisfactory degree of uniformity. Additional mixing at the job site, at the mixing speed designated by the manufacturer, may be allowed by the Engineer or designated representative as long as the concrete is discharged before the drum has revolved a total of 300 revolutions after the introduction of the mixing water to the cement and the aggregates.

Re-tempering or adding concrete chemical admixtures is only permitted at the job site when concrete is delivered in a truck mixer. Water shall not be added after introduction of mixing water at the batch

plant except on arrival at the job site with approval of the Engineer or designated representative, in order to adjust the slump of the concrete. When this water is added, the mix design water-cementitious-material ratio shall not be exceeded. The drum or blades shall be turned at least 30 additional revolutions at mixing speed to ensure thorough and uniform mixing of the concrete. Water or chemical admixtures shall not be added to the batch after any concrete has been discharged.

When the concrete contains silica fume, mixing times and batching operations shall be adjusted as necessary to ensure that the material is completely and uniformly dispersed in the mix. The dispersion of the silica fume within the mix shall be verified in trial batches.

E. Hand-mixed Concrete

Hand mixing of concrete may be permitted for small placements or in case of an emergency and then only on authorization of the Engineer or designated representative. Hand-mixed batches shall not exceed a 4 cubic foot (0.113 cubic meters) batch in volume. Material volume ratios shall not be leaner than 1 part cement, 2 parts large aggregate, 1 part fine aggregate and enough water to produce a consistent mix with a slump not to exceed 4 inches (100 mm). Admixtures shall not be used unless specifically approved by the Engineer or designated representative.

403S.10 - Excavation, Placing of Concrete, Finishing, Curing and Backfill

Excavation, placing of concrete, finishing, curing and backfill shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill", Standard Specification Item No. 410S, "Concrete Structures" and Standard Specification Item No. 411S, "Surface Finishes for Concrete".

403S.11 - Measurement

Where measurement of concrete for a structure is not provided by another governing pay item, measurement shall be made under this specification in accordance with the following.

The quantities of concrete of the various classifications which constitute the completed and accepted structure or structures in place will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.308 cubic yards), each, square yard (square meter: 1 square yard equals 0.836 square meters) or linear foot as indicated in the Contract Documents. Measurement will be as follows:

A. General

1. Measurement based on dimensions shall be for the completed structure as measured in place. However, field-measured dimensions shall not exceed those indicated on the drawings or as may have been directed by the Engineer or designated representative in writing.
2. No deductions shall be made for chamfers less than 2 inches (50 mm) in depth, embedded portions of structural steel, reinforcing steel, nuts, bolts, conduits less than 5 inches (125 mm) in diameter, pre/post tensioning tendons, keys, water stops, weep holes and expansion joints 2 inches (50 mm) or less in width.
3. No measurement shall be made for concrete keys between adjoining beams or prestressed concrete planks.
4. No measurement shall be made for fill concrete between the ends or adjoining prestressed concrete planks/box beams at bent caps or between the ends of prestressed concrete planks/box beams and abutment end walls.
5. No measurement shall be made for inlet and junction box invert concrete.
6. No measurement shall be made for any additional concrete required above the normal slab thickness for camber or crown.

- B. **Plan Quantity.** For those items measured for plan quantity payment, adequate calculations have been made. If no adjustment is required by Article 403S.11, additional measurements or calculations will not be required or made.
- C. **Measured in Place.** For those items not measured for Plan Quantity payment, measurement will be made in place, subject to the requirements of Article 403S.10.A.1 above.

403S.12 - Payment

The work performed and materials furnished as prescribed by this item and measured in accordance with the applicable provisions of "Measurement" above will be paid for as follows.

The quantity to be paid for will be that quantity indicated in the contract documents and/or shown on the drawings, regardless of errors in calculations, except as may be modified by the following.

Plan Quantities will be adjusted:

- A. When a complete structure element has been erroneously included or omitted from the drawings, the quantity shown on the drawings for that element will be added to or deducted from the plan quantity and included for payment. A complete structure element will be the smallest portion of a total structure for which a quantity is included on the drawings. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.
- B. When the plan quantity for a complete structure element is in error by 5 percent or more, a recalculation will be made and the corrected quantity included for payment. Quantities revised in this manner will not be subject to the provisions of the "General Conditions", Article 11.
- C. When quantities are revised by a change in design, the "plan quantity" will be increased or decreased by the amount involved in the design change. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The party to the contract requesting the adjustment shall present to the other, a copy of the description and location, together with calculations of the quantity for the structure element involved. When this quantity is certified correct by the Engineer or designated representative, it will become the revised plan quantity.

Payment for increased or decreased costs due to a change in design on those items measured as "Cubic Yard", "Each", "Square Foot", "Square Yard" or "Linear Foot" will be determined by Change Order. Quantities revised in this manner will be subject to the provisions of the "General Conditions", Article 11.

The unit prices bid for the various classes of concrete shown shall include full compensation for furnishing, hauling, and mixing all concrete material; placing, finishing and curing all concrete; all grouting, pointing and finishing; furnishing and placing drains; furnishing and placing metal flashing strips; furnishing and placing expansion joint material required by this item; and for all forms and false work, labor, tools, equipment and incidentals necessary to complete the work.

Pay Item No. 403S-CY:	(Structure or Structural Component)	Per Cubic Yard.
Pay Item No. 403S-EA:	(Structure or Structural Component)	Per Each.
Pay Item No. 403S-SY:	(Structure or Structural Component)	Per Square Yard.
Pay Item No. 403S-LF:	(Structure or Structural Component)	Per Lineal Foot.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item 403S, "Concrete For Structures"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 401S	Structural Excavation and Backfill
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finishes for Concrete
<u>Texas Department of Transportation: Departmental Material Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS-4640	Chemical Admixtures for Concrete
<u>American Association of State Highway & Transportation Officials, AASHTO Standard Method of Test for</u>	
<u>Designation</u>	<u>Description</u>
Method T 26	Quality of Water to be Used in Concrete
<u>American Concrete Institute, ACI</u>	

<u>Designation</u>	<u>Description</u>
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>
ASTM C 94	Specification For Ready-Mixed Concrete
ASTM C 150	Specification For Portland Cement
ASTM C 685	Concrete Made By Volumetric Batching and Continuous Mixing
ASTM C-1260	Standard Test Method for Potential Alkali Reactivity of Aggregates
ASTM D-512	Test Methods for Chloride Ion in Water
ASTM D-516	Test Methods for Sulfate Ion in Water
ASTM D-4191	Test Method for Sodium in Water by Atomic Absorption
ASTM D-4192	Test Method for Potassium Water by Atomic Absorption
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
TEX-203-F	Sand Equivalent Test
TEX-401-A	Sieve Analysis of Fine and Coarse Aggregate
TEX-406-A	Mineral Finer than 75 μm (No. 200) Sieve in Mineral Aggregates (Decantation Test for Concrete Aggregates)

TEX-408-A	Organic Impurities in Fine Aggregate for Concrete
TEX-410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
TEX-411-A	Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
TEX-413-A	Determination of Deleterious Materials in Mineral Aggregate
TEX-415-A	Slump of Portland Cement Concrete
TEX-416-A	Air Content of Freshly-Mixed Concrete by the Pressure Method
TEX-418-A	Compressive Strength of Cylindrical Concrete Specimens
TEX-612-J	Acid Insoluble Residue

Texas Department of Transportation: Publications

<u>Designation</u>	<u>Description</u>
Bulletin C-11	Construction Bulletin

Texas Department of Transportation: Departmental Material Specifications

<u>Designation</u>	<u>Description</u>
DMS-4610	Fly Ash
DMS-4620	Ground Granulated Blast-Furnace Slag
DMS-4630	Silica Fume
DMS-4635	Metakaolin

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item 403S, "Concrete For Structures"</u>	
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
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
<u>Texas Department of Transportation: Departmental Material Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS-4650	Hydraulic Cement Concrete Curing Materials and Evaporation Retardants
DMS-6100	Epoxy and Adhesives
DMS 8900	Fly Ash

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ITEM NO. 405S - CONCRETE ADMIXTURES 11-13-07

405S.1 - Description

This item shall govern material requirements of admixtures for Portland cement concrete.

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

405S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type and manufacturer of any proposed admixture.
- B. Certification that proposed admixture meet the requirements of this specification, ASTM C260 and ASTM C494.
- C. For a specific mix design, a statement of compatibility of products shall be submitted when admixtures from multiple manufacturers are proposed.

405S.3 - Materials

All admixture submittals must be approved by the Engineer or designated representative. No admixture shall be chloride-based or have chloride(s) added in the manufacturing process. Admixtures must be pretested by the Texas Department of Transportation (TXDOT) Materials and Tests Engineer and be included in the State's current approved admixture list. All admixtures must retain an approved status through the duration of a mix design's one-year approval period.

(1) Air Entraining Admixture:

An "Air Entraining Admixture" is defined as a material which, when added to a concrete mixture in the proper quantity, will entrain uniformly dispersed microscopic air bubbles in the concrete mix. The admixture shall meet the requirements of ASTM Designation: C 260 modified as follows:

- (a) The cement used in any series of test shall be either the cement proposed for the specific work or a "reference" Type I cement from one mill.
- (b) The air entraining admixture used in the reference concrete shall be Neutralized Vinsol Resin.

(2) Water-reducing Admixture:

A "Water-reducing Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and required strength. This admixture shall conform to ASTM C 494, Type A.

(3) Accelerating Admixture:

An "Accelerating Admixture" is defined as an admixture that accelerates the setting time and the early strength development of concrete. This admixture shall conform to ASTM C 494, Type C. The accelerating admixture will contain no chlorides.

(4) Water-reducing, Retarding Admixture:

A "Water-reducing, Retarding Admixture" is defined as a material which, when added to a concrete mixture in the correct quantity, will reduce the quantity of mixing water required to produce concrete of a given consistency and retard the initial set of the concrete. This admixture shall conform to ASTM C 494, Type D.

(5) High-range Water Reducing Admixtures:

A "High-range Water Reducing Admixture", referred to as a superplasticizer, is defined as a synthetic polymer material which, when added to a low slump concrete mixture increases the slump without adversely affecting segregation, impermeability or durability of the mix. This admixture shall conform to ASTM C 494, Type F or G.

(6) Fly Ash:

Fly ash used in Portland cement concrete as a substitute for Portland cement or as a mineral filler shall comply with TXDOT Materials Specification D-9-8900 and be listed on TXDOT's current list of approved fly ash sources. Fly ash obtained from a source using a process fueled by hazardous waste (30 Texas Administrative Code, Section 335.1) shall be prohibited. This applies to any other specification concerning the use of fly ash. Contractor shall maintain a record of source for each batch. Supplier shall certify that no hazardous waste is used in the fuel mix or raw materials.

405S.4 - Certification and Product Information

The Contractor shall submit the name of the admixture proposed and manufacturer's certification that the selected admixtures meet the requirements of this item and of ASTM C 260 and C 494 as applicable. Admixtures for a mix design shall be of the same brand. If more than one admixture is proposed in the concrete mix, a statement of compatibility of components shall accompany certification. Manufacturer's product literature shall specify when in the batching/mixing operation the admixture must be added.

The Engineer or designated representative may request additional information such as infrared spectrophotometry scan, solids content, pH value, etc., for further consideration. Any unreported changes in formulation discovered by any of the tests prescribed herein may be cause to permanently bar the manufacturer from furnishing admixtures for Owner's work.

405S.5 - Construction Use of Admixtures

All admixtures used shall be liquid except high-range water reducers which may be a powder. Liquid admixtures shall be agitated as needed to prevent separation or sedimentation of solids; however, air agitation of Neutralized Vinsol Resin will not be allowed.

No admixture shall be dispensed on dry aggregates. Admixtures shall be dispensed at the batching site separately, but at the same time as the mixing water. Only high range water reducers may be introduced into the mix at the job site.

When other admixtures are used with fly ash, the amount of the other admixture to be used shall be based on the amount of Portland cement only and not the amount of Portland cement and fly ash.

When high-range water reducers are to be added at the job site, transit mixers shall be used. Admixture manufacturer literature shall indicate recommended mixing methods and time for the specific equipment and mix design used. The transit mix equipment shall not be loaded in excess of 63 percent of its rated capacity to ensure proper mixing of the admixture at the site. If during discharging of concrete a change in slump in excess of 30% is noted, the remaining concrete shall be rejected unless prior approval was given by the Engineer or designated representative to retemper a load with a second charge of admixture. Retempering with water shall not be allowed.

Accelerating admixtures will not be permitted in combination with Type II cement.

All mixes with air entrainment shall have a minimum relative durability factor of 80 in accordance with ASTM C 260. Dosage of air entrainment admixtures may be adjusted by the Contractor to stay within the specified tolerances for air entrainment of Standard Specification Item No. 403S, "Concrete for Structures".

405S.6 - Measurement and Payment

The requirements of this specifications shall not be measured and paid for directly, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 405S, "Concrete Admixtures"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>
ASTM C260	Air-Entraining Admixtures for Concrete
ASTM C495	Chemical Admixtures for Concrete
<u>Texas Department of Transportation: Department Material Specification</u>	
<u>Designation</u>	<u>Description</u>
DMS-8900	Fly Ash

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 405S, "Concrete Admixtures"</u>	
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of</u>	

Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item 360	Concrete Pavement
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 437	Concrete Admixtures
Item 520	Weighing and Measuring Equipment
Item 522	Portland Cement Concrete Plants
Item 524	Hydraulic Cement

ITEM NO. 406S - REINFORCING STEEL 9-26-12**406S.1 - Description**

This item shall govern furnishing and placement of reinforcing steel, deformed and smooth, of the size and quantity indicated on the drawings and in accordance with these specifications.

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

406S.2 - Submittals

The submittal requirements of this specification item may include:

- A. Evidence that the steel reinforcement producer is included on the TxDOT list of approved producing mills
- B. Listing of the size, grade, type and quantity of reinforcing steel proposed for the project.
- C. If welding of reinforcing steel is proposed, evidence that carbon equivalent (C.E.) of the proposed steel is at least 0.55% with a report of chemical analysis showing the percentages of elements necessary to establish C.E.
- D. If epoxy coated steel is proposed, evidence that the steel reinforcement producer is included on the TxDOT list of approved epoxy coating applicators
- E. If epoxy coated steel is proposed, written certification that the epoxy-coated reinforcing steel meets the requirements of this Item with a copy of the manufacturer's control tests.
- F. When mechanical splices are proposed, the types of couplers proposed for use.

406S.3 - Materials**A. Approved Mills**

Prior to furnishing reinforcing steel, the producing mills must be included on the list of approved producing mills that is maintained by the Construction Division of the State of Texas Department of Transportation

B. Deformed Bars and Wire Reinforcement

Unless indicated otherwise on the drawings, Bar reinforcement shall be Grade 60 and deformed. Reinforcing steel must conform to one of the following:

ASTM A615/615M, Grades 40 or 60 (300 or 420)

ASTM A996/996M, Type A, Grades 40 or 60 (300 or 420)

ASTM A996/996M, Type R, Grade 60 (420), permitted in concrete pavement only (furnished as straight bars only without bends. Bend tests are not required)

ASTM A706/706M

In cases where the provisions of this item are in conflict with the provisions of the ASTM Designation to which reference is made, the provisions of this item shall govern.

The nominal size, area and weight (mass) of reinforcing steel bars covered by these specifications are as follows:

Bar Size Number 1/8 ins (mm)	Nominal Diameter, inches (mm)	Nominal Area, Sq. ins. (mm ²)	Weight/Linear Foot Lbs. (kg)
2 (6)	0.250 (6.6)	0.05 (32)	0.167 (.075)
3 (10)	0.375 (9.5)	0.11 (71)	0.376 (.171)
4 (13)	0.500 (12.5)	0.20 (127)	0.668 (.303)
5 (16)	0.625 (15.5)	0.31 (198)	1.043 (.473)
6 (19)	0.750 (19.0)	0.44 (285)	1.502 (.681)
7 (22)	0.875 (22.0)	0.60 (388)	2.044 (.927)
8 (25)	1.000 (25.5)	0.79 (507)	2.670 (2.211)
9 (29)	1.128 (28.5)	1.00 (641)	3.400 (1.542)
10 (32)	1.270 (32.0)	1.27 (792)	4.303 (1.952)
11 (36)	1.410 (36.0)	1.56 (958)	5.313 (2.410)
14 (43)	1.693 (43.0)	2.25 (1552)	7.65 (3.470)
18 (57)	2.257 (57.5)	4.00 (2565)	13.60 (6.169)

Smooth, round bars shall be designated by size number through a No. 4. Smooth bars above No. 4 shall be designated by diameter in inches.

C. Smooth Bar and Spiral Reinforcement

Smooth bars and dowels for concrete pavement must have a minimum yield strength of 60 ksi (414 MPa) and meet ASTM A615/615M. Smooth bars that are greater in diameter than a No. 3 (10 mm) designation shall conform to ASTM A615 or meet the physical requirements of ASTM A36.

Spiral reinforcement shall be either smooth or deformed bars or wire of the minimum size or gauge indicated on the drawings. Bars for spiral reinforcement shall comply with ASTM A615 Grade 40(300), ASTM A996, Type A, Grade 40 (300); or ASTM A675, Grade 80(550), meeting dimensional requirements of ASTM A615. Smooth wire shall comply with ASTM A82, and deformed wire shall comply with ASTM A496.

D. Weldable Reinforcing Steel

Reinforcing steel to be welded must comply with ASTM A706 or have a carbon equivalent (C.E.) of at most 0.55%. A report of chemical analysis showing the percentages of elements necessary to establish C.E. is required for reinforcing steel that does not meet ASTM A706 to be structurally welded. No tack welding will be allowed. All welding shall conform to the requirements of AWS D1.1/D1.1M.

Carbon Equivalent (C.E.) shall be calculated as follows:

$$\text{C.E.} = \%C + 1.67*(\% \text{ Mn}) + .025*(\% \text{ Cu}) + .05*(\% \text{ Ni}) + .01*(\% \text{ Cr}) - .02*(\% \text{ Mo}) - .1*(\% \text{ V})$$

Where C is carbon,

Mn is manganese

Cu is copper

Ni is nickel

Cr is chromium

Mo is molybdenum, and

V is vanadium.

The requirements above do not apply to the following miscellaneous welding applications:

Splicing reinforcing steel to extend bars in the bottom of a drilled shaft;

Attaching chairs to the reinforcing steel cage of a drilled shaft;

Armor joints and their supports;

Screed rail and form hanger supports where permitted on steel units;

Reinforcing steel to R-bars for lateral stability between prestressed beams, spirals, or bands of reinforcing bars in drilled shaft cages;

Permanent bridge deck forms;

Steel added in railing when slip-form construction is used; and

Other similar miscellaneous members that have no load carrying capacity in the completed structure.

E. Welded Wire Fabric

Wire shall conform to the requirements of the Standard Specifications for Cold-Drawn Steel Wire for Concrete Reinforcement, ASTM A 82 or A 496. Wire fabric, when used as reinforcement, shall conform to ASTM A 185 or A 497.

When wire is ordered by size numbers, the following relation between size number, diameter in inches and area shall apply unless otherwise indicated on the drawings:

Size, W Number 1/100 in ² (mm ²)	Nominal Diameter inch (mm)	Nominal Area, sq. inches (mm ²)
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31 (200)	0.628 (16.0)	0.310 (200)
30 (194)	0.618 (15.7)	0.300 (194)
28 (181)	0.597 (15.2)	0.280 (181)
26 (168)	0.575 (14.6)	0.260 (168)
24 (155)	0.553 (14.0)	0.240 (155)
22 (142)	0.529 (13.4)	0.220 (142)
20 (129)	0.505 (12.8)	0.200 (129)
18 (116)	0.479 (12.2)	0.180 (116)
16 (103)	0.451 (11.5)	0.160 (103)
14 (90)	0.422 (10.7)	0.140 (90)
12 (77)	0.391 (9.9)	0.120 (77)
10 (65)	0.357 (9.1)	0.100 (65)
8 (52)	0.319 (8.1)	0.080 (52)
7 (45)	0.299 (7.6)	0.070 (45)
6 (39)	0.276 (7.0)	0.060 (39)
5.5 (35)	0.265 (6.7)	0.055 (35)
5 (32)	0.252 (6.4)	0.050 (32)
4.5 (29)	0.239 (6.1)	0.045 (29)
4 (26)	0.226 (5.7)	0.040 (26)
3.5 (23)	0.211 (5.4)	0.035 (23)

3 (19)	0.195 (5.0)	0.030 (19)
2.5 (16)	0.178 (4.5)	0.025 (16)
2 (13)	0.160 (4.1)	0.020 (13)
1.5 (9)	0.138 (3.5)	0.015 (9.7)
1.2 (8)	0.124 (3.1)	0.012 (7.7)
1 (6)	0.113 (2.9)	0.010 (6.5)
0.5 (3)	0.080 (2.0)	0.005 (3.2)

Where deformed wire is required, the size number shall be preceded by D and for smooth wire the prefix W shall be shown.

Welded wire fabric shall be designated as follows: 6 x 12 - W16 x W8, which indicates a 6 in. (150 mm) longitudinal wire spacing and 12-in (300 mm) transverse wire spacing with smooth No. 16 (103) wire longitudinally and smooth no. 8 (52) wire transversely.

F. Epoxy Coating

Epoxy coating shall be required as indicated on the drawings. Prior to furnishing epoxy-coated reinforcing steel, the epoxy applicator must be included on the list of approved applicators that is maintained by the Construction Division of the State of Texas Department of Transportation.

The reinforcing steel shall be epoxy coated in accordance with the following.

Epoxy Coating Requirements for Reinforcing Steel

Material	Specification
Bar	ASTM A775 or A934
Wire or Fabric	ASTM A884 Class A or B
Mechanical Coupler	As indicated on the drawings
Hardware	As indicated on the drawings

The epoxy coating material and coating repair material shall comply with TxDOT's DMS-8130, "Epoxy Powder Coating for Reinforcing Steel". The applicator shall not patch more than ¼ inch total length in any foot (20 mm total length in any meter) at the applicator's plant.

The epoxy-coated reinforcing steel shall be sampled and tested in accordance with TxDOT Test Method Tex-739-I, "Sampling and Testing Epoxy Coated Reinforcing Steel".

The identification of all reinforcing steel shall be maintained throughout the epoxy coating and fabrication and until delivery to the project site.

Written certification that the epoxy-coated reinforcing steel meets the requirements of this Item shall be provided along with a copy of the manufacturer's control tests.

G. Mechanical Couplers

When mechanical splices in reinforcing steel bars are indicated on the drawings, the following types of couplers may be used:

Sleeve-filler

Sleeve-threaded

Sleeve-swaged, or

Sleeve-wedge.

H. Chairs and Supports

Chairs and Supports shall be steel, precast mortar or concrete blocks cast in molds meeting the approval of the Engineer or designated representative of sufficient strength to position the reinforcement as indicated on the drawings when supporting the dead load of the reinforcement, the weight of the workers placing concrete and the weight of the concrete bearing on the steel. Chairs shall be plastic coated when indicated on the drawings.

Chair Types and Applicable Uses	
Structural or Architectural Elements (columns, beams, walls, slabs) exposed to weather, not subjected to sand blasting, water blasting or grinding.	Galvanized steel or steel chairs with plastic coated feet.
Structural or Architectural Elements exposed to weather and subject to sand blasting, water blasting or grinding.	Stainless steel chairs.
Structural or Architectural Elements not exposed to weather or corrosive conditions.	Uncoated steel chairs
Slabs and grade beams cast on grade.	Steel chairs with a base with 9 inch ² (58 cm ²) minimum area or sufficient area to prevent the chair from sinking into

	fill or subgrade. Precast mortar or concrete blocks meeting the requirements of this item may be used.
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406S.4 - Bending

The reinforcement shall be bent cold, true to the shapes indicated on the drawings. Bending shall preferably be done in the shop. Irregularities in bending shall be cause for rejection. Improperly fabricated, damaged or broken bars shall be replaced at no additional expense to the City. Damaged or broken bars embedded in a previous concrete placement shall be repaired using a method approved by the Engineer or designated representative.

Unless otherwise indicated on the drawings, the inside diameter of bar bends, in terms of the nominal bar diameter (d), shall be as follows:

Bends of 90 degrees and greater in stirrups, ties and other secondary bars that enclose another bar in the bend.

Bar Number in 1/8 inches (mm)	Diameter
3, 4, 5 (10, 13, 16)	4d
6, 7, 8	6d

All bends in main bars and in secondary bars not covered above.

Bar Number in 1/8 inches (mm)	Diameter
3 thru 8 (10 thru 25)	6d
9, 10, 11 (29, 32, 36)	8d
14, 18 (43, 57)	10d

406S.5 - Tolerances

Fabricating tolerances for bars shall not be greater than shown on Standard (Detail) 406S-1.

406S.6 - Storing

Steel reinforcement shall be stored above the surface of the ground upon platforms, skids or other supports and shall be protected as far as practicable from mechanical injury and surface deterioration caused by exposure to conditions producing rust. When placed in the work, reinforcement shall be free from dirt, paint, grease, oil or other foreign materials. Reinforcement shall be free from injurious defects such as cracks and laminations. Rust, surface seams, surface irregularities or mill scale will not be cause for rejection, provided the minimum dimensions, cross sectional area and tensile properties of a hand wire brushed specimen meets the physical requirements for the size and grade of steel indicated on the drawings.

406S.7 - Splices

Splicing of bars, except when indicated on the drawings or specified herein, will not be permitted without written approval of the Engineer or designated representative. No substitution of bars will be allowed without the approval of the Engineer or designated representative. Any splicing of substituted bars shall conform to the requirements in the Table below.

Splices not indicated on the drawings will be permitted in slabs not more than 15 inches (380 mm) in thickness, columns, walls and parapets.

Splices will not be permitted in bars 30 feet (9.1 meters) or less in plan length unless otherwise approved. For bars exceeding 30 feet (9.1 meters) in plan length, the distance center to center of splices shall not be less than 30 feet (9.1 meters) minus 1 splice length, with no more than 1 individual bar length less than 10 feet (3 meters). Splices not indicated on the drawings, but permitted hereby, shall conform to the Table below. The specified concrete cover shall be maintained at such splices and the bars placed in contact and securely tied together.

Minimum Lap Requirements		
Bar Number in 1/8 inches (mm)	Uncoated Lap Length	Coated Lap Length
3 (10)	1 foot 4 inches (0.4 meters)	2 foot 0 inches (0.610 meters)
4 (13)	1 foot 9 inches (0.533 meters)	2 foot 8 inches (0.813 meters)
5 (16)	2 foot 2 inches (0.660 meters)	3 feet 3 inches (0.991 meters)
6 (19)	2 foot 7 inches (0.787 meters)	3 feet 11 inches (1.194 meters)
7 (22)	3 feet 5 inches (1.041 meters)	5 feet 2 inches (1.575 meters)
No. 8 (25)	4 feet 6 inches (1.372 meters)	6 feet 9 inches (2.057 meters)
No. 9 (29)	5 feet 8 inches (1.727 meters)	8 feet 6 inches (2.591 meters)

No. 10 (32)	7 feet 3 inches (2.210 meters)	10 feet 11 inches (3.327 meters)
No. 11 (36)	8 feet 11 inches (2.718 meters)	13 feet 5 inches (4.089 meters)

Spiral steel shall be lapped a minimum of 1 turn. Bar No. 14 and No. 18 may not be lapped.

Welded wire fabric shall be spliced using a lap length that includes an overlap of at least 2 cross wires plus 2 inches (50 mm) on each sheet or roll.

Splices using bars that develop equivalent strength and are lapped in accordance with the table above are permitted.

Welding of reinforcing bars may be used only where indicated on the drawings or as permitted herein. All welding operations, processes, equipment, materials, quality of work and inspection shall conform to the requirements indicated on the drawings. All splices shall be of such dimension and character as to develop the full strength of the bar being spliced.

End preparation for butt-welding reinforcing bars shall be done in the field, except Bar No. 6 and larger shall be done in the shop. Delivered bars shall be of sufficient length to permit this practice.

For box culvert extensions with less than 1 foot (0.3 meters) of fill, the existing longitudinal bars shall have a lap with the new bars as shown in the table above. For box culvert extensions with more than 1 foot (0.3 meters) of fill, a minimum lap of 12 inches (300 mm) will be required.

Unless otherwise indicated on the drawings, dowel bars transferring tensile stresses shall have a minimum embedment equal to the minimum lap requirements shown in the table above. Shear transfer dowels shall have a minimum embedment of 12 inches (300 mm).

406S.8 - Placement

Reinforcement shall be placed as near as possible in the position indicated on the drawings. Unless otherwise indicated on the drawings, dimensions shown for reinforcement are to the centers of the bars. In the plane of the steel parallel to the nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of the spacing between bars. In the plane of the steel perpendicular to the nearest surface of concrete, bars shall not vary from plan placement by more than ¼ inch (6 mm). Cover of concrete to the nearest surface of steel shall be as follows:

	Minimum Cover, Inches (mm)
(a) Concrete cast against and permanently exposed to earth	3 (76 mm)
(b) Concrete exposed to earth or weather:	
Bar No. 6 (19) through No. 18 bars (57)	2 (51 mm)
Bar No. 5 (16), W31 (W200) or D31 (D200) wire and smaller	1½ (38 mm)

(c) Concrete not exposed to weather or in contact with ground:	
Slabs, walls, joists:	
Bar No. 14 (43) and 18 (57)	1½ (38mm)
Bar No. 11 (36) and smaller	1 (25 mm)
Beams, columns:	
Primary reinforcement, ties, stirrups, spirals	1 ½ (38 mm)
Shells, folded plate members:	
Bar No. 6 (19) and larger	1 (25 mm)
Bar No. 5 (16), W31 (W200) or D31 (D200) wire, and smaller	1 (25 mm)

Vertical stirrups shall always pass around the main tension members and be attached securely thereto.

The reinforcing steel shall be located accurately in the forms and held firmly in place before and during concrete placement by means of bar supports that are adequate in strength and number to prevent displacement and to keep the steel at the required distance from the form surface. Bars shall be supported by means of approved galvanized metal spacers, metal spacers with plastic coated tips, stainless steel spacers, plastic spacers or approved precast mortar or concrete blocks when supports are in contact with removable or stay-in-place forms. Bright basic bar supports shall be used to support reinforcing steel placed in slab overlays on concrete panels or on existing concrete slabs. Bar supports in contact with soil or subgrade shall be approved.

For bar supports with plastic tips, the plastic protection must be at least 3/32 in. (2.4 mm) thick and extend upward on the wire to a point at least ½ in. (12.5 mm) above the formwork.

For approval of plastic spacers on a project, representative samples of the plastic shall show no visible indications of deterioration after immersion in a 5 percent solution of sodium hydroxide for 120 hours.

All accessories such as tie wires, bar chairs, supports, or clips used with epoxy-coated reinforcement shall be of steel, fully coated with epoxy or plastic. When approved by the Engineer or designated representative, plastic supports may also be used with epoxy-coated reinforcement.

All reinforcing steel shall be tied at all intersections, except that where spacing is less than 1 foot (300 mm) in each direction, alternate intersections only need be tied. For reinforcing steel cages for other structural members, the steel shall be tied at enough intersections to provide a rigid cage of steel. Mats of wire fabric shall overlap each other 1 full space as a minimum to maintain a uniform strength and shall be tied at the ends and edges.

Where prefabricated deformed wire mats are specified or if the Contractor requests, welded wire fabric may be substituted for a comparable area of steel reinforcing bar plan, subject to the approval of the Engineer or designated representative.

Mortar or concrete blocks shall be cast to uniform dimensions with adequate bearing area. A suitable tie wire shall be provided in each block, to be used for anchoring to the steel. Except in unusual cases and when specifically authorized by the Engineer, the size of the surface to be placed adjacent to the forms shall not exceed 2½ inches (63.5 mm) square or the equivalent thereof in cases where circular or rectangular areas are provided. Blocks shall be cast accurately to the thickness required and the surface to be placed adjacent to the forms shall be a true plane, free of surface imperfections. The blocks shall be cured by covering them with wet burlap or mats for a period of 72 hours. Mortar for blocks should contain approximately 1 part hydraulic cement to three parts sand. Concrete for blocks should contain 850 pounds of hydraulic cement per cubic yard (500 kilograms per cubic meter) of concrete.

Individual bar supports shall be placed in rows at 4-ft (1.22 meters) maximum spacing in each direction. Continuous type bar supports shall be placed at 4-ft (1.22 meters) maximum spacing. Continuous bar supports shall be used with permanent metal deck forms.

The exposure of the ends of longitudinals, stirrups and spacers used to position the reinforcement in concrete pipe and in precast box culverts or storm drains is not a cause for rejection.

Reinforcing steel for bridge slabs, top slabs of direct traffic culverts, and top slabs of prestressed box beams at all intersections, except tie only alternate intersections where spacing is less than 1 ft. (300 mm) in each direction.

For steel reinforcing cages for other structural members, reinforcement shall be supported and tied in such a manner that a sufficiently rigid cage of steel is provided. Fasten mats of wire fabric securely at the ends and edges. If the cage is not adequately supported to resist settlement or floating upward of the steel, overturning of truss bars or movement in any direction during concrete placement, permission to continue concrete placement will be withheld until corrective measures are taken. Sufficient measurements shall be made during concrete placement to insure compliance with the above.

No concrete shall be deposited until the Engineer or designated representative has reviewed the placement of the reinforcing steel and all mortar, mud, dirt, etc., shall be cleaned from the reinforcement, forms, workers' boots and tools. Do not place concrete until authorized by the Engineer or designated representative.

406S.9 - Handling, Placement and Repair of Epoxy-coated Reinforcement Steel

A. Handling

Systems for handling coated-reinforcement with padded contact areas shall be provided. Handling bands shall be padded to prevent damage to the coating. Bundles of coated reinforcement shall be lifted with a strongback, spreader bar, multiple supports or a platform bridge. The bundled reinforcement shall be carefully transported and stored on protective cribbing. The coated reinforcement should not be dropped or drug during handling.

B. Construction Methods

Coated reinforcement shall not be flame-cut but shall be sawn or shear-cut only when approved. Cut ends shall be coated as specified in Section C, "Repair of Coating".

Coated reinforcement steel shall not be welded or mechanically coupled except where specifically indicated on the drawings. When welding or coupling is indicated on the drawing, the epoxy coating shall be removed at least 6 in. (150 mm) beyond the weld limits before welding and 2 in. (50 mm) beyond the limits of the mechanical coupler before assembly. After the welding or coupling operation is completed the steel shall be cleaned of oil, grease, moisture, dirt, welding contamination (slag or

acid residue) and rust to a near-white finish. The existing epoxy coating shall be examined for damage and any damaged or loose epoxy shall be removed to expose sound epoxy coating.

After cleaning the coated-steel, the splice area shall be coated with epoxy repair material to a thickness of 7 to 17 mils (0.18 to 0.43 mm) after curing. A second application of the repair material shall be applied to the bar and coupler interface to ensure complete sealing of the joint.

C. Repair of Coating

The material used for coating repair shall comply with the requirements of this Item and ASTM D3963/D3963M, "Specification for Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars". Repairs shall be made in accordance with procedures recommended by the manufacturer of the epoxy coating powder. For areas to be patched, a minimum coating thickness as required for the original coating shall be applied. All visible damage to the coating shall be repaired.

Sawed and sheared ends, cuts, breaks and other damage shall be promptly repaired before additional oxidation occurs. The areas to be repaired shall be cleaned to ensure that they free from surface contaminants. Repairs shall be made in the shop or in the field as required.

406S.10 - Measurement

The measurement of quantities of reinforcement furnished and placed will be based on the calculated weight of the steel actually placed as indicated on the drawings, with no allowance made for added bar lengths for splices requested by the Contractor nor for extra steel used when bars larger than those indicated on the drawings are used or for a higher grade of steel that is substituted with the permission of the Engineer or designated representative. Tie wires and supporting devices will not be included in the calculated weights. The calculated weight of bar reinforcement will be determined using the theoretical bar weight set forth in this item.

Measurement required by a change in design will be computed as described above for the actual steel required to complete the work.

406S.11 - Payment

This item shall be paid for at the contract unit price bid per pound of "Reinforcing Steel". The unit bid price shall include full compensation for all work specified herein including furnishing, bending, fabricating, welding and placing reinforcement, for all clips, blocks, metal spacers, ties, chairs, wire or other materials used for fastening reinforcement in place and for all tools, labor, equipment and incidentals necessary to complete the work.

Reinforcing steel will generally not be paid for directly, but shall be included in the unit price bid for the items of construction in which the reinforcing steel is used.

When specified in the contract bid form as a separate pay item, this item shall be paid for at the contract unit price bid per pound of "Reinforcing Steel". The unit bid price shall include full compensation for all work specified herein including furnishing, bending, fabricating, welding and placing reinforcement, for all clips, blocks, metal spacers, ties, chairs, wire or other materials used for fastening reinforcement in place and for all tools, labor, equipment and incidentals necessary to complete the work.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 406S-RC:	Reinforcing Steel	Per Pound.
Pay Item No. 406S-ERC:	Epoxy-Coated Reinforcing Steel	Per Pound.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item 406S, "Reinforcing Steel"</u>	
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>
ASTM A 36/A 36M	Carbon Structural Steel
ASTM A 82	Steel Wire, Plain, for Concrete Reinforcement
ASTM A 185	Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM A 496	Steel Wire, Deformed, for Concrete Reinforcement
ASTM A 497	Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement
ASTM A 615/A 615M	Deformed and Plain Billet-steel Bars for Concrete Reinforcement
ASTM A 675/A 675M	Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
ASTM A 706/A 706M	Low- Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A 775/A 775M	Epoxy-Coated Reinforcing Steel Bars
ASTM A 884/A 884M	Epoxy-Coated Steel Wire and Welded Wire Fabric For Reinforcement
ASTM A 934/A 934M	Epoxy-Coated Prefabricated Reinforcing Steel Bars
ASTM A 996/A 996M	Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM D3963/D3963M	Fabrication and Jobsite Handling of Epoxy-coated Reinforcing Steel Bars

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
Tex-739-I	Sampling and Testing Epoxy Coated Reinforcing Steel

City of Austin Standard (Details)

<u>Designation</u>	<u>Description</u>
Standard 406S-1	Reinforced Steel Tolerances

Texas Department of Transportation: Departmental Material Specifications

<u>Designation</u>	<u>Description</u>
DMS 8130	Epoxy Powder Coating for Reinforcing Steel

American Welding Society

<u>Designation</u>	<u>Description</u>
AWS D1.1/D1.1M	Structural Welding Code

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item 406S, "Reinforcing Steel"

City of Austin Standard Specification Items

<u>Designation</u>	<u>Description</u>
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Item No. 360	Concrete Pavement
Item No. 403S	Concrete for Structures
Item No. 410S	Concrete Structures
Item No. 414S	Concrete Retaining Walls
Item No. 420S	Drilled Shaft Foundations
Item No. 830S	Traffic Signal Controller Foundation
Item No. 831S	Traffic Signal Drilled Shaft Foundation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 360	Concrete Pavement
Item No. 420	Concrete Structures
Item No. 421	Hydraulic Cement Concrete
Item No. 422	Reinforced Concrete Slab
Item No. 423	Retaining Walls
Item No. 440	Reinforcing Steels

ITEM NO. 408S - CONCRETE JOINT MATERIALS 11-13-07

408S.1 - Description

This item shall govern the furnishing and placing of all longitudinal, transverse contraction and expansion joint material in concrete work as herein specified in the various items of these specifications as indicated or as directed by the Engineer or designated representative.

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

408S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type and manufacturer of all joint materials proposed for use.
- B. Technical data indicating that proposed products meet the requirements specified herein.

408S.3 - Materials

(1) Preformed Asphalt Board

Preformed asphalt board formed from cane or other suitable fibers of a cellular nature securely bound together and uniformly impregnated with a suitable asphaltic binder and meeting the requirements of the Standard Specifications for Preformed Expansion Joint Filler for Concrete (Bituminous Type), ASTM D 994.

(2) Preformed Nonbituminous Fiber Material

Preformed nonbituminous fiber material shall meet the requirements of the Standard Specifications for the Preformed Expansion Joint Filler for Concrete Paving and Structural Construction, ASTM D 1751, except that the requirements pertaining to bitumen content, density and water absorption shall be voided.

(3) Boards

Boards obtained from Redwood timber, of sound heartwood, free from sapwood, knots, clustered birdseye, checks and splits. Occasional sound or hollow birdseye, when not in clusters, will be permitted provided the board is free from any other defects that will impair its usefulness as a joint filler.

(4) Joint Sealer (Concrete Pavement)

This material shall be a one part low modulus silicone especially designed to cure at ambient temperatures by reacting with moisture in the air and shall have the following properties:

As Supplied	
Color	Gray
Flow, MIL-2-8802D Sec. 4.8.4	0.2 maximum

Working Time, minutes	10Tack-Free Time at 77°F 2F (25°C 1.66°C) Min.
MIL-2-8802D Sec.4.8.7	60
Cure time, at 77°F (25°C), days	7-14
Full Adhesion, days	14-21
As Cured—after 7 days at 77°F (25°C) and 40% RH	
Elongation, percent minimum	1200
Durometer Hardness, Shore A, points ASTM 2240	15
Joint Movement Capability, percent	+100/-50
Tensile Strength, maximum elongation,psi (kPa)	100 (689)
Peel Strength, psi (kPa)	25 (172)

The joint sealer shall adhere to the sides of the concrete joint or crack and shall be an effective seal against infiltration of water and incompressibles. The material shall not crack or break when exposed to low temperature.

(5) Backer Rod

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

(6) Joint Sealing Material

Joint Sealing Material for other than pavement use may be a two-component, synthetic polymer or cold-pourable, self leveling type meeting the following requirements:

The material shall adhere to the sides of the concrete joint or crack and shall form an effective seal against infiltration of water and incompressibles. The material shall not crack or break when exposed to low temperatures. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles. It shall cure sufficiently at an average temperature of 77°F 3°F (25°C 1.66°C) so as not to pick up under wheels of traffic in a maximum of 3 hours.

Performance Requirements:

When tested in accordance with Test Method Tex-525-C, the joint sealing material shall meet the above curing times and the requirements as follows:

It shall be of such consistency that it can be mixed and poured or mixed and extruded into joints at temperatures above 60°F (1.66°C).

Penetration 77°F (25°C), 150 gm. Cone, 5 sec., max.-cm	0.90
Bond and Extension 75%, 0F, 5 cycles:	
Dry Concrete Blocks	Pass
Wet Concrete Blocks	Pass
Steel Blocks (Primed if specified by manufacturer)	Pass
Flow at 200 °F (93°C)	None
Water content % by weight, max.	5.0
Resilience:	
Original sample min. % (cured)	50
Oven-aged at 158°F (70°C) min. %	50
For Class 1-a material only, Cold Flow (10 minute)	None

(7) Rebonded Recycled Tire Rubber

This material consists of granular particles of rubber, made by grinding automobile and truck tires, securely bound together by a synthetic resin or plastic binder. The filler must be molded into sheets of the required dimensions, which meet the testing requirements of both ASTM D 1751 and ASTM D 1752, except that the requirements for asphalt content and expansion are waived. The density of the material must be at least 30 lb/ft³ (440kg/m³).

408S.4 - Construction Methods

The Contractor shall install "Concrete Joint Materials" which will function as a compatible system. Joint sealer shall not be placed where a bond breaker is present.

Asphalt, Redwood board or other materials used shall extend the full depth of the concrete and shall be perpendicular to the exposed face. All joints shall be shaped to conform to the contour of the finished section in which they are installed. All material shall be a minimum of ½ inch (12.5 mm) thick or as indicated. Wood materials shall be anchored to the adjacent concrete to permanently hold them in place. Joint sealer shall be installed in accordance with the manufacturer's recommendations.

The material used for side walk expansion joints shall conform to No. 3 above, unless otherwise indicated.

The material used for curb and gutter expansion joints filler shall conform to any of the above, except when placed adjacent to concrete pavement, the joint material shall match the pavement joint material.

408S.5 - Measurement and Payment

No additional compensation will be made for materials, equipment or labor required by this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 408S, " Concrete Joint Materials"</u>	
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
D 994	Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
D 1751	Specification for Preformed Expansion Joint Filler for Concrete
	Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
D 1752	Specification for Preformed Sponge Rubber and Cork Expansion
	Joint Fillers for Concrete Paving and Structural Construction
D 2240	Standard Test Method for Rubber Property-Durameter Hardness
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-525-C	Tests for Asphalt and Concrete Joint Sealers

ITEM NO. 409S - MEMBRANE CURING 11-13-07**409S.1 - Description**

This item shall govern curing concrete pavement, concrete base, pavement, curbs, gutters, retards, sidewalks, driveways, medians, islands, concrete riprap, cement stabilized riprap, concrete structures and other concrete as indicated by applying an impervious liquid membrane forming material.

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

409S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type and manufacturer for all membrane curing materials proposed.
- B. Proposed curing procedures.

409S.3 - Material

The liquid forming membrane curing compound shall comply with the "Standard Specification for Liquid Membrane-forming Compounds for Curing Concrete", ASTM C 309, Type 1-D clear or translucent, with fugitive dye or Type 2 white pigmented. The material shall have a minimum flash point of 80°F (26.7°C) when tested by the "Pensky-Martin Closed Cup Tester", ASTM D 93.

It shall be of such consistency that it can be satisfactorily applied as a fine mist through an atomizing nozzle by means of approved pressure spraying equipment at atmospheric temperatures above 40°F (4.4°C).

It shall be of such nature that it will not produce permanent discoloration of concrete surfaces nor react deleteriously with the concrete or its components. Type 1 compound shall contain a fugitive dye that will be distinctly visible not less than 4 hours nor more than 7 days after application.

Type 2 compound shall not settle out excessively or cake in the container and shall be capable of being mixed to a uniform consistency by moderate stirring and shall exhibit a daylight reflectance of not less than 60 percent of that of magnesium oxide when tested as indicated.

The compound shall produce a firm, continuous, uniform moisture impermeable film, free from pinholes and shall adhere satisfactorily to the surfaces of damp concrete. When applied to the damp concrete surface at the rate of coverage indicated, the compound shall dry to the touch in not more than 4 hours and shall not be tacky or track off concrete after 12 hours.

It shall adhere to horizontal and vertical surfaces in a tenacious film and shall not run off or show an appreciable sag, disintegrate, check, peel or crack during the required curing period.

Under traffic, the compound shall not pick up or peel and shall gradually disintegrate from the surface.

The compound shall be delivered to the job only in the manufacturer's original containers, which shall be clearly labeled with the manufacturer's name, the trade name of the material and a batch number or symbol with which test samples may be correlated.

The water retention test shall be in accordance with the following:

Percentage loss shall be defined as the water lost after the application of the curing material was applied. The permissible percentage moisture loss (at the rate of coverage specified herein) shall not exceed the following:

24 hours after application	2 percent
72 hours after application	4 percent

409S.4 - Measurement and Payment

The membrane curing compound shall be applied after the surface finishing has been completed and immediately after the free surface moisture has disappeared. The surface shall be sealed with a single uniform coating of the specified type of curing compound applied at the rate of coverage recommended by the manufacturer and directed by the Engineer or designated representative, but not less than 1 gallon per 180 square feet (3.8 liters per 16.7 square meters) of area. The Contractor shall provide satisfactory means and facilities to properly control and check the rate of application of the compound.

The compounds shall not be applied before the surface has become dry, but shall be applied just after free moisture has disappeared.

The compound shall be thoroughly agitated during its use and shall be applied by means of approved mechanical power pressure sprayers for street and bridge applications. The sprayers used to apply the membrane to concrete exposed surfaces shall travel at a uniform speed along the forms and be mechanically driven. The equipment shall be of such design that it will insure uniform and even application of the membrane material. The sprayers shall be equipped with satisfactory atomizing nozzles. On small miscellaneous items or on interim bridge deck curing will the Contractor be permitted to use hand-powered spray equipment. For all spraying equipment, the Contractor shall provide facilities to prevent the loss of the compound between the nozzle and the concrete surface during the spraying operations.

At locations where the coating shows discontinuities, pinholes or other defects or if rain falls on the newly coated surface before the film has dried sufficiently to resist damage, an additional coat of the compound shall be applied immediately at the same rate of coverage specified herein.

To insure proper coverage, the Engineer or designated representative shall inspect all treated areas after application of the compound for the period of time designated in the specification for curing, either for membrane curing or for other methods. Dry areas are identifiable because of the lighter color of dry concrete as compared to damp concrete. All suspected areas shall be tested by placing a few drops of water on the suspected areas. If the water stands in rounded beads or small pools which can be blown along the surface of the concrete without wetting the surface, the water impervious film is present. If the water wets the surface of the concrete as determined by obvious darkening of the surface or by visible soaking into the surface, no water-impervious film is present. Should the foregoing test indicate that any area during the curing period is not protected by the required water-impervious film an additional coat or coats of the compound shall be applied immediately and the rate of application of the membrane compound shall be increased until all areas are uniformly covered by the required water-impervious film.

The compounds shall not be applied to a dry surface and if the surface of the concrete has become dry, it shall be thoroughly moistened prior to the application of the membrane by fogging or mist application. Sprinkling or coarse spraying will not be allowed.

When temperatures are such as to warrant protection against freezing, curing by this method shall be supplemented with an approved insulating material capable of protecting the concrete for the specified curing period.

If at any time there is reason to believe that this method of curing is unsatisfactory or is detrimental to the work, the Contractor, when notified, shall immediately cease the use of this method and shall change to curing by one of the other methods specified under this contract.

Curing compounds shall be compatible with the adhesion of toppings or overlays where curing has been applied to the concrete base surface in order to assure adequate bond.

When forms are stripped before the 4 minimum curing days have passed, curing shall continue by an approved method.

409S.5 - Measurement and Payment

Membrane curing will not be measured for payment. The work and materials prescribed herein will not be paid for directly, but shall be included in the unit price bid for the item of construction in which these materials are used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 409S, "Membrane Curing"</u>	
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
C 309	Liquid Membrane-forming Compounds for Curing Concrete
D 93	Pensky-Martin Closed Cup Tester

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 409S, "Membrane Curing"</u>	
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 360	Concrete Pavement
Item 420	Concrete Structures

Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 431	Pneumatically Placed Concrete
Item 437	Concrete Admixtures
Item 520	Weighing and Measuring Equipment
Item 522	Portland Cement Concrete Plants
Item 524	Hydraulic Cement

ITEM NO. 411S - SURFACE FINISHES FOR CONCRETE 11-13-07**411S.1 - Description**

This item shall govern the furnishing of all materials and the application by the methods of construction indicated on the Drawings for the application of a surface finish to concrete.

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

411S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type and manufacturer of cement(s).
- B. Type and manufacturer of membrane curing compound.
- C. Type and manufacturer of adhesive grout.
- D. Type and manufacturer of resin paint.
- E. Samples as requested.
- F. Locations of proposed grade/class of finishes.

411S.3 - Materials**(1) Masonry Sand**

Masonry sand shall conform to ASTM C 144.

(2) White Cement

White cement shall conform to ASTM C 150.

(3) Portland Cement

All cement unless otherwise indicated shall be Portland cement conforming to ASTM C 150.

Portland cement manufactured in a cement kiln fueled by hazardous waste shall be considered as an approved product if the production facility is authorized to operate under regulation of the Texas Natural Resource Conservation Commission (TNRCC) and the U. S. Environmental Protection Agency (EPA). Supplier shall provide current TNRCC and EPA authorizations to operate the facility.

(4) Membrane Curing

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

(5) Adhesive Grout

This subsection sets forth the requirements for three epoxy adhesives with different viscosities designed to bond fresh Portland Cement concrete to existing Portland

Cement concrete, hardened concrete to hardened concrete and steel to fresh or hardened concrete. These adhesives are as follows:

Type V: Standard (medium viscosity) for applying to horizontal and vertical surfaces. This material is suitable for surface sealing of fine cracks in concrete.

Type VI: Low viscosity for application with spray equipment to horizontal surfaces.

Type VII: Paste consistency for overhead application and where a high buildup is required. This material is suitable for surface sealing of cracks in concrete, which are veed out prior to sealing, and for grouting of dowel bars where clearance is 1/16 inch (1.6 mm) or less.

- (a) **Mixing Ratio:** The ratio of resin and hardener components to be mixed together to form the finished adhesive shall be either 1 to 1 or 2 to 1 by volume.

Any specific coloring of resin and/or hardener components desired will be stated by the Engineer or designated representative.

Fillers, pigments and thixotropic agents. All fillers, pigments and/or thixotropic agents in either the epoxy resin or hardener component must be of sufficiently fine particle size and dispersed so that no appreciable separation or settling will occur during storage.

Any fillers present in the low viscosity version must be of such a nature that they will not interfere with application by spray equipment or abrade or damage such equipment.

The concrete adhesive shall contain no volatile solvents.

- (b) **Consistency:** The adhesives shall comply with the following:

	Type V	Type VI	Type VII
Viscosity of mixed adhesive 77° ± 1°F, (25° ± -17°C) Poises	400 Maximum	150 Maximum	must be sufficiently fluid to apply by trowel or spatula without difficulty
Pot Life at 77°F (25°C), minutes minimum - 30			
Set Time at 77°F (25°C) (Time required to attain 180 psi (1.3 mPa)), hours maximum - 12			

Thixotropy test shall be performed at both 77° and 120°F (25° and 49°C). Average thickness of cured adhesive remaining on test panel, mils minimum.

Type V	Type VII
30	45

Samples of the individual components in sealed containers shall be maintained at 115° + 3°F (46° + -16°C) for 2 weeks. The mixed adhesive prepared from these samples must still comply with the minimum thixotropy requirements.

The viscosity of the Type V and Type VI versions must not show an increase of more than 20 percent compared with the viscosity prior to the stability test. The Type VII adhesive must still be sufficiently fluid to apply by trowel or spatula without difficulty.

(c) Physical Properties of the Cured Adhesive

Property	Requirements
Adhesive Shear Strength, psi (mPa), minimum	2200 (15)
Water Gain, percent by weight (mass), maximum	0.20
Ability to bond fresh Portland cement concrete to cured Portland cement concrete psi (mPa), minimum (7 days cure time)	400 (2.8)

(6) Synthetic Resin Paint

Type X Epoxy: This is a high solids epoxy coating designed for application by brush or roller. The materials can also be applied by airless spray by addition of a maximum of 5 percent toluene solvent at the direction of the Engineer or designated representative.

Raw Materials: The basic raw materials to be incorporated into this coating are listed below, along with the specific requirements for each material. The final decision as to the quality of materials shall be made by the Engineer or designated representative. After the Engineer or designated representative has approved the brand names of raw materials proposed by the Contractor, no substitution will be allowed during the manufacture without prior approval of the Engineer or designated representative.

Epoxy Resin: The basic epoxy resin used in the formulation shall be an unmodified liquid resin conforming to the following chemical and physical requirements:

Viscosity at 25.0 + 0.1 C, cps	7,000 to 10,000
Weight per epoxy equivalent, gms per gm - mole	175 to 195
Color (Gardner Number), maximum	5
Hydrolyzable chlorine, maximum % by weight	0.2
Specific gravity, 25/25 degrees	1.14 to 1.18

Test methods to be used in determining these qualities are listed below:

- (a) Viscosity - Test for Kinematic Viscosity (ASTM Designation: D 445).
- (b) Weight per Epoxy Equivalent - Test for Epoxy Content of Epoxy Resins (ASTM Designation: D 1652).

- (c) Color - Test for Color of Transparent Liquids (Gardner Color Scale) (ASTM Designation: D 1544).
- (d) Hydrolyzable Chlorine - Test for Hydrolyzable Chlorine Content of Liquid Epoxy Resins (ASTM Designation D: 1726).
- (e) Specific Gravity - Method of Test for Density of Paint, Varnish, Lacquer and Related Products (ASTM Designation: D 1475).

Pigment

Titanium Dioxide: The titanium dioxide used in this formulation shall be equivalent to DuPont R-900. This shall be a pure, chalk-resistant, rutile titanium dioxide meeting the requirements of ASTM D 476, Type III.

Extender: The extender used in this formulation shall be Nyad 400, manufactured by Interpace Pigments. Specific requirements are as follows:

Particle size distribution	Minimum	Maximum
Minus 20 microns, percent by weight	95	
Minus 10 microns, percent by weight	70	80
Minus 5 microns, percent by weight	40	50
Minus 3 microns, percent by weight	30	40
Minus 1 micron, percent by weight	14	20
Oil Absorption (rub out, lbs/100 lbs)		25 maximum
Brightness (G.E.)	92.5 minimum	

411S.4 - Grade of Finish

(1) General

The grade and/or class of finish shall be as described herein and as indicated.

"Grade" of finish designates the areas to which a higher finish is to be applied beyond the requirements of an Ordinary Surface Finish. Four grades of finish are included herein.

"Class" of finish designates the materials or the process to be used in providing the grade of finish. Three classes of finish are included herein.

For structures and surfaces not described herein under grade of finish, a class of finish only may be indicated. Where neither a grade nor class is specified, an Ordinary Surface Finish only will be required as specified in Item No. 410S, "Concrete Structures".

Where the plans specify a grade and class of finish, i.e., Grade II, Class C, only that type of finish shall be furnished.

Where the plans specify a grade of finish only, i.e., Grade I Finish, any of the classes of finish may be furnished. Only one class of finish shall be furnished on any individual structure, twin structures or on structures in close proximity to each other, except as specified for prestressed concrete members below.

(2) Grade I

The following areas shall receive a Class A, B or C (two rub) Finish, except that prestressed members shall receive either a Class A or B Finish only.

All concrete surfaces of railing, including the parapet types; exterior vertical faces of slabs, slab spans, arches and box girders; the outside and bottom surfaces of fascia beams or girders (including prestressed members); the underside of overhanging slabs to the point of juncture of the supporting beam; all exposed vertical surfaces of bents and piers and bottom surfaces of bent caps; all exposed surfaces of tie beams, abutments, bridge wingwalls, culvert headwalls and wingwalls and retaining walls exposed to view after all backfill and is placed.

Unless otherwise indicated, the underside of the slab of slab spans shall be finished its entire width.

Unless otherwise indicated, exposed surfaces of pump houses and other miscellaneous concrete surfaces shall receive a Class A, B or C (one rub) Finish.

(3) Grade II

All concrete surfaces of railing, including the parapet types, all exposed surfaces of bridge wingwalls and the exterior vertical faces of slabs and slab spans shall receive a Class A, B or C (two rub) Finish. All other surfaces described under Grade I Finish shall receive a Class A or B finish only. The underside of slab spans shall receive an Ordinary Surface Finish only.

(4) Grade III

All concrete surfaces of railing, including the parapet types, all exposed surfaces of bridge wingwalls and the exterior vertical faces of slabs shall receive a Class A, B or C (two rub) Finish. All other surfaces described under Grade I Finish shall receive an Ordinary Surface Finish.

(5) Grade IV

The top and roadway faces only of all concrete railing, including the parapet types and bridge wingwalls shall receive a Class A, B or C (one rub) Finish. All other surfaces described under Grade I shall receive an Ordinary Surface Finish.

411S.5 - Class of Finish

The Class of Finish designates either an adhesive grout material, a paint-type material or a rubbing process applied to surfaces specified in "Grade of Finish", as required above and/or as indicated.

Unless otherwise indicated the color shall be concrete gray.

(1) Class A

This finish shall consist of an adhesive grout textured coating with a minimum 1/16 inch thickness, composed of 1 part white cement, 1 part natural (gray) cement, 2 parts masonry sand, 1 part (latex)

emulsion and enough water to form a viscous slurry of a consistency that may be applied by spray gun, brush or roller without appreciable running or sagging. The proportions of white and gray cement may be varied slightly to obtain the desired color.

Gradation of the masonry sand shall be as required to produce a texture satisfactory to the Engineer or designated representative.

Prepackaged materials meeting these requirements and acceptable to the Engineer or designated representative as to color, texture and appearance will be permitted.

(2) Class B

The finish shall be a paint-type material, consisting of a synthetic resin, containing fibrous as well as texturing pigments, which when applied by a 1 coat spray application at the rate of 45 ± 5 square feet per gallon (15.9 ± 1.9 square meters per liter) yield an acceptable textured coating. Certification by the manufacturer of the above materials will be required.

(3) Class C

This finish shall consist of a one rub or two rub system, as the case may be, meeting the requirements set forth below under "Construction Methods".

411S.6 - Approval of Surface Finishing Materials

The material to be furnished shall meet the requirements of TxDOT Specification DMS-8110, Structural Coatings, latest revision.

In addition to the above, the manufacturer shall furnish the following:

- (1) At the time of original request for approval of the surface furnishing material, the manufacturer shall supply a 1-gallon (3.8 L) sample of the material to the Engineer or designated representative, if requested.
- (2) Each 6 months after approval of the material, the manufacturer shall furnish a notarized certification indicating that the material originally approved has not been changed or altered in any way. Any change in formulation of a surface finish shall require retesting prior to use.

The Engineer or designated representative may request additional information to be submitted such as infrared spectrophotometry scan, solids content, etc., for further identification. A change in formula discovered by any of the tests prescribed herein or by other means and not reported and retested, may be cause to permanently bar the manufacturer from furnishing surface finish materials for City work.

The City reserves the right to perform any or all of the tests required by this specification as a check on the tests reported by the manufacturer. In case of any variance the City tests will govern.

411S.7 - Construction Methods

Prior to application of any of the finishes required herein, concrete surfaces shall be given an Ordinary Surface Finish. For Class A and B materials, concrete surfaces shall be clean and free of dirt, grease, curing compound or any other bond breaking substance. Class A shall be applied on moistened surfaces but Class B requires a dry surface. The temperature of the atmosphere, concrete and compound shall be above 50°F (10°C) for Classes A and B at the time of application. The finished surfaces shall be protected against rain or freezing for a period of 24 hours after application.

Class A materials shall be applied by spraying, by roller or by brush. Class B materials shall be applied by spraying only. All applications shall provide an acceptable texture of the proper coverage.

The Class A and B material shall be applied after all preparation work required by Ordinary Surface Finish has been completed.

The Class C Finish shall be performed with a carborundum stone as follows, after all preparatory work required by Ordinary Surface Finish has been completed:

For a two-rub system, the first rubbing shall bring the wetted concrete face to a paste and produce a smooth dense surface without pits, form marks or other irregularities. The use of cement or grout to form the paste will not be permitted. Striping with a brush and washing after the first rubbing will not be required. Chamfer lines shall be finished during the second rubbing.

The first rubbing shall be done soon after form removal. Membrane curing, if used, shall be applied after the first rub is complete. Prior to the second rubbing, any remaining curing membrane shall be removed from the surface by brushing, buffing or other satisfactory methods.

The second rubbing shall be performed when conditioning the structure for final acceptance. The specified surfaces shall be cleaned of drip marks and discolorations and given a final rubbing. The surface shall be striped neatly with a brush and the paste allowed to take a reset, after which the surfaces shall be washed with clean water leaving them with a neat and uniform appearance and texture.

For a one rub system, the rubbing requirements shall be the same as for the first rub above, except chamfer lines shall be finished and the paste spread uniformly, striped with a brush and allowed to take a reset after which the surfaces shall be washed with clean water leaving them with a neat and uniform appearance and texture.

411S.8 - Special Surfaces Finishes

(1) General

When special surface finishes are required for retaining walls, panels, copings or similar construction, the Contractor shall prepare sample panels for approval of the finish and the method of application. Unless otherwise indicated, panel or pattern arrangement and dimensions may be varied to achieve a more pleasing appearance or to utilize forming material more efficiently when approved by the Engineer or designated representative. Aggregates, materials, variation of panel or pattern arrangement, dimensions and other features affecting the work shall be approved prior to start of the work.

(2) Striated Finish

The striated (grooved) pattern shall be as indicated or as approved by the Engineer or designated representative.

The finish shall be made by lining the forms with striated sheets of plywood, plastic, fiberglass, metal or other material acceptable to the Engineer or designated representative. The striations on the panels shall be of a smooth, wide pattern, not sharp or angular.

A chamfer groove shall be used along all edges of each panel. All ties, bolts or other forming accessories shall be located along the chamfer grooves or panel edges.

(3) Exposed Aggregate Finish

(a) Structural Concrete

Exposed aggregate panels may be either raised, recessed or as indicated with the sides of each panel chamfered as directed by the Engineer or designated representative.

The aggregate used for this finish shall be approved by the Engineer or designated representative. Unless otherwise indicated, aggregate shall conform to the grading requirements of Grade 2 aggregate except that a minimum of 50 percent shall be retained on

the ¾-inch (19 mm) sieve. Gravel of predominately rounded particles shall be used, except that when indicated or approved by the Engineer or designated representative in writing, crushed stone may be used. The aggregate shall be large enough to remain firmly anchored in the face of the final product. The depth shall be ¼-inch (6.4 mm) minimum to ½-inch (12.7 mm) maximum, unless otherwise indicated or directed by the Engineer or designated representative.

A surface retarder that penetrates the concrete approximately ¼ (6.4 mm) inch shall be applied to the forms or concrete surface as an aid in achieving the desired finish. Wood forms may require 2 or 3 coatings to compensate for absorption. Form joints shall be taped or caulked to prevent escape of the retarder during placing operations.

Treated form surfaces shall be protected from sun and rain while exposed to the atmosphere. In case of high humidity or if rain has dampened the forms prior to placing concrete, a reapplication of the surface retarder may be required to provide uniform coverage of the retarder on the forms.

Adjacent areas of fresh concrete not requiring exposed aggregate finish shall be protected when the retarder is applied.

The finish shall be obtained by sandblasting, bush hammering, water blasting or other methods, as approved by the Engineer or designated representative. Horizontal surfaces may be finished by a combination of brushing and washing, but only after the concrete has set sufficiently to prevent loosening of the aggregate.

Unless otherwise directed by the Engineer or designated representative, forms for surface requiring exposed aggregate finish shall be removed 12 to 15 hours after concrete placement. The exposed aggregate operation shall be accomplished immediately after form removal. Except for the time required for obtaining the exposed aggregate finish, curing of all surfaces shall be maintained for the minimum 4 day curing time. All surfaces shall be either water cured or may be cured with an approved clean membrane compound. If water curing is used, it shall be followed by a clear membrane curing compound conforming to Item No. 409S, "Membrane Curing".

Care shall be taken to ensure proper vibration at all points of concrete placement to prevent honeycomb or segregation of the materials. Vibration shall be done in such a manner as to provide adequate penetration of previously placed concrete lifts. Care shall be taken to prevent contact of the vibrator with the face form.

(b) Sidewalks

When exposed aggregate surfaces are required for sidewalks, driveways and/or medians, the coarse aggregate shall consist of particles with at least 40 percent crushed faces. Uncrushed gravel, polished aggregates and clear resilient coatings are not acceptable. Grade 5 coarse aggregates shall be used for exposed aggregate finishes for sidewalks, driveways and/or medians.

411S.9 - Measurement and Payment

No direct measurement or payment will be made for the work to be done, the equipment or materials to be furnished under this item, but shall be included in the unit price bid for the item of construction in which this item is used.

End

<p><u>SPECIFIC CROSS REFERENCE MATERIALS</u></p>

Standard Specification Item No. 411S, " Surface Finishes for Concrete"City of Austin Standard Specification Items

<u>Designation</u>	<u>Description</u>
Item No. 410S	Concrete Structures

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
DMS-8110	Coatings for Concrete

American Society for Testing and Materials (ASTM)

<u>Designation</u>	<u>Description</u>
C 144	Aggregate for Masonry Mortar
C 150	Portland Cement
D 445	Kinematic Viscosity of Transparent and Opaque Liquids
D 476	Standard Classification for Dry Pigmentary Titanium Dioxide Products
D 1475	Standard Test Method for Density of Liquid Coatings, Inks and Related Products
D 1544	Standard Test Method for Color of Transparent Liquids (Gardner Color Scale)
D 1652	Standard Test Method for Epoxy Content of Epoxy Resins
D 1726	Standard Test Method for Hydrolyzable Chloride Content of Liquid Epoxy Resins

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item No. 411S, " Surface Finishes for Concrete"City of Austin Standard Specification Items

<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures
Item No. 410S	Concrete Structures
Item No. 411S	Surface Finished for Concrete

ITEM NO. 420S – DRILLED SHAFT FOUNDATIONS**420S.1 - Description**

This item shall govern the construction of foundations consisting of "Reinforced Concrete Drilled Shafts" and/or "Non-reinforced Concrete Drilled Shafts", with or without concrete bell footings. Concrete shafts shall be placed in a drilled excavation when the shafts are without bell footings and in a drilled and underreamed excavation when shafts are with bell footings. Foundations shall be constructed in accordance with this item and in conformance with the details and dimensions indicated on the Drawings. Any required test loading of shafts shall be in accordance with standard foundation test loading procedures used by the TXDOT or by other procedures 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.

420S.2 - Submittals

The submittal requirements of this specification item may include:

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

420S.3 - Materials

All concrete and materials shall conform to Item No. 403S, "Concrete for Structures" and the requirements herein. Concrete shall be Class A. The maximum size coarse aggregate shall be 1½ inches (38 mm) for cased shafts. A retarder or water reducing agent will be required in all concrete when casing is used. Reinforcing steel shall conform to Item No. 406S, "Reinforcing Steel".

420S.4 - Construction Methods**(1) Excavation**

The Contractor shall perform the excavation required for the shafts and bell footings, through whatever materials encountered, to the dimensions and elevations indicated or required by the site conditions.

Shaft alignment shall be within a tolerance of 1 inch (25 mm) per 10 feet (3 m) of depth.

Bells shall be excavated to form a bearing area of the size and shape indicated. Bell outlines varying slightly from those indicated are permissible provided the bottom bearing area equals that specified.

Bells may be excavated either by hand or by mechanical methods. Blasting will not be used except with written permission of the Engineer or designated representative and shall be controlled to avoid disturbance of the formations below or outside the limits of the proposed shaft.

The plans indicate the expected depths and elevations where satisfactory bearing material will be encountered. This information will be used as a basis for the contract. If satisfactory material is not encountered at plan elevation, the footing may be raised or lowered as determined by the Engineer

or designated representative. Alteration of plan depth shall be made to satisfactorily comply with the design requirements. Casing will be required when necessary to prevent caving of the material or when necessary to exclude seepage water. Casing shall be metal of ample strength to withstand handling stresses, the pressure of concrete and of the surrounding earth or backfill materials and shall be watertight. The outside diameter of casing shall not be less than the specified size of shaft; otherwise, the size of casing and the size of drilled excavation in which it is to be placed will be left to the discretion of the Contractor, except as noted below. No extra compensation will be allowed for concrete required to fill an oversize casing or oversize excavation.

Where caving conditions and/or excessive ground water is encountered, no further drilling will be allowed until a construction method is employed which will prevent excessive caving that will make the excavation appreciably larger than the size of casing to be used. Drilling in a mud slurry or other method which will control the size of excavation, will be required.

If the elevation of the top of shaft is below ground level at the time of concrete placement, an oversize casing from ground elevation to a point below the top of the shaft will be required to control caving of any material into the freshly placed concrete.

Where casing is not required, any excavation for the bells or shafts beyond the lines indicated shall be filled with Class A concrete at the Contractor's expense. Where casings are used, the Contractor will be permitted to backfill around the upper portions of the casing with pea gravel or other granular material, but space shall be provided to allow for escape of muck, slurry or water displaced by the concrete.

When casing is used, it shall be smooth and well oiled and shall extend approximately to the top of the shaft.

Under normal operations, the removal of the casing shall not be started, until all concrete placement is completed in the shaft. Movement of the casing for short pulls of a few inches, rotating, exerting downward pressure and tapping it to facilitate extraction will be permitted. When unusual conditions warrant, the casing may be pulled in partial stages. A sufficient head of concrete shall be maintained above the bottom of the casing to overcome hydrostatic pressure. Casing extraction shall be at a slow uniform rate with the pull in line with the center of the shaft.

The elevation of the top of the steel cage shall be carefully checked before and after casing extraction. Generally any upward movement of the steel not exceeding 2 inches (50 mm) or any downward movement thereof not exceeding 6 inches (150 mm) per 20 feet (6 m) of shaft length will be acceptable. Any upward movement of the concrete or displacement of the steel beyond the above limits will be cause for rejection.

The minimum length of steel required for lap with column steel shall be maintained. Dowel bars may be used if the proper lap length is provided both into the shaft and into the column.

Placing of drilled shaft concrete under water shall not be done without the permission of the Engineer or designated representative. If permission is granted, the concrete shall be placed conforming to Item No. 410S, "Concrete Structures" and shall be placed with a closed tremie. Provisions shall be made for a sump or other approved method to channel displaced water away from the shaft.

Material excavated from shafts and bells, including drilling mud and not used in the backfill around the completed bents or piers shall be disposed of as directed by the Engineer or designated representative and shall not be placed in the stream or otherwise impair the efficiency or appearance of the structure or other parts of the work.

At the time concrete is placed, the excavation shall be free from accumulated seepage water. All loose material shall be removed from the bottom of the excavation prior to placing concrete.

The Contractor shall provide suitable access and lighting for proper inspection of the completed excavation, to check the dimensions and alignment of shafts and underreamed excavation.

Any required lighting shall be electric. Any mechanical equipment used within the excavation shall be operated by air or electricity. The use of gasoline driven engines within the excavation for pumping or drilling will not be permitted.

In order that the Engineer or designated representative may judge the adequacy of a proposed foundation, the Contractor, if requested, shall make soundings or take cores at the Contractor's expense to determine the character of the supporting materials. The depth of such soundings or cores will not be required to exceed 5 feet (1.5 m) below the proposed footing grade. It is the intent of this provision that soundings shall be made or cores taken at the time the excavation in each foundation is approximately complete.

When shafts in abutment bents are indicated, the embankment at the bridge ends shall be completed to grade and thoroughly compacted prior to drilling.

(2) Reinforcing Steel

The cage of reinforcing steel, consisting of longitudinal bars and spiral reinforcement, lateral ties or horizontal bands, shall be completely assembled and placed as a unit immediately prior to concrete pavement.

If the shaft is lengthened and the plans require full depth reinforcement, a minimum of $\frac{1}{2}$ the longitudinal bars required in the upper portion of the shaft shall be extended to the bottom, with proper lateral reinforcement. These bars may be lap spliced, spliced by welding or unspliced bars of the proper length. Any splices required shall be in the lower portion of the shaft.

Where spiral reinforcement is used, it shall be tied or tack welded to the longitudinal bars at a spacing not to exceed 12 inches (300 mm). Unless otherwise indicated welding will not be permitted within the top 15 feet (4.5 m) of the steel cage.

Horizontal steel bands shall be placed and welded as indicated.

The cage shall be supported from the top by some positive method, to minimize its slumping downward during concrete placement and/or extraction of the casing. The support shall be concentric with the cage to prevent racking and distortion of the steel. A minimum of $\frac{1}{2}$ of the vertical bars shall be supported.

In uncased shafts, concrete spacer blocks or steel chairs shall be used at sufficient intervals to insure concentric spacing for the entire length of the cage. In cased shafts, concrete spacer blocks shall not be used. Metal "chair" type spacers or bent pieces of steel bars shall be placed at sufficient intervals around the steel cage to insure con-centric spacing inside the casing.

(3) Concrete

The work shall be performed conforming to Item No. 410S, "Concrete Structures", details indicated and with the requirements herein.

Concrete shall be placed as soon as possible after all excavation is complete and reinforcing steel placed and shall be of such workability that vibrating or rodding will not be required. 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.

Concrete placing shall be continuous in the shaft to the construction joint indicated. The height of free fall of concrete shall be limited to 3 to 4 feet (900 to 1,200 mm), preventing segregation.

Concrete shall be placed through a suitable tube or tremie to prevent segregation of materials. The tube or tremie shall be made in sections to provide proper discharge and permit raising it as the placement progresses. A non-jointed pipe may be used if sufficient openings of the proper size are provided to allow for the flow of concrete into the shaft.

The elapsed time from the beginning of concrete placement in the cased portion of the shaft, until extraction of the casing is begun, shall not exceed 1 hour.

Where a cap or tie beam is required to be placed monolithically with the shaft, a time interval will be allowed for placing the required form and reinforcing after casing removal.

A riser block of equal diameter as the column and of a maximum height of 6 inches (150 mm) may be cast at the top of the completed shaft.

The top surface shall be cured and any construction joint area shall be treated as prescribed in Item No. 410S, "Concrete Structures".

420S.5 - Test Holes

When indicated or when ordered by the Engineer or designated representative in writing, test holes will be required to establish elevations for "belling", to determine elevation of ground water or other soil characteristics.

The diameter and depth of test hole or holes shall be as indicated or as directed by the Engineer or designated representative.

420S.6 - Test Bells

When indicated or when ordered by the Engineer or designated representative in writing, the reaming of bells on specified test holes will be required to establish the feasibility of belling in a specific soil strata.

The diameter and shape of the test bell shall be as indicated or as approved by the Engineer or designated representative in writing.

420S.7 - Measurement

Acceptable drilled shafts (of the specified diameter), complete in place, will be measured by the linear foot. Shafts for interior bents and piers will be measured from a point approximately 6 inches (150 mm) below the ground elevation at the center of shaft unless specific elevations or dimensions are indicated or unless the Engineer or designated representative directs otherwise to meet unusual conditions. (The bent height indicated is for estimating purposes only and does not control the top of shaft measurement.) For grade separations and railroad underpasses, the ground elevation used will be the completed subgrade section under the structure. At stream crossings and at railroad overpasses, the existing ground elevation at the time drilling begins will be used. For abutment bents and retaining walls, the length of shaft shall be measured from the

bottom of footing or cap elevation. For sign structures and illumination towers, the elevation of top of shaft will be shown either as a dimension above ground or as a dimension to the bottom of footing.

Drilled shafts used with commercial designs of overhead sign bridges will not be measured for payment but will be included in the unit price bid for the item of construction in which this item is used.

The quantity for acceptable bell footings placed will be measured by the cubic yard, computed by using dimensions and shape indicated or as revised in diameter by the Engineer or designated representative. The bell shall consist of the volume outside the plan or authorized dimensions of the shaft, which will extend to the bottom of the bell for the purpose of measurement.

Test holes of the specified diameter will be measured from the elevation of the ground at the time drilling begins, by the linear foot of acceptable test hole drilled.

Test bells will be measured by the cubic yard of material excavated, computed from the dimensions indicated or those authorized by the Engineer or designated representative in writing.

420S.8 - Payment

Drilled shafts will be paid for at the unit price bid per linear foot of "Drilled Shaft" or "Drilled Shaft (Non-reinforced)", of the specified diameter, subject to the following limitations for overruns authorized by the Engineer or designated representative.

- (1) Payment for individual completed shaft lengths up to and including 5 feet (1.5 m) in excess of the maximum plan length shaft, as defined herein, will be made at the unit price bid per linear foot of the specified diameter of "Drilled Shaft".
- (2) Payment for that portion of individual completed shaft length in excess of 5 feet (1.5 m) and up to and including 15 feet (4.5 m) more than the maximum plan length shaft, as defined herein, will be made at a unit price equal to 115 percent of the unit price bid per linear foot of the specified diameter of "Drilled Shaft".
- (3) Payment for that portion of individual completed shaft length in excess of 15 feet (4.5 m) and up to and including 25 feet (7.5 m) more than the maximum plan length shaft, as defined herein, will be made at a unit price equal to 125 percent of the unit price bid per linear foot of the specified diameter of "Drilled Shaft".
- (4) Payment for that portion of individual completed shaft length, over 25 feet (7.5 m) in excess of the maximum plan length shaft, as defined herein, will be made at a unit price equal to 150 percent of the unit price bid per linear foot of the specified diameter of "Drilled Shaft".
- (5) For extra depth drilling at interior bents and piers, the maximum plan length shaft shall be the maximum length shaft, regardless of diameter, for any interior pier or bent of any bridge included in the contract.
- (6) For extra depth drilling for abutment bents and retaining walls, the maximum plan length shaft shall be the maximum length shaft, regardless of diameter, for any abutment bent of any bridge or of any retaining wall included in the contract.
- (7) For extra depth drilling for sign structures, the maximum plan length shaft shall be the maximum length shaft, regardless of diameter, for any sign structures included in the contract.
- (8) For extra depth drilling for illumination towers, the maximum plan length shaft shall be the maximum length shaft, regardless of diameter, for any illumination tower included in the contract.

The 20 percent limitation referred to in the "General Conditions", Section 11.6.5, will not apply to overruns due to extra depth of drilled shafts.

Bell footings, constructed to the specified dimensions or to the altered dimensions authorized by the Engineer or designated representative, will be paid for at the contract unit price bid per cubic yard for "Bell Footings". Authorized increase in bell footing diameter beyond 3 times the specified shaft diameter, unless indicated, shall be considered as beyond the scope and intent of these specifications. Payment for such increased bell footing quantity shall conform to the "General Conditions":

Test holes, of the specified diameter, when included in the contract as a bid item, will be paid for at the contract unit price bid per linear foot for "Test Hole".

Test bells of the diameter and shape specified, when included in the contract as a bid item or authorized by the Engineer or designated representative, will be paid for at the contract unit price bid per cubic yard of "Test Bells".

The foregoing unit prices shall be full compensation for making all excavations, for drilling all test holes and test bells, for doing any necessary pumping; for furnishing, placing and removing any required casings, for furnishing and placing all concrete and reinforcing steel, for all backfilling and for furnishing all tools, labor, equipment and incidentals necessary to complete the work. When the bottom of any drilled shaft is ordered to be placed at an elevation below plan grade and a splice of reinforcement is required, no payment will be made for the extra reinforcement required, but it shall be included in the unit price bid for the item of construction in which this item is used. No extra payment will be made for casings left in place.

No partial estimates will be allowed for "Bell Footing" or for "Drilled Shaft" until the concrete has been placed, except that partial payments will be made for reinforcing steel materials delivered on the job conforming to the "General Conditions".

Payment will be made under one of the following:

Pay Item No. 420S-A:	Drilled Shaft, Dia.	Per Linear Foot.
Pay Item No. 420S-B:	Drilled Shaft, Non-reinforced, Dia.	Per Linear Foot.
Pay Item No. 420S-C:	Bell Footings	Per Cubic Yard.
Pay Item No. 420S-TB:	Test Bells, Dia.	Per Cubic Yard.
Pay Item No. 420S-TH:	Test Holes, Dia.	Per Linear Foot.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 420S, " Drilled Shaft Foundations"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures
Item No. 406S	Reinforcing Steel
Item No. 410S	Concrete Structures

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 420S, " Drilled Shaft Foundations"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 104S	Removing Portland Cement Concrete
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 401S	Structural Excavation and Backfill
<u>Texas Department of Transportation: Standard Specifications for Construction, Maintenance of Highways, Streets and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 420	Concrete Structures
Item No. 421	Portland Cement Concrete
Item No. 440	Reinforcing Steel
Item No. 449	Anchor Bolts
Item No. 618	Conduit

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ITEM NO. 430S - P.C. CONCRETE CURB AND GUTTER 11-15-11**430S.1 - Description**

This item shall govern Portland Cement (p.c.) concrete curb, p.c. concrete curb and gutter with reinforcing steel or p.c. concrete laydown curb as required, that is constructed in accordance with this specification on an approved subgrade and base in conformity with Standard Detail Series 430S and the lines, grades, section indicated on the Drawings or as established by the Engineer or designated representative.

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

430S.2 - Submittals

The submittal requirements of this specification item include:

- A. Class A p.c. concrete mix design,
- B. Type of Installation (i.e. P.C. Concrete Curb and Gutter or P.C. Concrete Curb or P.C. Concrete Laydown Curb) and construction details (i.e. base, reinforcing steel, joints, curing membrane),
- C. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.

430S.3 - Materials**A. Concrete**

The Portland cement (p.c.) concrete shall conform to Class A Concrete, Section 403S.7 (Table 4) of Standard Specification Item No. 403S, "Concrete for Structures" or Sections 360S.4 and 360S.6 of Standard Specification Item No. 360S, "Concrete Pavement" when curb and gutter is to be constructed integral with the pavement.

B. Reinforcing Steel

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

C. Expansion Joint Materials

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

D. Membrane Curing Compound

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

E. Flexible Base

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

430S.4 - Construction Methods**A. Subgrade and Base Preparation**

Subgrade for curb and gutter shall be excavated and prepared to depth and width requirements indicated on the Drawings, including a minimum of 12 inches (300 mm) behind the curb, unless a greater width is indicated on the Drawings. The subgrade shall be shaped to the line, grades, cross section and dimensions indicated on the Drawings. A minimum of 4 inches (100 mm) of flexible base shall be spread, wetted and thoroughly compacted under curb and gutter as specified in Standard

Specification Item No. 210S, "Flexible Base". If dry, the base shall be sprinkled lightly with water before p.c. concrete is deposited thereon.

B. C & G Forms

Forms shall be of metal, well-seasoned wood or other approved material. The length of the forms shall be a minimum of 10 feet (3 meters). Flexible or curved forms shall be used for curves of 100-foot (30 meter) radius or less. Wood forms for straight sections shall be not less than 2 inches (50 mm) in thickness. Forms shall be a section, that is satisfactory to the Engineer or designated representative, of the depth required and clean, straight, free from warp and, if required, oiled with a light form oil. All forms shall be securely staked to line and grade and maintained in a true position during the placement of p.c. concrete.

C. Reinforcing Steel

The reinforcing steel, if required, shall be placed as shown on the typical section of the Drawings. Care shall be exercised to keep all steel in its proper location during p.c. concrete placement.

D. Joints

Joints shall be of the type and spacing shown on the Drawings. Expansion joint material, $\frac{3}{4}$ 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 $\frac{3}{4}$ 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, $\frac{1}{2}$ 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 $\frac{1}{2}$ inch (12.5 mm) nor less than $\frac{1}{4}$ 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-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

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 430S, "P.C. Concrete Curb and Gutter"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No 130S	Borrow
Item No 210S	Flexible Base
Item No. 360	Concrete Pavement"
Section 360.4 of Item 360	Proportioning of Concrete

Section 360.6 of Item 360	Concrete Mixing and Placing
Item No. 403S	Concrete for Structures
Section 403S.7 of Item No. 403S	(Table 4)
Item No. 406S	Reinforcing Steel
Item No. 408S	Expansion Joint Materials
Item No. 409S	Membrane Curing
Item No. 604S	Seeding for Erosion Control
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
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 MATERIALSSpecification Item No. 430S, "P.C. Concrete Curb and Gutter"

<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>

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 1-4-10**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% 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 $\frac{3}{4}$ 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 $\frac{1}{4}$ inch wide and $\frac{3}{4}$ 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 ensure conformance with the drawings, specifications and this item. In addition, care shall be exercised to keep all steel in its proper position during placement of the p.c. concrete. If during placement of the concrete, the reinforcement is observed to loose bar support, float upward or move in any direction, the placement shall be stopped until corrective action is taken.

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 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 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

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, 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.

432S.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		

PORTLAND CEMENT CONCRETE SIDEWALKS

Item No. 432S

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	Per Each.
Pay Item 432S-SAC-7E:	Streetscape 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.
Pesdestrian 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

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 432S, "Portland Cement Concrete Sidewalks"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
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
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
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

<u>Designation</u>	<u>Description</u>
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)

<u>Designation</u>	<u>Description</u>
Section 4.29	Detectable Warnings on Walking Surfaces
Section A4.29.2	Detectable Warnings on Walking Surfaces

RELATED CROSS REFERENCE MATERIALS

Specification 432S, "Portland Cement Concrete Sidewalks"

City of Austin Standard Contract Documents

<u>Designation</u>	<u>Description</u>
00700	General Conditions
01500	Temporary Facilities
01550	Public Safety and Convenience
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 5.2.3	Utility Adjustments For Roadway Construction Projects
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
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
Item No. 436S	P.C. Concrete Valley Gutters
Item No. 602S	Sodding for Erosion Control
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 642S	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
432S-8A	Trash Receptacle Installation in Concrete Paver Sidewalk
432S-9A	Bench Installation in Concrete Paver Sidewalk
432S-10	Mailbox Placement Detail
433S-1	Type I Driveway (1 & 2 Family Residential Use Only)
433S-1A	Flared Type I Driveway (1 & 2 Family Residential Use Only)
433S-2	Type II Driveway
433S-3	Temporary Driveway

436S-2	Concrete Valley Gutter
470S-1	Curb Cut for Ramp or Driveway (Optional)
710S-3	Bicycle Rack Installation in Concrete Paver Sidewalks (Alternate 1)
1000-8(A)	Typical ROW and Front Lot Utility Assignments
1000-8(B)	Typical Single Service Utility Assignment Details (TV,W,WW)
1000S-10	Local Street Sections
1000S-11	Residential and Neighborhood Collector Street Sections
1000S-12	Primary Collector Street Sections
1000S-13	Minor Arterial Street Sections
1000S-14	Major Arterial Street Sections
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 112	Subgrade Widening
Item No. 132	Embankment
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling

Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)
<u>American Disabilities Act, Federal Register; Volume 56, No. 144; July 26, 1991 ADA Accessibility Guidelines For Building And Facilities</u>	
<u>Designation</u>	<u>Description</u>
Section 4.3	Accessible Route
Section 4.3.6	Surface Texture
Section 4.3.7 & 4.7.2	Slope
Section 4.3.8 & 4.5.2	Changes in Levels
Section 4.7	Curb Ramps
Section 4.8	Ramps
<u>Architectural Barriers; Texas Civil Statutes, Article 9102; June 14, 1995 Texas Accessibility Standards (TAS)</u>	
<u>Designation</u>	<u>Description</u>
Section 4.3	Accessible Route
Section 4.3.6	Surface Texture
Section 4.3.7 & 4.7.2	Slope
Section 4.3.8 & 4.5.2	Changes in Levels

Section 4.7	Curb Ramps
Section 4.8	Ramps

ITEM NO. 503S - FRAMES, GRATES, RINGS AND COVERS 2-17-00**503S.1 - Description**

This item shall govern furnishing and installation of frames, grates, rings and covers for inlets, manholes and other structures indicated on the Drawings.

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

503S.2 - Submittals

The submittal requirements of this specification item include manufacturer, model number, description, painting requirements and characteristics of frames, grates, rings, covers, height adjustment insert and nuts and bolts required for completion of the work.

503S.3 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation in the Work is the kind and quality that satisfies the specified functions and quality. The City of Austin Water and Wastewater Utility Standard Products Lists (SPLs) form a part of these Specifications. Contractors may, when appropriate, elect to use products from the SPLs; however, submittal to the Engineer or designated representative is still required. If the Contractor elects to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal.

The purpose of the SPLs is to expedite the review by the Engineer or designated representative and, if necessary, the City of Austin Water and Wastewater Utility Standard Products Committee of Contractor product submittals. The SPL's should not be interpreted as being a pre-approved list of products necessarily meeting the requirements for a given construction Project. Items contained in the SPL cannot be substituted for items that are shown on the Drawings, called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the Engineer or designated representative in conjunction with the Water and Wastewater Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

A. Welded

Steel Welded steel grates and frames shall conform to the number; size, dimensions and details indicated on the Drawings and shall be welded into an assembly in accordance with those details. Steel shall conform to the requirements of ASTM A 36/A 36M, "Specification for Structural Steel".

B. Castings

Castings, whether Carbon-Steel, Gray Cast Iron or Ductile Iron shall conform to the shape and dimensions indicated on the Drawings and shall be clean substantial castings, free from sand or blowholes or other defects. Surfaces of the castings shall be free from burnt on sand and shall be reasonably smooth. Runners, risers, fins and other cast on pieces shall be removed from the castings and such areas ground smooth. Bearing surfaces between manhole rings and covers or grates and frames shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact. Pairs of machined castings shall be matchmarked to facilitate subsequent identification at installation with the exception of water and wastewater manhole and valve castings. These manhole and valve castings shall be fabricated with such draft, tolerances, bolt hole spacing, etc., that all rings and covers of a particular type or class are interchangeable and match-marking will not be required.

Steel castings shall conform to ASTM A 27/27M, "Specifications for Steel Castings, Carbon, for General Application". Grade 70-36 (480-250) shall be furnished unless otherwise specified on the Drawings.

Cast iron castings shall conform to ASTM A 48, "Specification for Gray Iron Castings", Class 30.

Ductile Iron castings shall conform to ASTM A 536, "Specification for Ductile Iron Castings". Grade 60-40-18 (415-275-125) shall be used unless otherwise indicated on the Drawings.

C. Manhole Cover Riser Rings

Height-adjustment inserts for wastewater manhole rings, which are used for raising standard manhole covers, shall be those models listed in Water and Wastewater Standard Products List item QPL WW-330.

D. Nuts and Bolts

Nuts and bolts shall be hex head 5/8 " × 2.5" (16 mm × 63.5 mm) #11 National Coarse Thread, Type 316 stainless steel. For bolted manhole covers, a thin film of an approved "Anti-freeze" compound, approved by the Engineer or designated representative, shall be applied to all bolts.

E. Mortar

Unless otherwise specified or approved by the Engineer or designated representative, the mortar for bedding castings shall consist of one (1) part Portland cement and three (3) parts sand and sufficient water to provide the desired consistency. The gradation of the fine aggregate shall meet the requirements for Grade No. 1, Item No. 403, "Concrete for Structures".

503S.4 - Construction Methods

Frames, grates, rings and covers shall be constructed of the specified materials in accordance with the details indicated on the Drawings or in the City of Austin Standard Details. The Frames, grates, rings and covers shall be placed carefully to the lines or grades indicated on the Drawings or as directed by the Engineer or designated representative.

All welding shall conform to the requirements of the ANSI/AWS Structural Welding Code D1.1. Welded frames, grates, rings and covers shall be given 1 coat of a commercial grade red lead oil paint and 2 coats of commercial grade aluminum paint. All coats shall be a minimum of 1.5 mils (0.4 mm), dry.

Painting of gray iron castings will not be required, except when used in conjunction with structural steel shapes.

503S.5 - Measurement and Payment

Frames, grates, rings and covers will not be measured and payment for furnishing all materials, tools, equipment, labor and incidentals to complete the Work will be included in the Bid Items which constitute the complete structures.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item Number 503S, "Frames, Grates, Rings and Covers"</u>	

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures

City of Austin Water and Wastewater Standard Products List

<u>Designation</u>	<u>Description</u>
QPL-WW-330	Manhole Cover Riser Rings for raising City of Austin Standard Manhole Covers

American Society for Testing Materials (ASTM)

<u>Designation</u>	<u>Description</u>
A36/A36M	Specification for Structural Steel
A27/A27M	Specification for Steel Castings, Carbon, for General Application
A48	Specification for Gray Iron Castings
A536	Specification for Ductile Iron Castings

ANSI/AWS

<u>Designation</u>	<u>Description</u>
Code D 1.1	Structural Welding Code

RELATED CROSS REFERENCE MATERIALS

<u>Standard Specification Item Number 503S, "Frames, Grates, Rings and Covers"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 504S	Adjusting Structures
Item No. 510	Pipe
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 503S-1	457mm (18") Cover and Frame
No. 503S-2S	Storm Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-2W	Sanitary Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-3S	Bolted Storm Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-3W	Bolted Sanitary Sewer Manhole Ring and 610 mm (24") Cover
No. 503S-4S	Storm Sewer Manhole Ring and 813 mm (32") Cover
No. 503S-4W	Sanitary Sewer Manhole Ring and 813 mm (32") Cover
No. 503S-5S	Bolted Storm Sewer Manhole Ring and 813 mm (32") Cover
No. 503S-5W	Watertight Manhole Ring and 813 mm (32") Cover
No. 506S-2	Major Manhole Adjustment
No. 506S-11	Storm Sewer Manhole Details

<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 421	Portland Cement Concrete

ITEM NO. 504S - ADJUSTING STRUCTURES 2-24-10**504S.1 - Description**

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

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

504S.2 - Submittals

The submittal requirements of this specification item include:

- A. Aggregate type, gradations and physical characteristics for the Portland cement concrete mix.
- B. Proposed proportioning of materials for the mortar mix.
- C. Type structures and proposed adjustment technique (lowering, raising, lateral displacement).
- D. Type structure, repair technique and materials to be furnished (new replacement or reuse of existing) Type of mixing plant and associated equipment including chart indicating the calibration of each cold bin

504S.3 - Materials

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

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

504S.4 - Construction Methods

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

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

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

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

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

504S.5 - Measurement

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

504S.6 - Payment

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

Payment will be made under one of the following:

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

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 504S, "Adjusting Structures"</u>	
<u>City of Austin Standard Specifications</u>	

<u>Designation</u>	<u>Description</u>
Item No. 403	Concrete for Structures
Item No. 509S	Trench Safety Systems
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
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 HMA/C

RELATED CROSS REFERENCE MATERIALSSpecification 504S, "Adjusting Structures"

<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
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
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
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
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No.421	Portland Cement Concrete

ITEM NO. 506 - MANHOLES 3-15-11

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 ¼ part hydrated lime), and sand equal to 2½ 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, 24½ 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 40°F. If a sudden drop in temperature below 40°F occurs or temperatures below 40°F 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. × ____ Dia.	Per Each.
Pay Item No. 506S T__:	Tangent Tee Manhole, ____ Dia. × ____ Dia.	Per Each.
Pay Item No. 506S J__:	Junction Box, ____ Ft. × ____ Ft.	Per Each.
Pay Item No. 506S B__:	Box Manhole ____ Ft. × ____ 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

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 506, "Manholes"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
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

<u>Designation</u>	<u>Description</u>
Item 421	Hydraulic Cement Concrete

City of Austin Utilities Criteria Manual

<u>Designation</u>	<u>Description</u>
Section 2.8.0	Abandonment of Facilities
Subsection 2.8.2	Manholes

City of Austin Water Utility Documents

<u>Designation</u>	<u>Description</u>
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

<u>Designation</u>	<u>Description</u>
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
<u>City of Austin Standard Contract</u>	
<u>Designation</u>	<u>Description</u>
00300U	Bid Form (Unit Prices)
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
ASTM C 55	Specification for Concrete Building Brick
ASTM C 62	Specification for Building Brick Solid Masonry Units Made from Clay or 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
<u>American Concrete Institute</u>	
<u>Designation</u>	<u>Description</u>
Item 347	Guide to Formwork for Concrete

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 506, "Manholes"</u>	
<u>City of Austin Utilities Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 2	Water and Wastewater Design Criteria
<u>City of Austin Standards</u>	
<u>Designation</u>	<u>Description</u>
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
<u>American Association of State Highway and Transportation Officials (AASHTO)</u>	
<u>Designation</u>	<u>Description</u>
M306	Standard Specifications for Drainage Structure Castings

ITEM NO. 508S - MISCELLANEOUS STRUCTURES AND APPURTENANCES 2-24-10**508S.1 - Description**

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

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

508S.2 - Submittals

The submittal requirements of this specification item include:

- A. Type of structure and appurtenances (inlets, headwalls, frames, grates, energy dissipators, etc.), construction methods and sequence (precast, cast in place), materials (bolts, nuts, plates, angles, etc.)
- B. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix.
- C. Proposed proportioning of materials for the mortar mix.
- D. Analysis and thickness calculations for temporary steel covers.

508S.3 - Types

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

508S.4 - Materials**A. Portland Cement Concrete**

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

Cast in Place Concrete Class A

Precast Concrete Class C

B. Mortar

Mortar shall be composed of 1 part Portland cement and 2 parts clean, sharp mortar sand suitably graded for the purpose by conforming in other respects to the provisions of Standard Specification Item No. 403S, "Concrete for Structures" for fine aggregate. Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight (mass) of the total dry mix.

C. Reinforcement and Steel

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

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

D. Frames, Grates, Rings and Covers

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

E. Safety End Treatment for Structures

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

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

F. Miscellaneous Items

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

508S.5 - Construction Methods

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

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

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

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

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

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

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

508S.6 - Measurement

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

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

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

508S.7 - Payment

A. Inlets

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

B. Energy Dissipators and Headwalls

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

C. Safety End Treatment

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

Payment will be made under one of the following:

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

MISCELLANEOUS STRUCTURES AND APPURTENANCES

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Pay Item No. 508S-I15S:	Inlet, Standard	Per Each.
Pay Item No. 508S-I20S:	Inlet, Standard	Per Each.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 508S, "Miscellaneous Structures and Appurtenances"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
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
<u>TxDOT Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 467	Safety End Treatment
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>

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

RELATED CROSS REFERENCE MATERIALS

Standard Specification Item No. 508S, "Miscellaneous Structures and Appurtenances"

City of Austin Drainage Criteria Manual

Designation

Description

Section 6.6.0

Energy Dissipators

City of Austin Standard Specification Items

Designation

Description

Item No. 501S

Jacking or Boring Pipe

Item No. 504S

Adjusting Structures

Item No. 506

Manholes

MISCELLANEOUS STRUCTURES AND APPURTENANCES

Item No. 508S

Item No. 507S	Bulkheads
Item No. 510	Pipe
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
508S-13	Standard Headwall and Energy Dissipators
510S-1	Concrete Trench Cap
<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
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

ITEM NO. 509S - EXCAVATION SAFETY SYSTEMS 9-26-12

509S.1 - Description

This item shall govern the designing, furnishing, installing, maintaining and removing or abandoning of temporary Excavation Safety Systems consisting of trench shields, aluminum hydraulic shoring, timber shoring, trench jacks, tied-back or braced sheeting, tied-back slurry walls, soil nailing, rock bolting, tied-back or braced soldier piles and lagging, and other systems for protecting workers in excavations. This item shall also govern the designing and constructing of sloping and benching systems for protecting workers in excavations.

At a minimum, the Excavation Safety Systems shall conform to United States Department of Labor Rules 29 CFR, Occupational Safety and Health Administration, Part 1926 Safety and Health Regulations for Construction, Subpart P, Excavation (hereinafter called OSHA).

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

509S.2 - Definitions

COMPETENT PERSON shall mean one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. The **COMPETENT PERSON** shall be capable of interpreting the manufacturer's data sheets and interpreting and implementing the Excavation Safety System Plan.

An **EXCAVATION** shall mean any cut, cavity, trench, or depression in an earth surface, formed by earth removed by the Contractor. The Contractor shall provide an Excavation Safety System for all excavations except when 1) the excavation is in stable rock as determined by the Texas-licensed Professional Engineer who prepared the Contractor's Excavation Safety System Plan or 2) the excavation is less than 5 feet (1.52 m) in depth and examination of the ground by the Contractor's competent person provides no indication of a potential cave-in.

TRENCH (TRENCH EXCAVATION) shall mean any narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth shall be greater than the width, but the trench (measured at the bottom) shall not be wider than 15 feet (4.56 m). Excavation Safety Systems for such trenches shall be defined as Trench Excavation Safety Protective Systems.

If the Contractor installs or constructs forms or other structures in an excavation such that the dimension measured from the forms or structures to the sides of the excavation is reduced to 15 feet (4.6 m) or less (measured at the bottom of the excavation), those excavations shall also be defined as a **TRENCH** if workers must enter it. Excavation Safety Systems for such **TRENCHES** shall also be defined as **TRENCH EXCAVATION SAFETY PROTECTIVE SYSTEMS**.

509S.3 - Excavation Safety System Plan Submittal

A. The Notice to Proceed with construction may be issued by the Owner before the Contractor has submitted the necessary Excavation Safety Plan(s); however, excavation shall not proceed until the Owner has received the Contractor's Excavation Safety Plan(s) for the Project.

B. Prior to Starting Excavation

Prior to starting any Excavation, the Contractor shall submit to the Owner:

1. A certificate indicating that the Contractor's Competent Person(s) has completed training in an excavation safety program based on OSHA regulations within the past 5 years.

2. Manufacturer's tabulated data or other tabulated data for Excavation Safety Systems consisting of pre-engineered protective systems such as trench shields, aluminum hydraulic shoring, timber shoring, pneumatic shoring, or trench jacks, or benching or sloping or other protective systems that are not designed specifically for the Project.

Manufacturer's tabulated data shall meet the requirements in OSHA and shall describe the specific equipment to be used on the Project. Tabulated data must bear the seal of the licensed professional engineer who approved the data. Manufacturer's tabulated data shall be an attachment to the Contractor's Excavation Safety System Plan described below.

509S.4 - Excavation Safety System Plan Review

The Contractor shall prepare an Excavation Safety System Plan (hereafter called the "Plan") specifically for the Project. The Contractor shall retain a Texas-licensed Professional Engineer to prepare the Plan. On City-funded projects, the Contractor must follow qualifications-based procedures to procure the required Professional Engineering services, according to Chapter 2254 of the Texas Government Code.

The Contractor shall be responsible for obtaining geotechnical information necessary for design of the Excavation Safety System. If geotechnical information for design of the Project has been acquired by the Owner or designated representative, it shall be provided to the Contractor for information purposes subject to the provisions of City of Austin Standard Contract Section 00220, "Geotechnical Data."

- A. The Plan for Excavation Safety Systems consisting of pre-engineered protective systems such as trench shields, aluminum hydraulic shoring, timber shoring, pneumatic shoring, or trench jacks, or benching or sloping or other protective systems that are not designed specifically for the Project shall include:
 1. Detailed Drawings of the Excavation Safety System(s) that will provide worker protection conforming to OSHA. The Drawings shall note the required load carrying capacity, dimensions, materials, and other physical properties or characteristics in sufficient detail to describe thoroughly and completely the Excavation Safety System(s).
 2. Drawings, notes, or tables clearly detailing the specific areas of the Project in which each Excavation Safety System shall be used, the permissible size of the excavation, the length of time that the excavation shall remain open, the means of egress from the excavation, the location of material storage sites in relation to the excavation, the methods for placing/compacting bedding/backfill within the safety of the system, any excavation safety equipment restrictions and subsequent removal of the system.
 3. Recommendations and limitations for using the Excavation Safety Systems.
 4. A Certificate of Insurance of the Excavation Safety System Engineer's Professional Liability Insurance coverage. For City-funded projects, coverage meeting the requirements of Standard Contract Documents Section 00810 shall be provided. For privately funded projects the coverage shall be at least \$1,000,000.
- B. The Plan for Excavation Safety Systems consisting of tied-back or braced sheeting, tied-back or braced soldier piles and lagging, slurry walls, soil nailing, rock bolting or other protective systems that are designed specifically for the Project shall include:
 1. Detailed Drawings of the Excavation Safety System(s) that will provide worker protection conforming to OSHA. The Drawings shall note the design assumptions, design criteria, factors of safety, applicable codes, dimensions, components, types of materials, and other physical properties or characteristics in sufficient detail to describe thoroughly and completely the Excavation Safety System(s).
 2. Detailed technical specifications for the Excavation Safety System addressing the properties of the materials, construction means and methods, quality control and quality assurance testing, performance monitoring, and monitoring of adjacent features, as appropriate.

3. Drawings that clearly detail the specific areas of the Project in which each type of system shall be used and showing the Special Shoring in plan and elevation (vertical profile) views.
4. Drawings, notes or tables clearly detailing the length of time that the excavation shall remain open, the means of egress from the excavation, the location of material storage sites in relation to the excavation, the methods for placing/compacting bedding/backfill within the safety of the system, any excavation safety equipment restrictions and subsequent removal or abandonment of the system or parts thereof.
5. Recommendations and limitations for using the Excavation Safety Systems.
6. A Certificate of Insurance of the Excavation Safety System Engineer's Professional Liability Insurance coverage. For City-funded projects, coverage meeting the requirements of Standard Contract Documents Section 00810 shall be provided. For privately funded projects the coverage shall be at least \$1,000,000.

509S.5 - Excavation Safety System Submittal Review

Review of the Excavation Safety System submittal conducted by the Owner or designated representative shall only relate to conformance with the requirements herein. The Owner's failure to note exceptions to the submittal shall not relieve the Contractor of any or all responsibility or liability for the adequacy of the Excavation Safety System. The Contractor shall remain solely and completely responsible for all Excavation Safety Systems and for the associated means, methods, procedures, and materials.

509S.6 - Contractor's Responsibility

The Contractor shall be responsible for implementing the Excavation Safety System Plan and for confirming that the Excavation Safety System(s) used on the Project meets the requirements of the Plan.

The Contractor's Competent Person(s) shall be on the Project whenever workers are in an excavation meeting the definitions of a Trench given in 509S.2.

509S.7 - Construction Methods

The Contractor's Competent Person(s) shall maintain a copy of appropriate OSHA regulations on-site and shall implement OSHA excavation safety regulations at the work site. The Contractor shall perform all excavation in a safe manner and shall maintain the Excavation Safety Systems to prevent death or injury to personnel or damage to structures, utilities or property in or near excavation.

If evidence of possible cave-ins or earthen slides is apparent or an installed Excavation Safety System is damaged, the Contractor shall immediately cease work in the excavation, evacuate personnel from any potentially hazardous areas and notify the Owner. Personnel shall not be allowed to re-enter the excavation until necessary repairs or replacements are completed and are inspected and approved by the Contractor's Competent Person(s). Repair and replacement of damaged Excavation Safety System shall be at the Contractor's sole expense.

509S.8 - Changed Conditions

When changed conditions require modifications to the Excavation Safety System, the Contractor shall provide to the Owner or designated representative a new design or an alternate Excavation Safety System Plan that is proposed by the Contractor's Excavation Safety System Engineer to address the changed conditions. Copies of the new design or alternate system shall be provided to the Owner or designated representative in accordance with the requirements of section 509S.3, "Excavation Safety System Plan Submittals." A copy of the most current Excavation Safety System Plan shall be maintained on site and made available to inspection and enforcement officials at all times.

Any changes to the Excavation Safety System Plan that are initiated by the Contractor for operational efficiency or as a result of changed conditions, that could be reasonably anticipated, will not be cause for contract time extension or cost adjustment. When changes to the Excavation Safety System Plan are necessitated by severe and uncharacteristic natural conditions or other conditions not reasonably within the control of the Contractor, the Contractor may make a written request to the Owner for a Change Order to address the anticipated work. The Contractor shall notify the Owner in writing within 24 hours of the occurrence of changed conditions that the Contractor anticipates the submittal of a claim for additional compensation. Under "Changed Conditions" the work deemed immediately necessary by the Contractor to protect the safety of workers and public, equipment or materials may only be accomplished until the Owner or designated representative has a reasonable opportunity to investigate the Contractor's written request for a Change Order and respond in writing to the request.

509S.9 - Measurement

Trench Excavation Safety Protective Systems will only be measured and paid for those trenches that workers would reasonably be expected to enter.

Trench Excavation Safety Protective Systems for Trenches excavated to a final width (measured at the bottom of the excavation) not exceeding 15 feet (4.56 m) shall be measured by the linear foot (meter: 1 meter equals 3.281 feet) through manholes, bore pits, receiving pits, and other appurtenances along the centerline of the trench. This method of measurement shall apply to any and all protective systems, including but not limited to tieback or braced sheeting, tieback or braced soldier piles and lagging, slurry walls, soil nails, rock bolts, shoring, trench boxes, and sloping or benching as used to provide a Trench Excavation Safety Protective System in accordance with the Excavation Safety System Plan.

Trench Excavation Safety Protective Systems for Trenches created by installation or construction of forms or other structures in an excavation whose width is greater than 15 feet (4.56 m) such that the dimension measured from the forms or structures to the sides of the excavation is reduced to 15 feet (4.56 m) or less (measured at the bottom of the excavation) shall be measured by the linear foot along the centerline of the Trench. Where forms or structures create multiple Trenches in one excavation, each Trench shall be measured separately. This method of measurement shall apply to any and all protective systems, including but not limited to tieback or braced sheeting, tieback or braced soldier piles and lagging, slurry walls, soil nails, rock bolts, shoring, trench boxes, and sloping or benching as used to provide a Trench Excavation Safety Protective System in accordance with the Excavation Safety System Plan.

509S.10 - Payment

Payment for Trench Excavation Safety Protective Systems, measured as prescribed above, will be made at unit bid price per centerline linear foot of Trench. The unit bid price shall include full compensation for designing, furnishing, installing the system; for dewatering, and for maintaining, replacing, repairing and removing the Trench Excavation Safety Protective System and for sloping, special clearing, and excavation necessary to safely implement the Excavation Safety System Plan. No payment will be made for Trench Excavation Safety Protective Systems made necessary by the Contractor's selection of an optional design or sequence of work that creates the need for the Trench Excavation Safety Protective System

Payment will be made under the following:

Pay Item No. 509S-1:	Trench Excavation Safety Protective Systems (all depths)	Per Linear Foot.
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END

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 509S, "Excavation Safety Systems"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
Section 00020	Invitation for Bids
Section 00220	Geotechnical Data
Section 00650	Certificate of Insurance
Section 00700, Article 6.11	Safety and Protection
Section 810	Supplemental General Conditions
29 CFR, Occupational Safety and Health Administration, Part 1926 Safety and Health Regulations for Construction, Subpart P, Excavation	
Texas Health and Safety Code Title 9 Chapter 756 Subchapter C	
Texas Government Code Chapter 2254	

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 509S, "Excavation Safety Systems"</u>	
<u>Texas Department of Transportation: Standard Specifications For Construction and Maintenance of Highways, Streets, and Bridges</u>	

<u>Designation</u>	<u>Description</u>
Item 104	Removing Concrete
Item 110	Excavation
Item 402	Trench Excavation Protection
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 402S	Controlled Low Strength Material
Item No. 501S	Jacking or Boring Pipe
Item No. 503S	Frames, Grates, Rings and Covers
Item No. 504S	Adjusting Structures
Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 506	Manholes

Item No. 507S	Bulkheads
Item No. 510	Pipe
Item No. 511S	Water Valves
Item No. 593S	Concrete Retards
Item No. 594S	Gabions and Revet Mattresses

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ITEM NO. 510 - PIPE 12-18-18

510.1 - Description

This item governs the furnishing and installing all pipe and/or materials for constructing pipe mains, sewers, laterals, stubs, inlet leads, service connections, culverts, temporary service lines and temporary diversion lines, including all applicable Work such as excavating, bedding, jointing, backfilling materials, tests, concrete trench cap, concrete cap and encasement, etc., prescribed under this item in accordance with the provisions of the Edwards Aquifer Protection Ordinance, when applicable, and City of Austin Utility Criteria Manual, Section 5, "Working in Public Rights-of-Way." The pipe shall be of the sizes, types, class and dimensions indicated or as designated by the E/A and shall include all joints or connections to new or existing mains, pipes, sewers, manholes, inlets, structures, etc., as may be required to complete the Work in accordance with specifications and published standard practices of the trade associations for the material specified and to the lines and grades indicated. This item shall include any pumping, bailing, and drainage when indicated or applicable. Unless otherwise provided, this item shall consist of the removal and disposition of trees, stumps and other obstructions, old structures or portions thereof such as house foundations, old sewers, masonry or concrete walls, the plugging of the ends of abandoned piped utilities cut and left in place and the restoration of existing utilities damaged in the process of excavation, cutting and restoration of pavement and base courses, the furnishing and placing of select bedding, backfilling and cement or lime stabilized backfill, the hauling and disposition of surplus materials, bridging of trenches and other provisions for maintenance of traffic or access as indicated.

510.2 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation into the Work are of the kind and quality that satisfies the specified functions and quality. Austin Water Utility Standard Products Lists (SPL) form a part of the Specifications. Contractors may, when appropriate, elect to use products from the SPL; however, submittal to the E/A is still required. Should the Contractor elect to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal. This will expedite the review process in which the E/A, and, if necessary, the Austin Water Utility Standard Products Committee, decides whether the products meet the Contract requirements and the specific use foreseen by the E/A in the design of this engineered Project. The purpose of the SPL's is to expedite review, by the E/A and, if necessary, the Austin Water Utility Standard Products Committee, of Contractor product submittals. The SPL's shall not be considered as being a pre-approved list of products necessarily meeting the requirements of the Project. Items contained in the SPL cannot be substituted for items shown on the Drawings, or called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the E/A in conjunction with the Austin Water Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

(1) Concrete

Concrete shall conform to Item No. 403S, "Concrete for Structures".

(2) Coarse Aggregate

Coarse aggregate shall conform to Item No. 403S, "Concrete for Structures" or one of the following:

(a) Pipe Bedding Stone

Pipe bedding stone shall be clean gravel, crushed gravel or crushed limestone, free of mud, clay, vegetation or other debris, conforming to ASTM C 33 for stone quality. Size gradation shall conform to ASTM C-33 No. 57 or No. 67 or the following Table:

SIEVE SIZE	% RETAINED BY WEIGHT
1½"	0
1"	0—10
½"	40—85
#4	90—100
#8	95—100

(b) Foundation Rock

Foundation rock shall be well graded coarse aggregate ranging in size from 2 to 8 inches.

(c) Flexible Base

Flexible base shall conform to Item No. 210S, "Flexible Base".

(3) Fine Aggregate

(a) Concrete and Mortar Sand

Fine aggregate shall conform to Item No. 403S, "Concrete for Structures".

(b) Bedding Sand

Sand for use as pipe bedding shall be clean, granular and homogeneous material composed mainly of mineral matter, free of mud, silt, clay lumps or clods, vegetation or debris. The material removed by decantation TxDOT Test Method Tex-406-A, plus the weight of any clay lumps, shall not exceed 4.5 percent by weight.

The resistivity shall not be less than 3000 ohms-cm as determined by TxDOT Test Method Tex-129-E. Size gradation of sand for bedding shall be as follows:

GRADATION TABLE	
SIEVE SIZE	% RETAINED BY WEIGHT
¼"	0
#60	75—100
#100	95—100

(c) Stone Screenings

Stone screenings shall be free of mud, clay, vegetation or other debris, and shall conform to the following Table:

SIEVE SIZE	% PASSING
3/8 "	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

All screenings shall be the result of a rock crushing operation.

(4) Controlled Low Strength Material

Controlled Low Strength Material (CLSM) shall conform to Item 402S, "Controlled Low Strength Material.

(5) Pea Gravel

Pea gravel bedding shall be clean washed material, hard and insoluble in water, free of mud, clay, silt, vegetation or other debris. Stone quality shall meet ASTM C 33. Size gradation shall be as follows:

SIEVE SIZE	% RETAINED BY WEIGHT
3/4"	0
1/2"	0—25
1/4"	90—100

(6) Select Backfill or Borrow

This material shall consist of borrow or suitable material excavated from the trench. It shall be free of stones or rocks over 8 inches and shall have a plasticity index of less than 20. The moisture content at the time of compaction shall be within 2 percent of optimum as determined by TxDOT Test Method Tex-114-E. Sandy loam borrow will not be allowed unless shown on the Drawings or authorized by the E/A.

All suitable materials from excavation operations not required for backfilling the trench may be placed in embankments, if applicable. All unsuitable materials that cannot be made suitable shall be considered surplus excavated materials as described in 510.3(13). The Contractor may, if approved by the engineer, modify unsuitable materials to make them suitable for use. Modification may include drying, removal or crushing of over-size material, and lime or cement treatment.

(7) Cement Stabilized Backfill

When indicated or directed by the E/A, all backfill shall be with cement-stabilized backfill rather than the usual materials. Unless otherwise indicated, cement stabilized backfill material shall consist of a mixture of the dry constituents described for Class J Concrete. The cement and aggregates shall be thoroughly dry mixed with no water added to the mixture except as may be directed by the E/A.

(8) Pipe

General

Fire line leads and fire hydrant leads shall be ductile iron. Domestic water services shall not be supplied from fire service leads, unless the domestic and fire connections are on separately valved branches with an approved backflow prevention device in the fire service branch. All wastewater force mains shall be constructed of ductile iron pipe Pressure Class 250 minimum for pipe greater than 12-inch size and Pressure Class 350 for pipe 12-inch size and smaller. Wastewater pipe shall be in accordance with Austin Water Utility's Standard Products List SPL WW-534 and shall have a corrosion resistant interior lining acceptable to the Owner.

All water pipe within utility easements on private property shall be Ductile Iron Pipe, Pressure Class 350 minimum for pipe 12-inch size and smaller and Pressure Class 250 minimum for pipe greater than 12-inch size wrapped as indicated. For sizes over 24 inches, Concrete Pressure Pipe, steel cylinder type, conforming to the requirements of AWWA C-301 will be acceptable.

There may be no service connections to Concrete Pressure Pipe installed in utility easements on private property. Approved service clamps or saddles shall be used when tapping ductile iron pipe 12 inch size and smaller. All service tubing ($\frac{3}{4}$ inch thru 2 inches) installed in utility easements on private property shall be 150 psi annealed seamless Type K copper tubing with no sweat or soldered joints.

All reclaimed water mains shall be constructed of ductile iron pipe, Pressure Class 350 minimum for pipe 12-inch size and smaller and pressure class 250 for pipe greater than 12-inch size. For mains 12-inch size and smaller, PVC pipe, conforming to the requirements of AWWA C-900, DR 14 shall be acceptable. Reclaimed water pipe shall be manufactured purple, painted purple, or wrapped in purple polyethylene film wrap.

Manufacturers of concrete pipe and pipe larger than 24-inch diameter shall have a quality control program consisting of one or more of the following: 1) a quality management system certified by the American National Standards Institute (ANSI) or National Sanitation Foundation (NSF) to comply with ISO 9001:2000, 2) a quality management system certified by the QCast

Program following the requirements of the ACPA Plant Certification Manual, 3) a quality management system certified by the National Precast Concrete Association 4) a quality control program approved by the OWNER prior to submittal of bids for the PROJECT, or 5) an independent, third party quality control testing and inspection firm for testing and inspecting pipe produced for the PROJECT and approved by the OWNER prior to submittal of bids for the PROJECT. All such quality control programs shall be paid for by the manufacturer. It is the intent of this requirement that the manufacturer will document all appropriate tests and inspections with sampling and inspection criteria, frequency of testing and inspection, date of testing and inspection and date on which every piece was manufactured. Required testing and inspection, including that by an independent, third party, shall be performed full-time during production of pipe for the PROJECT. When requested by the OWNER, the manufacturer will provide copies of test data and results and inspection reports with the shipment of pipe for the PROJECT. Test data and results and inspection reports shall be traceable to specific pipe lots or pieces. Owner approval of the manufacturer's quality control program will expire after three years, at which time the manufacturer must present a current quality control program for approval in order to retain listing on the applicable SPL. Owner approval of the Concrete Pipe manufacturer's quality control program will expire after three years, at which time the manufacturer must present a current quality control program for approval.

The quality of materials, the process of manufacture and the finished pipe shall be subject to inspection and approval by the E/A at the pipe manufacturing plant and at the project site prior to and during installation. Plant inspections shall be conducted at the discretion of the City Representative. Only manufacturers having a quality control program of the type described above will be considered as approved providers of concrete pipe and pipe products as listed in the Standard Products List (SPL).

All water distribution pipe and fittings shall be listed in the Fire Protection Equipment Directory published by the Underwriter's Laboratories, Inc., or shall be Factory Mutual approved for fire service. All water pipe and related products shall be registered by the National Sanitation Foundation as having been certified to meet NSF/ANSI Standard 61.

(a) Reserved

(b) Iron Pipe

Iron pipe shall be ductile iron pipe meeting all requirements of standards as follows:

-For push-on and mechanical joint pipe: AWWA C-151

-For flanged pipe: AWWA C-115

Barrels shall have a nominal thickness required by Table 1 of AWWA C-115, which thickness corresponds to Special Class 53 in sizes through 54 inch, and Class 350 in 60 and 64-inch sizes. Flanges shall be ductile iron (gray iron is not acceptable); they shall be as shown in ANSI/AWWA C115/A21.15 and shall conform to dimensions shown in Table 2 and Figure 1 of AWWA C115. These flanges are the same in all respects as flanges shown in ANSI/AWWA C110/A21.10 for fittings and are standard for all flanges used with pipe, valve, and equipment units in the City of Austin water distribution and wastewater force main systems. Flanges shall be fabricated and attached to the pipe barrels by U.S. fabricators using flanges and pipe barrels of U.S. manufacture. If fabrication is to be by other than the pipe barrel manufacturer, a complete product submittal and approval by the Austin Water Utility will be required. Additionally, such fabricator shall furnish certification that each fabricated joint has been satisfactorily tested hydrostatically at a minimum pressure of 300 psi.

-Linings and Coating:

Interior surfaces of all iron potable or reclaimed water pipe shall be cement-mortar lined and seal coated as required by AWWA C104. Interior surfaces of all iron wastewater line and force main pipe shall be coated with a non-corrosive lining material as indicated on Austin Water Utility's Standard Products List SPL WW-534. Pipe exteriors shall be coated as required by the applicable pipe specification. The type and brand of interior lining shall be clearly marked on the outside of the pipe and fittings. Except as authorized by the E/A, only one type and brand of pipe lining shall be used on a given project.

Except as described above for flanged pipe (Thickness Class 53) and where not otherwise indicated, ductile iron pipe shall be minimum Class 250 as defined by ANSI/AWWA C150/A21.50-current; all ductile iron pipe and flanges shall meet the following minimum physical requirements:

Grade 60-42-10:

- Minimum tensile strength: 60,000 psi (414 mPa).
- Minimum yield strength: 42,000 psi (290 mPa).
- Minimum elongation: 10 percent.

The flanges for AWWA C115 pipe may be also be made from:

Grade 70-50-05:

- Minimum tensile strength: 70,000 psi (483 mPa).
- Minimum yield strength: 50,000 psi (345 mPa).
- Minimum elongation: 5 percent.

1. Ductile Iron Fittings:

Fittings shall be push-on, flanged or mechanical joint as indicated or approved and shall meet all requirements of standards as follows:

- Sizes 4 inch through 24 inch: AWWA C-110 or AWWA C-153
- Sizes larger than 24 inch: AWWA C-110.
- Lining and Coating:

Interior surfaces of all iron potable/reclaimed water pipe fittings shall be lined with cement-mortar and seal coated as required by AWWA C104. Interior surfaces of all iron wastewater and force main fittings shall be coated with a non-corrosive lining material acceptable to Owner. Fitting exteriors shall be coated as required by the applicable pipe specification.

2. Joint Materials

Gaskets for mechanical joints shall conform to ANSI/AWWA A21.11/C-111.

Joining of slip joint iron pipe shall, without exception, be accomplished with the natural or synthetic rubber gaskets of the manufacturer of that particular pipe being used. A joint lubricant shall be used and applicable recommendations of the manufacturer shall be followed.

Gaskets for flanged joints shall be continuous full face gaskets, of 1/8 inch minimum thickness of natural or synthetic rubber, cloth-reinforced rubber or neoprene material,

preferably of deformed cross section design and shall meet all applicable requirements of ANSI/AWWA A21.11/C-111 for gaskets. They shall be manufactured by, or satisfy all recommendations of, the manufacturer of the pipe/fittings being used and be fabricated for use with Class 125 ANSI B16.1 flanges.

Tee-head bolts, nuts and washers for mechanical joints shall be high strength, low alloy, corrosion resistant steel stock equal to "COR-TEN A" having UNC Class 2 rolled threads or alloyed ductile iron conforming to ASTM A 536; either shall be fabricated in accordance with ANSI/AWWA A21.11/C-111.

Hex head bolts and nuts shall satisfy the chemical and mechanical requirements of ASTM A449 SAE Grade 5 plain, and shall be fabricated in accordance with ASTM B 18.2 with UNC Class 2 rolled threads.

Either Tee-Head or Hex-Head bolts, nuts and washers as required, shall be protected with bonded fluoro-polymer corrosion resistant coating where specifically required by the E/A.

All threaded fasteners shall be marked with a readily visible symbol cast, forged or stamped on each nut and bolt, which will identify the fastener material and grade. The producer and the supplier shall provide adequate literature to facilitate such identification; painted markings are not acceptable.

3. Polyethylene Film Wrap

All iron pipe, fittings and accessories shall be wrapped with standard 8 mil (minimum) low density polyethylene film or 4-mil (minimum) cross laminated high-density polyethylene conforming to AWWA C-105, with all edges overlapped and taped securely with duct tape to provide a continuous wrap to prevent contact between the piping and the surrounding backfill. Repair all punctures of the polyethylene, including those caused in the placement of bedding aggregates, with duct tape to restore the continuous protective wrap before backfilling. Polyethylene film wrap for reclaimed water pipe shall be purple.

4. Marking

Each pipe joint and fitting shall be marked as required by the applicable AWWA specification. This includes in all cases: Manufacturer's identification, Country where cast, year of casting, and "DUCTILE" or "DI". Barrels of flanged pipe shall show thickness class; others shall show pressure class. The flanges of pipe sections shall be stamped with the fabricators identification; fittings shall show pressure rating, the nominal diameter of openings and the number of degrees for bends. Painted markings are not acceptable.

5. Warning Tape

Warning tape for identifying restrained joint pipe and fittings shall be yellow and shall have black lettering at least 2 inches high that reads "Restrained Joint / Junta de Restriccion" at intervals not exceeding 24 inches. The warning tape shall be polypropylene having a minimum thickness of 2 mils, a minimum width of 3 inches, and adhesive backing on the side opposite the lettering.

(c) Concrete

1. General

Pipe shall conform to ASTM C 76 for Circular Pipe. Concrete pipe smaller than 12 inches in diameter shall conform to ASTM C 14, Extra Strength. All pipe shall be machine made or cast by a process which will provide uniform placement of the

concrete in the form and compaction by mechanical devices, which will assure a dense concrete. Concrete shall be mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the concrete can be assured. Transit mixed concrete shall not be acceptable for use in precast pipe. The pipe shall be Class III or the class indicated. Storm sewer pipe shall be of the tongue and groove or O-ring joint design. Wastewater pipe shall be of the O-ring joint design; it shall be acceptably lined for corrosion protection.

2. Marking

Each joint of pipe shall be marked with the pipe class, the date of manufacture, the manufacturer's name or trade mark, diameter of pipe and orientation, if required.

Pipe marking shall be waterproof and conform to ASTM C 76.

3. Minimum Age for Shipment

Pipe shall be considered ready for shipment when it conforms to the tests specified in ASTM C 76.

4. Joint Materials

When installing storm sewers (or storm drains), the Contractor shall have the option of using joints with preformed flexible joint sealants or with rubber gaskets. Preformed flexible joint sealants for storm drain joints shall comply with ASTM C990, and rubber gaskets for storm drain joints shall comply with ASTM C 1619. Mortar shall not be used to seal pre-fabricated joints. Pipe manufacturer shall be responsible for submitting to the Owner a detailed design of the joint upon request. The pipe manufacturer shall be responsible for submitting to the Owner a complete list of joint sizes showing the minimum size of material to be used with each size joint, along with complete instructions on recommended installation procedures. Quality control testing at the manufacturing plant shall be in accordance with Texas Department of Transportation (TxDOT) Departmental Materials Specifications (DMS) 7310, "Reinforced Concrete Pipe And Machine-Made Precast Concrete Box Culvert Fabrication And Plant Qualification". The pipe manufacturer shall be verified as compliant with TxDOT DMS 7310 at time of pipe delivery to the jobsite.

a. Mortar

Mortar for joints shall meet the requirements set forth below in "Mortar".

b. Cold Applied Preformed Plastic Gaskets

Cold Applied Plastic Gaskets shall be suitable for sealing joints of tongue and groove concrete pipe. The gasket sealing the joint shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents, irritating fumes or obnoxious odors. The gasket joint sealer shall not depend on oxidizing, evaporating or chemical action for its adhesive or cohesive strength and shall be supplied in extruded rope form of suitable cross section. The size of the plastic gasket joint sealer shall be in accordance with the manufacturer's recommendations and sufficient to obtain squeeze-out around the joint. The gasket joint sealer shall be protected by a suitable removable wrapper that may be removed longitudinally without disturbing the joint sealer to facilitate application.

The chemical composition of the gasket joint sealing compound as shipped shall meet the following requirements:

Composition (% by weight)	Test Method	Typical Analysis
Bitumen (petroleum plastic content)	ASTM D 4	50-70
Ash-inert Mineral Water	Tex-526-C	30-50
Volatile Matter (at 325 F)	Tex-506-C	2.0 Maximum

The gasket joint sealing compound when immersed for 30 days at ambient room temperature separately in 5 percent solution of caustic potash, a mixture of 5 percent hydrochloric acid, a 5 percent solution of sulfuric acid and a saturated H₂S solution shall show no visible deterioration.

The physical properties of the gasket joint sealing compound as shipped shall meet the following requirements:

Property	Test Method	Typical Analysis	
		Minimum	Maximum
Specific Gravity at 77 F	ASTM D 71	1.20	1.35
Ductility at 77F (cm) Minimum	Tex-503-C	5.0	
Softening point	Tex-505-C	275 F	
Penetration:			
32 F (300 g) 60 sec	Tex-502-C	75	
77 F (150 g) 5 sec	Tex-502-C	50	120
115 F (150 g) 5 sec	Tex-502-C		150
Flashpoint C.O.C. F	Tex-504-C	600 F	
Fire Point C.O.C. F	Tex-504-C	625 F	

When constructing wastewater lines, the Contractor shall use O-ring gasket joints conforming to ASTM C 443. Just before making a joint, the ends of the pipe shall be clean, dry, free of blisters or foreign matter and shall be wire brushed. For O-ring joints, the gasket and the inside surface of the bell shall be lubricated with a light film of soft vegetable soap compound to facilitate assembly of the joint. The rubber O-ring gasket shall be stretched uniformly in the joint. Wedge seal type ("Forsheda" pre-lubricated) gaskets may be used if joint details submitted are approved; installation of such gaskets shall be in strict accordance with the manufacturer's recommendations, and shall be the sole element depended upon to make the joint flexible and watertight.

In wastewater lines no horizontal or vertical angles in the alignment of pipes shall be permitted unless indicated. The spigot shall be centered in the bell, the pipe pushed uniformly home and brought into true alignment. Bedding material shall be placed and tamped against pipe to secure the joint.

5. Bends

When horizontal or vertical angles in the alignment of storm sewers are indicated, the bend or angle shall be constructed by cutting on a bias one or both pipes as may be required for the alignment indicated. The pipe cut shall be sufficiently long to allow exposing the reinforcement, which shall be bent, welded and incorporated into the pipe bend and reinforced concrete collar to maintain the structural integrity. The collar shall be 6 inches minimum, reinforced with #4 bars on a 1 foot center both directions. Builder's hardware cloth may be used on the outside of the joint to aid in holding cementing materials in place. Plywood, fiberboard or other materials placed on the inside of the pipe as formwork shall be removed as soon as the joint materials have obtained initial set, after which the inside surface of the pipe joint shall be finished smooth and true to the line and grade established. The Contractor may use prefabricated bends meeting the specification requirements in lieu of field fabricated bends. All bends shall be watertight, have a smooth flow line and be equal or greater in strength to the adjacent pipe.

Horizontal or vertical changes in alignment in wastewater lines shall be accomplished by use of manholes. With the E/A's approval, horizontal changes in alignment may be made by the "Joint Deflection" method. Joint deflection is limited by regulations of the Texas Commission on Environmental Quality (TCEQ) to 80 percent of the maximum recommended by the manufacturer; such deflection may not exceed 5 degrees at any joint. Changes in alignment using pipe flexure shall not be allowed.

6. Sulfide and Corrosion Control

All concrete pipe used for wastewater installations shall be protected from sulfide and corrosion damage by using limestone aggregate.

(d) Concrete Steel Cylinder (CSC) Pipe

1. General Requirements

The Contractor shall submit to the E/A for approval along with other required data a tabulated layout schedule with reference to the stationing and grade lines to be used.

The manufacturer shall furnish all fittings and special pieces required for closures, bends, branches, manholes, air valves, blow offs and connections to main line valves and other fittings as indicated.

Each pipe length, fitting and special joint shall have plainly marked on the bell end of the pipe, the head condition for which it is designed. In addition, marking shall be required to indicate the location of each pipe length or special joint in the line and such markings will be referenced to the layout schedules and drawings and submitted for approval.

Concrete steel cylinder fittings shall be tested as required by the applicable AWWA Standards.

2. Design and Inspection

Where not otherwise indicated, concrete steel cylinder pipe shall be Class 150, designed to withstand a vacuum of not less than 28 feet of water. Valve reducers, tees and outlets from a pipe run shall be designed and fabricated so that all stresses are carried by the steel forming the fitting or outlet.

Concrete steel cylinder pipe shall meet one of the following specifications:

AWWA C-301 - Any Size

AWWA C-303 - 24-inch maximum size

All pipe flanges shall conform to AWWA C-207, requirements for standard steel flanges of pressure classes corresponding to the pipe class.

Pipe to be installed in a tunnel or encasement shall be manufactured with 1 inch thick by 24-inch wide skid bands of mechanically impacted mortar in addition to the normal coating.

All concrete steel cylinder fittings shall be constructed of steel plate of adequate strength to withstand both internal pressure and external loading. Rod reinforcing shall not be used to figure the required steel area. The fittings shall have a concrete lining and 1 inch minimum coating of cement mortar, except that centrifugally spun lining need not be reinforced.

Minimum lining thickness shall be $\frac{1}{2}$ inch for 16-inch pipe and $\frac{3}{4}$ inch for sizes larger than 16-inch pipe. Where it is impractical to place such concrete protection on interior surfaces of small outlets, 2 coats of "Bitumastic Tank Solution" shall be applied.

No fitting shall be made by cutting of standard pipe, except that outlets of less than 75 percent of the pipe diameter may be placed in a standard pipe. Beveled spigots may be placed on standard pipe.

3. Joint Materials

Joints shall be of the rubber gasket type conforming to the applicable standards. The inside and outside recesses between the bell and spigot shall be completely filled with Cement Grout in accordance with the pipe manufacturer's recommendations. Grout materials for jointing such pipe, unless otherwise indicated, shall be as described herein.

(e) Reserved

(f) Polyethylene Tubing

1. General

All polyethylene (PE) tubing shall be high density, high molecular weight plastic tubing meeting ASTM D2737; it shall be pressure rated at 200 psi working pressure and

must bear the National Sanitation Foundation seal of approval for potable water service. Pipe manufacturers shall be listed on SPL WW-65.

2. Materials

Polyethylene plastics shall be Designation PE3408 (Grade P34 with hydrostatic design stress of 800 psi).

3. Markings

Permanent marking on the tubing shall include the following at intervals of not more than 5 feet:

Nominal tubing size.

Type of plastic material, i.e., PE 3408.

Dimension Ratio (SDR) and pressure rating in psi for water at 73.4 F (e.g., SDR-9, 200 psi).

ASTM D 2737 designation.

Manufacturer's name or trademark, code and seal of approval (NSF mark) of the National Sanitation Foundation.

Polyethylene tubing for reclaimed service lines shall be purple.

4. Tube Size

PE tubing shall be standard copper tube size outside diameter, with Standard Dimension Ratio (SDR) of 9.

(g) Copper Tubing

All copper service tubing shall be annealed seamless Type K water tube meeting ASTM B88 and rated at 150 psi working pressure. The tubing shall be homogenous throughout and free from cracks, holes, crimping, foreign inclusions or other defects. It shall be uniform in density and other physical properties. Copper tubing for reclaimed water shall be wrapped in purple polyethylene film wrap. Pipe manufacturers shall be listed on SPL WW-613.

(h) Service Connection Fittings

All fittings used in customer service connection - tapping mains, connecting meters, etc. - must be currently listed on the applicable Water and Wastewater Standard Products List (SPL WW-68), or called for in the City of Austin Standard Details (520 - series).

(i) Brass Goods

All brass valves, couplings, bends, connections, nipples and miscellaneous brass pipe fittings and accessories used in meter connections, service lines, air release piping assemblies, and wherever needed in the water distribution system, shall conform to the City of Austin Standards, Austin Water Utility Standard Products Lists, and AWWA C-800, except as herein modified or supplemented.

Unless otherwise noted, the goods described herein shall be fabricated of standard Red Brass (Waterworks Brass) meeting ASTM B62 or B584, alloy 83600, consisting of 85 percent copper and 5 percent each of tin, lead and zinc.

Exposed threads shall be covered with plastic caps or sheeting to protect the threads.

Brass goods of each type and class shall be compatible with other fittings in common usage for similar purposes. Where not otherwise indicated, all such materials shall meet the following requirements:

Inlet threads of corporation valves shall be AWWA iron pipe (IP) thread (male); outlets of service saddles shall be tapped with AWWA IP thread (female). AWWA IP threads shall conform to ANSI/ASME B1.20.1 as required by AWWA C800 for "General Purpose (Inch) Pipe Threads". For $\frac{3}{4}$ " and 1" sizes only, corporation valve inlet threads, and the internal threads of saddles may be the AWWA taper thread conforming to AWWA C800 Figure 1 and Table 6. External threads of corporation valve inlet must be compatible with internal threads of the service saddle.

Connections of all new tubing, and of tubing repairs wherever possible, shall be by compression fittings. Compression connections shall be designed to provide a seal and to retain the tubing, without slippage, at a working water pressure of 150 psig.

Flanges shall conform to ANSI B16.1, Class 125, as to dimensions, drillings, etc. Copper tubing, when used, shall be Type K tubing having dimensions and weights given in Table A.1 of AWWA C800.

Brass pipe shall conform to the weights and dimensions for Extra Strong pipe given in Table A.2 of AWWA C800.

All fittings shall be suitable for use at hydrostatic working pressures up to 150 psig (hydrostatic testing of installed systems is at 200 psig).

- (j) Reserved
- (k) Polyvinyl Chloride Potable/Reclaimed Water Pipe
 - 1. General

All polyvinyl chloride (PVC) potable/reclaimed water pipe shall be of the rigid (UNPLASTICIZED) type and must bear the National Sanitation Foundation seal of approval for potable water pipe. Each joint of pipe shall consist of single continuous extrusion; bells or other components attached by solvent welding are not acceptable. Pipe shall be pressure rated at 200 psi (SDR-14).

Pipe shall have push-on, rubber gasket joints of the bell and spigot type with thickened integral bells with rubber gasket joints. The wall thickness of each pipe bell and joint coupling must be greater than the standard pipe barrel thickness. Clearance must be provided in every gasket joint for both lateral pipe deflection and for linear expansion and contraction. Concrete thrust blocking shall be placed behind bends and tees. Concrete support cradles or blocking shall be required for support of all fire hydrants, valves and AWWA C110 fittings; such support shall be provided for AWWA C153 fittings when required by the E/A.

- 2. Applicable Specifications

Except as modified or supplemented herein, PVC pipe shall meet the following standards:

AWWA C-900, or SDR 14 for PVC Pressure Pipe, in 4, 6, 8 and 12 inch nominal sizes, having Cast Iron Pipe size outside diameters.

Fittings used with PVC Pressure pipe shall be AWWA C-110 or AWWA C-153 compact ductile iron fittings.

All pipe 4 inches and larger must be approved Underwriter's Laboratories for use in buried water supply and fire protection systems.

3. Material Requirements

All pipe and fittings shall be made from clean, virgin, NSF certified, Class 12454B PVC. Clean reworked materials generated from the manufacturers own production may be used within the current limits of the referenced AWWA C-900.

4. Marking

PVC for reclaimed piping shall be purple or wrapped in purple polyethylene film wrap.

Permanent marking on each joint of pipe shall include the following at intervals of not more than 5 feet:

Nominal pipe size and OD base (e.g., 4 CIPS).

Type of plastic material (e.g., PVC 12454B).

Standard Dimension Ratio and the pressure rating in psi for water at 73 F (e.g., SDR 18, 150 psi).

AWWA designation with which the pipe complies (e.g., AWWA C-900).

Manufacturer's name or code and the National Sanitation Foundation (NSF) mark.

5. Tracer Tape

Inductive Tracer Detection Tape shall be placed directly above the centerline of all non-metallic pipe a minimum of 12 inches below subgrade or, in areas outside the limits of pavement, a minimum of 18 inches below finished grade. The tracer tape shall be encased in a protective, inert, plastic jacket and color coded according to American Public Works Association Uniform Color Code. Except for minimum depth of cover, the tracer tape shall be placed according to manufacturer's recommendations. Manufacturers must be listed on SPL WW-597.

(I) Polyvinyl Chloride (PVC) Pipe (Nonpressure) and Fittings

1. General

PVC sewer and wastewater pipe and fittings 6 through 15 inch diameter shall conform to ASTM D 3034. Pipe shall have minimum cell classification of 12364 or 12454. Fittings shall have cell classification of 12454 or 13343. Pipe stiffness shall be at least 115 psi as determined by ASTM D 2412. Pipe manufacturers shall be on SPL WW-227, and fitting manufacturers shall be on SPL WW-227B.

PVC sewer and wastewater pipe and fittings 18 through 27 inch diameter shall conform to ASTM F 679. Pipe shall have minimum cell classification of 12364 or 12454. Pipe stiffness shall be at least 72 psi as determined by ASTM D 2412. Pipe manufacturers shall be on SPL WW-227A, and fitting manufacturers shall be on SPL WW-227B.

2. Joints

PVC pipe and fitting shall have elastomeric gasket joints conforming to ASTM D 3212. Gaskets shall conform to ASTM F 477.

3. Pipe Markings

Pipe meeting ASTM D 3034 shall have permanent marking on the pipe that includes the following at intervals of not more than 5 feet:

Manufacturer's name and/or trademark and code.

Nominal pipe size.

PVC cell classification per ASTM D 1784.

The legend "SDR-__ PVC Sewer Pipe" (SDR 26, 23.5. or less is required)

The designation "ASTM D 3034"

Pipe meeting ASTM F 679 shall have permanent marking that includes the following at intervals of not more than 5 feet:

Manufacturer's name or trademark and code

Nominal pipe size

PVC cell classification per ASTM D 1784

Pipe stiffness designation "PS __ PVC Sewer Pipe" (PS of at least 72 is required)

The designation "ASTM F 679"

4. Fitting Markings

Fittings meeting ASTM D 3034 shall have permanent marking that includes the following:

Manufacturer's name or trademark

Nominal size

The material designation "PVC"

The designation, "ASTM F 679"

Fittings meeting ASTM F 679 shall have permanent marking that includes the following:

Manufacturer's name or trademark and code

Nominal size

The material designation "PVC"

The designation "ASTM F 679"

5. Tracer Tape

Inductive Tracer Detection Tape shall be placed directly above the centerline of all non-metallic pipe a minimum of 12 inches below subgrade or, in areas outside the limits of pavement, a minimum of 18 inches below finished grade. The tracer tape shall be encased in a protective, inert, plastic jacket and color coded according to American Public Works Association Uniform Color Code. Except for minimum depth of cover, the tracer tape shall be placed according to manufacturer's recommendations. Manufacturers must be listed on SPL WW-597.

(m) Steel Pipe

1. Standard Weight
ASTM A 53, Schedule 40.
2. Extra Heavy Weight
Seamless ASTM A 53, Schedule 80.
3. Encasement Pipe
 - a. For direct-bury installations, pipe shall conform to ASTM A134 with minimum thickness of 3/8 inch (9.5 mm).
 - b. For jacked installations, pipe shall conform to requirements on drawings.
4. Fittings
Nipples and fittings extra strong Federal Specification WW-N 351 or WW-P 521.
5. Coatings
Black or galvanized as indicated.

(n) Welded Steel Pipe and Fittings for Water-Pipe

1. General Reference Standards Specification.
Specifications of the American Water Works Association (AWWA) listed below shall apply to this Section.

C-200 Steel Water Pipe 6 inches and larger.

C-205 Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 4 inches and larger, Shop Applied.

C-206 Field Welding of Steel Water Pipe.

C-207 Steel Pipe Flanges for Waterworks Services, Sizes 4 inches through 144 inches.

C-208 Dimensions for Steel Water Pipe Fittings.

C-602 Cement-Mortar Lining of Water Pipelines, 4 inches and larger in Place.
2. Submittals
Furnish Shop Drawings, product data, design calculations and test reports as described below:
 - a. Certified copies of mill tests confirming the type of materials used in steel plates, mill pipe flanges and bolts and nuts to show compliance with the requirements of the applicable standards.
 - b. Complete and dimensional working drawings of all pipe layouts. Shop Drawings shall include the grade of material, size, wall thickness of the pipe and fittings, type and location of fittings and the type and limits of the lining and coating systems of the pipe and fittings.
 - c. Product data to show compliance of all couplings, supports, fittings, coatings and related items.
3. Job Conditions

- a. The internal design pressure of all steel pipe and fittings shall be as indicated.
 - b. The interior of all steel pipe for potable water, 4 inches and larger, shall be cement-mortar lined.
4. Manufacturing
- a. Description

Pipe shall comply with AWWA C-200.

 - (1) Circumferential deflection of all pipe in-place shall not exceed 2.0 percent of pipe diameter.
 - (2) Diameter

Nominal pipe diameter shall be the inside diameter of lining or pipe barrel, unless otherwise designated in Job Conditions.
 - b. Wall Thickness
 - (1) Steel pipe wall thickness shall be designed for the internal and external loads specified in this section. The cylinder thickness needed to resist internal pressure shall be based on an allowable stress in the steel equal to $\frac{1}{2}$ the minimum yield stress of the material used.
5. Fittings
- a. Welded

Fabricated steel fittings shall be of the same material as pipe and shall comply with AWWA C-208.
6. Flanges
- a. Flanges shall comply with the requirements of AWWA C-207, Class D or Class E. The class shall be based on operating conditions and mating flanges of valves and equipment.
 - b. Gaskets shall be cloth-inserted rubber, 1/8 inch thick.
 - c. Flanges shall be flat faced with a serrated finish.
7. Pipe Joints
- a. Lap Joints for Field Welding
 - (1) Lap joints for field welding shall conform to AWWA C-206. This item applies only to pipes 72 inches in diameter and larger.
 - (2) The bell ends shall be formed by pressing on a hydraulic expander or a plug die. After forming, the minimum radius of curvature of the bell end at any point shall not be less than 15 times the thickness of the steel shell. Bell ends shall be formed in a manner to avoid impairment of the physical properties of the steel shell. Joints shall permit a lap at least 1 $\frac{1}{2}$ inches when assembled. The longitudinal or spiral weld on the inside of the bell end and the outside of the spigot end on each section of pipe shall be ground flush with the plate surface. The inside edge of the bell and the outside edge of the spigot shall be scarfed or lightly ground to remove the sharp edges or burrs.
 - b. Bell and Spigot Joints with O-Ring Gasket
 - (1) Bell and spigot joints with rubber gasket shall conform to AWWA C-200.

- (2) The bell and spigot ends shall be so designed that when the joint is assembled, it will be self-centered and the gasket will be confined to an annular space in such manner that movement of the pipe or hydrostatic pressure cannot displace it. Compression of the gasket when the joint is completed shall not be dependent upon water pressure in the pipe and shall be adequate to ensure a watertight seal when subjected to the specified conditions of service. Bell and spigot ends shall be welded on preformed shapes. The bell and spigot ends shall conform to the reviewed Shop Drawings.

8. Interior and Exterior Protective Surface Coatings

- a. Exterior Surface to be mortar coated shall conform to AWWA C-205 for shop application and AWWA C-602 for field application. Pipe materials shall be the product of an organization, which has had not less than 5 years successful experience manufacturing pipe materials, and the design and manufacture of the pipe, including all materials, shall be the product of one company.
- b. All surfaces except as noted in c and d below shall receive shop application of mortar lining and coating.
- c. Field Welded Joints. After installation, clean, line and coat unlined or uncoated ends adjacent to welded field joints, including the weld proper, as specified for pipe adjacent to the weld. Potable water only shall be used in the preparation of any cement, mortar, or grout lining.
- d. Machined Surfaces. Shop coat machined surfaces with a rust preventative compound. After jointing surfaces, remaining exposed surfaces shall be coated per a) and b) above.

(o) Corrugated Metal Pipe

1. General

Pipe shall be corrugated continuous lock or welded seam helically corrugated pipe. Corrugated metal pipe may be galvanized steel, aluminized steel or aluminum conforming to the following:

Galvanized Steel AASHTO M 218

Aluminized Steel AASHTO M 274

Aluminum AASHTO M 197

Where reference is made herein to gage of metal, the reference is to U.S. Standard Gage for uncoated sheets. Tables in AASHTO M 218 and AASHTO M 274 list thickness for coated sheets in inches. The Tables in AASHTO M 197 list thickness in inches for clad aluminum sheets.

Sampling and testing of metal sheets and coils used for corrugated metal pipe shall be in accordance with TXDOT Test Method Tex-708-I.

Damaged spelter coating shall be repaired by thoroughly wire brushing the damaged area and removing all loose, cracked or weld-burned spelter coating. The cleaned area shall be painted with a zinc dust-zinc oxide paint conforming to Federal Specifications TT-P 641b. Damaged pipe shall be rejected and removed from the project.

Damaged aluminized coating shall be repaired in accordance with the manufacturer's recommendations.

The following information shall be clearly marked on each section of pipe:

Thickness and corrugations

Trade Mark of the manufacturer

Specification compliance

2. Fabrication

a. Steel Pipe

Galvanized or aluminized steel pipe shall be full circle or arch pipe conforming to AASHTO M 36, Type I or Type II as indicated.

It may be fabricated with circumferential corrugations; lap joint construction with riveted or spot welded seams or it may be fabricated with helical corrugations with continuous helical lock seam or ultra high frequency resistance butt-welded seams.

b. Aluminum Pipe

Pipe shall conform to AASHTO M 196, Type I, circular pipe or Type II, pipe arch as indicated. It may be fabricated with circumferential corrugations; lap joint construction with riveted or spot welded seams or it may be fabricated with helical corrugations with a continuous helical lock seam.

Portions of aluminum pipe that are to be in contact with high chloride concrete or metal other than aluminum, shall be insulated from these materials by a coating of bituminous material. The coating applied to the pipe or pipe arch to provide insulation between the aluminum and other material shall extend a minimum distance of 1 foot beyond the area of contact.

3. Selection of Gages

The pipe diameter, permissible corrugations and required gauges for circular pipe shall be as indicated on the drawings.

For pipe arch, the span, rise, gage, corrugation size and coating thickness shall be as shown on the drawings. A tolerance of plus or minus 1 inch or 2 percent of equivalent circular diameter, whichever is greater, will be permissible in span and rise, with all dimensions measured from the inside crests of the corrugations.

4. Joint Material

Except as otherwise indicated, coupling bands and other hardware for galvanized or aluminized steel pipe shall conform to AASHTO M 36 for steel pipe and AASHTO M 196 for aluminum pipe. Field joints for each type of corrugated metal pipe shall maintain pipe alignment during construction and prevent infiltration of soil material during the life of the installation.

Coupling bands shall be not more than 3 nominal sheet thickness lighter than the thickness of the pipe to be connected and in no case lighter than 0.052 inch for steel or 0.048 inch for aluminum.

Coupling bands shall be made of the same base metal and coating (metallic or otherwise) as the pipe.

Coupling bands shall lap equally on each of the pipes being connected to form a tightly closed joint after installation.

Pipes furnished with circumferential corrugations shall be field jointed with corrugated locking bands. This includes pipe with helical corrugations, which has reformed circumferential corrugations on the ends. The locking bands shall securely fit into at least one full circumferential corrugation on each of the pipe ends being coupled. The minimum width of the corrugated locking bands shall be as shown below for the corrugation which corresponds to the end circumferential corrugations on the pipes being joined:

10½ inches wide for 2 2/3 inches × ½-inch corrugations.

12 inches wide for 3 inches × 1 inch or 5 inches × 1-inch corrugations.

Helical pipe without circumferential end corrugations will be permitted only when it is necessary to join a new pipe to an existing pipe, which was installed with no circumferential end corrugations. In this event pipe furnished with helical corrugations at the ends shall be field jointed with either helically corrugated bands or with bands with projections or dimples. The minimum width of helically corrugated bands shall conform to the following:

12 inches wide for pipe diameters up to and including 72 inches.

14 inches wide for 1 inch deep helical end corrugations.

Bands with projections shall have circumferential rows of projections with one projection for each corrugation. The width of bands with projections shall be not less than the following:

12 inches wide for pipe diameters up to and including 72 inches.

The bands shall have 2 circumferential rows of projections.

16¼ inches wide for pipe diameters of 78 inches and greater.

The bands shall have 4 circumferential rows of projections.

Unless otherwise indicated, all bolts for coupling bands shall be ½-inch diameter. Bands 12 inches wide or less shall have a minimum of 2 bolts and bands greater than 12 inches wide shall have a minimum of 3 bolts.

Galvanized bolts may be hot dip galvanized conforming to AASHTO M 232, mechanically galvanized to provide the same requirements as AASHTO M 232 or electro-galvanized per ASTM A 164 Type RS.

5. Additional Coatings or Linings

a. Bituminous Coated

Bituminous Coated pipe or pipe arch shall be as indicated both as to base metal and fabrication and in addition shall be coated inside and out with a bituminous coating which shall meet the performance requirements set forth herein. The bituminous coating shall be 99.5 percent soluble in carbon bisulphide. The pipe shall be uniformly coated inside and out to a minimum thickness of 0.05 inch, measured on the crests of the corrugations.

The bituminous coating shall adhere to the metal tenaciously, shall not chip off in handling and shall protect the pipe from deterioration as evidenced by samples prepared from the coating material successfully meeting the Shock Test and Flow Test in accordance with Test Method Tex-522-C.

b. Paved Invert

Where a Paved Invert is indicated, the pipe or pipe arch, in addition to the fully coated treatment described above, shall receive additional bituminous material of the same specification as above, applied to the bottom quarter of the circumference to form a smooth pavement with a minimum thickness of 1/8 inch above the crests of the corrugations.

c. Cement Lined

(1) General

Except as modified herein, pipe shall conform to AASHTO M 36 for lock seam or welded helically corrugated steel pipe. Pipe shall be of full circle and shall be fabricated with two annular corrugations for purposes of joining pipes together with band couplers. Lock seams shall develop the seam strength as required in Table 3 of AASHTO M 36. Concrete lining shall conform to the following:

Composition

Concrete for the lining shall be composed of cement, fine aggregate and water that are well mixed and of such consistency as to produce a dense, homogeneous, non-segregated lining.

Cement

Portland Cement shall conform to AASHTO M 85.

Aggregate

Aggregates shall conform to AASHTO M 6 except that the requirements for gradation and uniformity of gradation shall not apply.

Mixture

The aggregates shall be sized, graded, proportioned and thoroughly mixed with such proportions of cement and water as will produce a homogenous concrete mixture of such quality that the pipe will conform to the design requirements indicated. In no case, however, shall the proportions of Portland Cement, blended cement or Portland Cement plus pozzolanic admixture be less than 470 lb/cu. yd of concrete.

Thickness

The lining shall have a minimum thickness of 1/8 inch above the crest of the corrugations.

Lining Procedures

The lining shall be plant applied by a machine traveling through a stationary pipe. The rate of travel of the machine and the rate of concrete placement shall be mechanically regulated so as to produce a homogenous nonsegregated lining throughout.

Surface Finish

The lining machine shall also mechanically trowel the concrete lining as the unit moves through the pipe.

Certification

Furnish manufacturer's standard certification of compliance upon request of the purchaser.

Joints

Pipe shall be joined together with coupling bands made from steel sheets to an indicated thickness of 0.064 inch (12 ga.). Coupling bands shall be formed with two corrugations that are spaced to provide seating in the third corrugation of each pipe end without creating more than ½ inch ± annular space between pipe ends when joined together.

Bands shall be drawn together by two ½ inch galvanized bolts through the use of a bar and strap suitably welded to the band.

When O-ring gaskets are indicated they shall be placed in the first corrugation of each pipe and shall be compressed by tightening the coupling band. Rubber O-ring gaskets shall conform to Section 5.9, ASTM C 361.

(2) Causes for Rejection

Pipe shall be subject to rejection on account of failure to conform to any of the indications. Individual sections of pipe may be rejected because of any of the following:

Damaged ends, where such damage would prevent making satisfactory joint.

Defects that indicate poor quality of work and could not be easily repaired in the field.

Severe dents or bends in the metal itself.

If concrete lining is broken out, pipe may be rejected or at the discretion of the E/A, repaired in the field in accordance with the manufacturer's recommendation.

Hairline cracks or contraction cracks in the concrete lining are to be expected and does not constitute cause for rejection.

d. Fiber Bonded

Where fiber bonded pipe is indicated, the pipe or pipe arch shall be formed from sheets whose base metal shall be as indicated. In addition, the sheets shall have been coated with a layer of fibers, applied in sheet form by pressing them into a molten metallic bonding. If a paved invert is indicated it shall be in accordance with the procedure outlined above. The test for spelter coating above is waived for fiber bonded pipe.

6. Slotted Drain Storm Sewers

The pipes for the slotted drain and slotted drain outfall shall be helically corrugated, lock seam or welded seam pipe. Materials and fabrication shall be in accordance with the above. The metal thickness shall be a minimum 16 gage.

The chimney assemblies shall be constructed of 3/16 inch welded plate or machine formed 14 gage galvanized steel sheets. The height of the chimney required shall be

as indicated. Metal for the welded plate slot shall meet the requirements of ASTM A 36 and the completed plate slot shall be galvanized after fabrication in accordance with ASTM A 123.

Weld areas and the heat affected zones where the slot is welded to the corrugated pipe shall be thoroughly cleaned and painted with a good quality asphalt base aluminum paint.

7. Mortar

Mortar shall be composed of 1 part Type I Portland Cement and 2 parts clean, sharp mortar sand suitably graded for the purpose and conforming in other respects to the provisions for fine aggregate of Item No. 403, "Concrete for Structures". Hydrated lime or lime putty may be added to the mix, but in no case shall it exceed 10 percent by weight of the total dry mix.

(9) Geotextile Filter Fabric for Pipe Bedding Material

Geotextile filter fabric for pipe bedding material shall be Hanes Geo Components - TerraTex NO4.5 (AOS US Standard Sieve 70) geotextile fabric or approved equal.

510.3 - Construction Methods

(1) General

Prior to commencing this Work, all erosion control and tree protection measures required shall be in place and all utilities located and protected as set forth in "General Conditions". Clearing the site shall conform to Item No. 102S, "Clearing and Grubbing". Maintenance of environmental quality protection shall comply with all requirements of "General Conditions" and Item No. 601S, "Salvaging and Placing Topsoil".

The Contractor shall Work such that a reasonable minimum of disturbance to existing utilities will result. Particular care shall be exercised to avoid the cutting or breakage of all existing utilities. If at any time the Contractor's operations damage the utilities in place, the Contractor shall immediately notify the owner of the utility to make the necessary repairs. When active wastewater sewer lines are cut in the trenching operations, temporary flumes shall be provided across the trench while open and the lines shall be restored when the backfilling has progressed to the original bedding lines of the sewer so cut.

The Contractor shall inform utility owners sufficiently in advance of the Contractor's operations to enable such utility owners to reroute, provide temporary detours or to make other adjustments to utility lines in order that the Contractor may Work with a minimum of delay and expense. The Contractor shall cooperate with all utility owners concerned in effecting any utility adjustments necessary and shall not hold the City liable for any expense due to delay or additional Work because of conflicts arising from existing utilities.

The Contractor shall do all trenching in accordance with the provisions and the directions of the E/A as to the amount of trench left unfilled at any time. All excavation and backfilling shall be accomplished as indicated and in compliance with State Statutes.

Where excavation for a pipe line is required in an existing City street, a street cut permit is required and control of traffic shall be as indicated in accordance with the Texas Manual on Uniform Traffic Control Devices.

Wherever existing utility branch connections, sewers, drains, conduits, ducts, pipes or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed by the Contractor through cooperation with the owner of the utility, structure or obstruction involved. In those instances

where their relocation or reconstruction is impractical, a deviation from line and grade will be ordered by the E/A and the change shall be made in the manner directed.

Adequate temporary support, protection and maintenance of all underground and surface utility structures, drains, sewers and other obstructions encountered in the progress of the Work shall be furnished by, and at the expense of, the Contractor and as approved by the E/A.

Where traffic must cross open trenches, the Contractor shall provide suitable bridges in conformance with Standard 804S-4. Adequate provisions shall be made for the flow of sewers; drains and watercourses encountered during construction and any structures, which may have been disturbed, shall be satisfactorily restored upon completion of Work.

When rainfall or runoff is occurring or is forecast by the U.S. Weather Service, the Contractor shall not perform or attempt any excavation or other earth moving Work in or near the flood plain of any stream or watercourse or on slopes subject to erosion or runoff, unless given specific approval by the E/A. When such conditions delay the Work, an extension of time for working day contracts will be allowed in accordance with "General Conditions".

(2) Water Line/New Wastewater Line Separation

Separation between water, reclaimed water, and wastewater lines shall be provided as shown in the Drawings.

Crossings of water, reclaimed water, and wastewater lines shall conform to details in the Drawings.

Wastewater manholes within 9 feet of water and reclaimed water lines shall be made watertight according to details in the Drawings.

(3) Utility and Storm Sewer Crossings

When the Contractor installs a pipe that crosses under a utility or storm sewer structure and the top of the pipe is within 18 inches of the bottom of the structure, the pipe shall be backfilled as shown in the Drawings. When the Contractor installs a pipe that crosses under a utility or storm sewer structure that is not shown in the Drawings, the pipe shall be backfilled as directed by the Engineer. Payment for backfilling pipe at utility or storm sewer structures not shown in the Drawings shall be by Change Order.

(4) Trench Excavation

Excavation in a paved street shall be preceded by saw cutting completely through any asphaltic cement concrete or Portland cement concrete surface, base, or subbase to the underlying subgrade. This requirement shall not apply to excavations made with trenching machines that use a rotating continuous belt or chain for cutting and removing of material.

Underground piped utilities shall be constructed in an open cut in accordance with Federal regulations, applicable State Statutes conforming to Item No. 509S, "Excavation Safety Systems" and with a trench width and depth described below. When pipe is to be constructed in fill above the natural ground, Contractor shall construct embankment to an elevation not less than one foot above the top of the pipe, after which trench is excavated. Required vertical sides shall be sheeted and braced as indicated to maintain the sides of the required vertical excavation throughout the construction period. Adequacy of the design of sheeting and bracing shall be the responsibility of the Contractor's design professional. The Contractor shall be responsible for installation as indicated. After the pipe has been laid and the backfill placed and compacted to 12 inches above the top of the pipe, any sheeting, shoring and bracing required may be removed with special care to insure that the pipe is not disturbed. As each piece of sheeting is removed, the space left by its removal must be thoroughly filled and compacted with suitable material and provisions made to prevent the sides of the trench from caving until the

backfill has been completed. Any sheeting left in place will not be paid for and shall be included in the unit price bid for pipe.

(5) Trench Width

Trenches for water, reclaimed, and wastewater lines shall have a clear width on each side beyond the outside surfaces of the pipe bell or coupling of not less than 6 inches nor more than 12 inches.

Trenches for Storm Sewers up to 42 inches shall have a width of 1 foot on each side beyond the outside surfaces of the pipe. Pipes more than 42 inches shall have a trench width not to exceed 18 inches on each side beyond the outside surfaces of the pipe.

If the trench width within the pipe zone exceeds this maximum, the entire pipe zone shall be refilled with approved backfill material, thoroughly compacted to a minimum of 95 percent of maximum density as determined by TxDOT Test Method Tex-114-E and then re-excavated to the proper grade and dimensions. Excavation along curves and bends shall be so oriented that the trench and pipe are approximately centered on the centerline of the curve, using short lengths of pipe and/or bend fittings if necessary.

For all utilities to be constructed in fill above natural ground, the embankment shall first be constructed to an elevation not less than 1 foot above the top of the utility after which excavation for the utility shall be made.

(6) Trench Depth and Depth of Cover

All pipe and in-line appurtenances shall be laid to the grades indicated. The depth of cover shall be measured from the established finish grade, natural ground surface, subgrade for staged construction, street or other permanent surface to the top or uppermost projection of the pipe.

(a) Where not otherwise indicated, all potable/reclaimed water piping shall be laid to the following minimum depths:

1. Potable/reclaimed water piping installed in undisturbed ground in easements of undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 36 inches of cover.
2. Potable/reclaimed water piping installed in existing streets, roads or other traffic areas shall be laid with at least 48 inches of cover below finish grade.
3. Unless approved by the E/A, installation of potable/reclaimed water piping in proposed new streets will not be permitted until paving and drainage plans have been approved and the roadway traffic areas excavated to the specified or standard paving subgrade, with all parkways and sidewalk areas graded according to any applicable provisions of the drainage plans or sloped upward from the curb line to the right-of-way line at a minimum slope of $\frac{1}{4}$ inch per foot. Piping and appurtenances installed in such proposed streets shall be laid with at least 36 inches of cover below the actual subgrade.

(b) Where not otherwise indicated, all wastewater piping shall be laid to the following minimum depths:

1. Wastewater piping installed in natural ground in easements or other undeveloped areas, which are not within existing or planned streets, roads or other traffic areas shall be laid with at least 42 inches of cover.
2. Wastewater piping installed in existing streets, roads or other traffic areas shall be laid with at least 66 inches of cover.
3. Wastewater piping installed in such proposed streets shall be laid with at least 48 inches of cover below the actual subgrade.

(7) Classification of Excavation

Excavation will not be considered or paid for as a separate item of Work, so excavated material will not be classified as to type or measured as to quantity. Full payment for all excavation required for the construction shall be included in the various unit or lump sum Contract prices for the various items of Work installed, complete in place. No extra compensation, special treatment or other consideration will be allowed due to rock, pavement, caving, sheeting and bracing, falling or rising water, working under and in the proximity of trees or any other handicaps to excavation.

(8) Dewatering Excavation

Underground piped utilities shall not be constructed or the pipe laid in the presence of water. All water shall be removed from the excavation prior to the pipe placing operation to insure a dry firm granular bed on which to place the underground piped utilities and shall be maintained in such unwatered condition until all concrete and mortar is set. Removal of water may be accomplished by bailing, pumping or by a well-point installation as conditions warrant.

In the event that the excavation cannot be dewatered to the point where the pipe bedding is free of mud, a seal shall be used in the bottom of the excavation. Such seal shall consist of Class B concrete, conforming to Item No. 403, "Concrete for Structures", with a minimum depth of 3 inches.

(9) Trench Conditions

Before attempting to lay pipe, all water, slush, debris, loose material, etc., encountered in the trench must be pumped or bailed out and the trench must be kept clean and dry while the pipe is laid and backfilled. Where needed, sump pits shall be dug adjoining the trench and pumped as necessary to keep the excavation dewatered.

Backfilling shall closely follow pipe laying so that no pipe is left exposed and unattended after initial assembly. All open ends, outlets or other openings in the pipe shall be protected from damage and shall be properly plugged and blocked watertight to prevent the entrance of trench water, dirt, etc. The interior of the pipeline shall at all times be kept clean, dry and unobstructed.

Where the soil encountered at established footing grade is a quicksand, saturated or unstable material, the following procedure shall be used unless other methods are indicated:

All unstable soils shall be removed to a depth of a minimum 2 feet below bottom of piped utility or as required to stabilize the trench foundation. Such excavation shall be carried out for the entire trench width.

All unstable soil so removed shall be replaced with a concrete seal, foundation rock or coarse aggregate materials placed across the entire trench width in uniform layers not to exceed 6 inches, loose measure and compacted by mechanical tamping or other means which shall provide a stable foundation for the utility.

Forms, sheathing and bracing, pumping, additional excavation and backfill required in unstable trench conditions shall be included in the unit price bid for pipe.

(10) Blasting

All blasting shall conform to the provisions of the "General Conditions" and/or "Public Safety and Convenience".

(11) Removing Old Structures

When out of service masonry structures or foundations are encountered in the excavation, such obstructions shall be removed for the full width of the trench and to a depth of 1 foot below the bottom of the trench. When abandoned inlets or manholes are encountered and no plan

provision is made for adjustment or connection to the new sewers, such manholes and inlets within the construction limits shall be removed completely to a depth 1 foot below the bottom of the trench. In each instance, the bottom of the trench shall be restored to grade by backfilling and compacting by the methods provided above. Where the trench cuts through storm or wastewater sewers which are known to be abandoned, these sewers shall be cut flush with the sides of the trench and blocked with a concrete plug in a manner satisfactory to the E/A. When old structures are encountered, which are not visible from the existing surface and are still in service, they shall be protected and adjusted as required to the finished grade.

(12) Lines and Grades

Grades, lines and levels shall conform to the General Conditions and/or "Grades, Lines and Levels". Any damage to the above by the Contractor shall be re-established at the Contractor's expense. The Contractor shall furnish copies of all field notes and "cut sheets" to the City.

The location of the lines and grades indicated may be changed only by direction of the E/A. It is understood that the Contractor will be paid for Work actually performed on the basis of the unit Contract prices and that the Contractor shall make no claim for damages or loss of anticipated profits due to the change of location or grade.

All necessary batter boards or electronic devices for controlling the Work shall be furnished by, and at the expense of, the Contractor. Batter boards shall be of adequate size material and shall be supported substantially. The boards and all location stakes must be protected from possible damage or change of location. The Contractor shall furnish good, sound twilled lines for use in achieving lines and grades and the necessary plummets and graduated poles.

The Contractor shall submit to the E/A at least 6 copies of any layout Drawings from the pipe manufacturer for review and approval. The Contractor shall submit the layout Drawings at least 30 days in advance of any actual construction of the project. The E/A will forward all comments of the review to the Contractor for revision. Revisions shall be made and forwarded to the E/A for his acceptance. Prior to commencement of the Project, reviewed layout Drawings will be sent to the Contractor marked for construction.

Should the Contractor's procedures not produce a finished pipe placed to grade and alignment, the pipe shall be removed and relayed and the Contractor's procedures modified to the satisfaction of the E/A. No additional compensation shall be paid for the removal and relaying of pipe required above.

(13) Surplus Excavated Materials

Excess material or material which cannot be made suitable for use in embankments will be declared surplus by the E/A and shall become the property of the Contractor to dispose of off site at a permitted fill site, without liability to the City or any individual. Such surplus material shall be removed from the Work site promptly following the completion of the portion of the utility involved.

(14) Pipe Bedding Envelope

Pipe shall be installed in a continuous bedding envelope of the type shown on the drawings or as described herein. The envelope shall extend the full trench width, to a depth of at least 6 inches (150 mm) below the pipe and to a depth of the springline of storm water pipe and at least 12 inches (300 mm) above water, reclaimed, and wastewater pipe.

(a) Standard Bedding Materials

USE/PIPE	Cement	Natural or	Pea	PIPE BEDDING STONE
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MATERIAL	Stabilized Backfill	Mf'd Sand	Gravel	Uncrushed Gravel	Crushed Gravel	Crushed Stone	Stone Screenings
WATER and RECLAIMED WATER							
Welded Steel	X					X	
Service Tubing ¾" to 2½"		X	X				X
WATER and RECLAIMED WATER (Ductile Iron)							
Up to 15 Inch ID		X	X	X			X
Larger Than 15 Inch ID			X	X			
WATER and RECLAIMED WATER (PVC only) and WASTEWATER							
Up to 15 Inch ID		X	X	X	X	X	X
Larger Than 15 Inch ID			X	X	X	X	
STORMWATER							
Concrete		X	X	X	X	X	X
Metal		X	X	X			X

(b) General requirements and limitations governing bedding selection.

- (1) Crushed gravel or crushed stone shall not be used with polyethylene tubing or polyethylene film wrap.
- (2) Uncrushed gravel may be used with polyethylene film wrap in trenches up to 6 feet deep and in deeper trenches where ample trench width, a tremmie, or conditions will allow controlled placement of the gravel without damaging the polyethylene wrap.

- (3) Bedding shall be placed in lifts not exceeding 8 inches loose thickness and compacted thoroughly to provide uniform support for the pipe barrel and to fill all voids around the pipe.
- (4) Pea Gravel or bedding stone shall be used in blasted trenches.
- (c) Requirements to prevent particle migration.

Bedding material shall be compatible with the materials in the trench bottom, walls and backfill so that particle migration from, into or through the bedding is minimized. The E/A may require one or more of the following measures to minimize particle migration: use of impervious cut-off collars; selected bedding materials, such as pea gravel or bedding stone mixed with sand; filter fabric envelopment of the bedding; cement stabilized backfill; or other approved materials or methods. Measures to minimize particle migration will be shown on the Drawings or designated by the E/A, and, unless provisions for payment are provided in the contract documents, the cost of these measures shall be agreed by change order. The following limitations shall apply.

- (1) Sand, alone, shall not be used in watercourses, in trenches where groundwater is present, or in trenches with grades greater than 5 percent.
 - (2) Pea gravel or bedding stone, alone, shall not be used in the street right-of-way within 5 feet of subgrade elevation in trenches that are 3 feet or wider.
 - (3) Each gravel or bedding stone, alone, shall not be used where the trench bottom, sides, or backfill is composed of non-cementitious, silty or sandy soils having plasticity indices less than 20, as determined by the E/A.
 - (4) Sand, alone, shall not be used for installation of concrete storm water pipe unless the bedding envelope is wrapped with a geotextile membrane and the joints of the stormdrain conduit are wrapped to prevent the migration of fines into the bedding envelope and into the stormdrain conduit.
 - (5) For concrete storm water pipe, if pea gravel, uncrushed gravel, crushed gravel, crushed stone, or combination thereof is used for pipe bedding material, a geotextile filter fabric shall be placed around the perimeter of the joint.
- (15) Laying Pipe

No pipe shall be installed in the trench until excavation has been completed, the bottom of the trench graded and the trench completed as indicated.

Laying of corrugated metal pipes on the prepared foundation shall be started at the outlet end with the separate sections firmly joined together, with outside laps of circumferential joints pointing upstream and with longitudinal laps on the sides. Any metal in joints, which is not protected by galvanizing, shall be coated with suitable asphaltum paint. Proper facilities shall be provided for hoisting and lowering the sections of pipe into the trench without damaging the pipe or disturbing the prepared foundation and the sides of the trench. Any pipe which is not in alignment or which shows any undue settlement after laying or damage, shall be taken up and re-laid without extra compensation.

Multiple installations of corrugated pipe or arches shall be laid with the centerlines of individual barrels parallel. When not otherwise indicated, clear distances of 2 feet between outer surfaces of adjacent pipes shall be maintained.

No debris shall remain in the drainways or drainage structures.

All recommendations of the manufacturer shall be carefully observed during handling and installation of each material. Unless otherwise indicated, all materials shall be delivered to the project by the manufacturer or agent and unloaded as directed by the Contractor. Each piece shall be placed facing the proper direction near to where it will be installed.

The interior of all pipe, fittings and other accessories shall be kept free from dirt and foreign matter at all times and stored in a manner that will protect them from damage. Stockpiled materials shall be stacked so as to minimize entrance of foreign matter.

The interior of all pipeline components shall be clean, dry and unobstructed when installed.

Piping materials shall not be skidded or rolled against other pipe, etc. and under no circumstances shall pipe, fittings or other accessories be dropped or jolted.

During handling and placement, materials shall be carefully observed and inspected and any damaged, defective or unsound materials shall be marked, rejected and removed from the job site. Minor damage shall be marked and repaired in a manner satisfactory to the E/A. Joints, which have been placed, but not joined, backfilled, etc., shall be protected in a manner satisfactory to the E/A.

(16) Assembling of Pipe

Angular spacing of all joints shall meet the manufacturer's recommendations for the pipe and accessories being used. Side outlets shall be rotated so that the operating stems of valves shall be vertical when the valves are installed. Pressure pipe shall be laid with bell ends facing the direction of pipe installation. Pipe end bells shall be placed upgrade for all wastewater lines.

Orientation marks, when applicable, shall be in their proper position before pipe is seated.

Before joining any pipe, all foreign matter, lumps, blisters, excess coal tar coating, oil or grease shall be removed from the ends of each pipe and the pipe ends shall then be wire brushed and wiped clean and dry. Pipe ends shall be kept clean until joints are made.

Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing or other materials shall be placed in the pipe.

(17) Joints

(a) Mortar (Storm Drain joints only)

Pipe ends shall be clean, free of asphalt or other contaminants, which will inhibit the bond of the mortar to the pipe. The pipe ends shall be moistened immediately prior to placing the mortar in the joint.

(b) Cold Applied Preformed Plastic Gaskets (Storm Drain joints only)

The pipe ends shall be clean and the joint material applied to the dry pipe. In cold weather, the joint material shall be heated to facilitate the seal of the joint.

(c) O-Ring and Push-on Joints

Just before making a joint the ends of the pipe shall be clean, dry, free of any foreign matter, lump blisters, excessive coal tar coating and grease or oil and shall be wire brushed. The gasket and the inside surface of the bell shall be lubricated with a light film of soft vegetable soap compound (Flax Soap) to facilitate telescoping the joints. The rubber gasket if not factory installed shall be stretched uniformly as it is placed in the spigot groove to insure a uniform volume of rubber around the circumference of the groove. The spigot shall be centered in the bell, the pipe pushed home uniformly and brought into true alignment. Bedding material shall be placed and tamped against pipe to secure the joint. Care should be taken to prevent dirt or foreign matter from entering the joint space.

(d) Bolted Joints

All flanged, mechanical or other bolted joints shall be joined with nuts and bolts and be coated as indicated above in Iron Pipe.

(e) Storm Drain Joints

Storm drain joints sealed with preformed flexible joint sealants shall be provided and installed in compliance with ASTM C990. Storm drain joints sealed with rubber gaskets shall comply with ASTM C443. Install joint sealants in accordance with the pipe and joint sealant manufacturers' recommendations. Place the joint sealer so that no dirt or other deleterious materials come in contact with the joint sealing material. Pull or push home the pipe with enough force to properly seal the joint with the final joint opening (gap) on the inside of the installed pipe being less than or equal to the pipe manufacturer's recommended dimensions. Protrusion of joint material greater than 1/8 " into the interior of the pipe will not be accepted. Excess joint material will be removed to within 1/8 " of pipe surface. Observe joint sealant manufacturer's recommendations for installation temperature of the joint sealant. Apply joint sealant to pipe joint immediately before placing pipe in trench, and then connect pipe to previously laid pipe.

If inspection (video or other means) reveal C-990 joints that show signs of backfill infiltration, or where joints or conduits exhibit excessive joint gap or are otherwise defective, then the contractor has the following options:

1. Conduits less than 36-inches in any dimension: pour a concrete collar around the joint or wrap joint with a wrap meeting requirements of ASTM C-877 or approved equal.
2. Conduits greater than or equal to 36-inches in all dimensions: repair joints using joint repair techniques recommended by the manufacturer to achieve a completed system that meets all Contract requirements.

(18) Pressure Pipe Laying

(a) Grout for Concrete Steel Cylinder Pipe (CSC) and Welded Steel Pipe

Aggregate, cement, etc., shall be as indicated in "Mortar" herein. Potable water shall be used in the preparation of any cement, mortar, or grout lining.

Grout shall be poured into the recess between the bell and spigot on the outside of the pipe and contained by a joint wrapper ("diaper") recommended by the pipe manufacturer. The wrapper shall have a minimum width of 7 inches for 30 inch and smaller and 9 inches for larger pipe, secured to the pipe by "Band Iron" steel straps. The grout shall be poured in one continuous operation in such manner that after shrinkage and curing the joint recess shall be completely filled.

Mortar for the inside recess shall be of the consistency of plaster. The inside recess between the bell and spigot shall be filled with mortar after the pipe joint on either side of the recess has been backfilled and well tamped with no less than one pipe joint installed ahead of the pipe forming the recess. The mortar shall completely fill the recess and shall be trowelled and packed into place and finished off smooth with the inside of the pipe.

The Contractor shall inspect the joint after the mortar has set and make repairs of any pockets, cracks or other defects caused by shrinkage to the satisfaction of the E/A. The inside surface shall be cleared of any mortar droppings, cement, water, slurry, etc., before they have become set and shall be cleared of any other foreign matter. The inside surface of the pipe shall be left clean and smooth.

Pipe shall be handled at all times with wide non abrasive slings, belts or other equipment designed to prevent damage to the coating and all such equipment shall be kept in such repair that its continued use is not injurious to the coating. The use of tongs, bare pinch-bars, chain slings, rope slings without canvas covers, canvas or composition belt slings with protruding rivets, pipe hooks without proper padding or any other handling equipment, which the E/A deems to be injurious to the coating, shall not be permitted. The spacing of

pipe supports required to handle the pipe shall be adequate to prevent cracking or damage to the cement mortar lining.

(19) Placing Pipe in Tunnels

Piping installed as a carrier pipe in a tunnel, encasement pipe, etc., shall have uniform alignment, grade, bearing and conform to the reviewed Shop Drawings. All necessary casing spacers, bedding material, grout cradle or paving, bracing, blocking, etc., as stipulated by the Contract or as may be required to provide and maintain the required pipe alignment and grade, shall be provided by the Contractor at no cost except as provided by the Bid Items. This shall include casing spacers acceptable to the Owner attached to the carrier pipe in accordance with the manufacturer's recommendations. The insertion pushing forces shall not exceed the pipe manufacturer's recommendation. Such carrier piping shall have flexible bolted or gasketed push-on joints or Concrete Steel Cylinder pipe installed as follows:

(a) 21 Inch Pipe and Smaller

Prior to placing the pipe in the tunnel, the inside joint recess at the bell shall be buttered with cement mortar.

After the joint is engaged, the excess mortar shall be smoothed by pulling a tight fitting swab through the joint. Cement mortar protection shall then be placed in the normal manner to the exterior of the joint and allowed to harden sufficiently to avoid dislodgment during installation. If time is of the essence, a quick setting compound may be used.

(b) 24 Inch Pipe and Larger

Each length of pipe shall be pushed into the tunnel as single units. A flexible mastic sealer shall be applied to the exterior of the joint prior to joint engagement. The surfaces receiving the mastic sealer shall be cleaned and primed in accordance with the manufacturer's recommendation. Sufficient quantities of the mastic sealer shall be applied to assure complete protection of all steel in the joint area. The interior of the joint shall be filled with cement mortar in the normal manner after the pipe is in its final position within the tunnel.

(20) Temporary Pipe Plugs, Caps, Bulkheads and Trench Caps

Temporary plugs, caps or plywood bulkheads shall be installed to close all openings of the pipe and fittings when pipeline construction is not in progress.

All temporary end plugs or caps shall be secured to the pipe as provided under Item No. 507, "Bulkheads".

Trench caps shall be reinforced Class D concrete as indicated.

(21) Corrosion Control

(a) Protective Covering

Unless otherwise indicated, all flanges, nuts, bolts, threaded outlets and all other iron or steel components buried and in contact with earth or backfill shall be wrapped with 8-mil (minimum) polyethylene film meeting ANSI/AWWA C-105 to provide a continuous wrap.

(22) Pipe Anchorage, Support and Protection

Pressure pipeline tees, plugs, caps and bends exceeding 22½ degrees; other bends as directed shall be securely anchored by suitable concrete thrust blocking or by approved metal harness. Unless otherwise indicated, on 24 inch or larger piping, all bends greater than 11 ¼ degrees shall be anchored as described herein.

Storm sewers on steep grades shall be lugged as indicated.

(a) Concrete Thrust Blocking

Concrete for use as reaction or thrust blocking shall be Class B conforming to Item No. 403, "Concrete for Structures".

Concrete blocking shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as indicated or directed by the E/A. The blocking shall, unless otherwise indicated, be so placed that the pipe, fittings and joints will be accessible for repair.

The trench shall be excavated at least 6 inches outside the outermost projections of the pipe or appurtenance and the trench walls shaped or undercut according to the detail Drawings or as required to provide adequate space and bearing area for the concrete.

The pipe and fittings shall be adequately weighted and laterally braced to prevent floating, shifting or straining of the pipeline while the concrete is being placed and taking initial set. The Contractor shall be solely responsible for the sufficiency of such restraints.

(b) Metal Thrust Restraint

Fabricated thrust restraint systems such as those described below may be approved for use instead of concrete blocking. To obtain approval, the project Drawings must include sufficient drawings, notes, schedules, etc., to assure that the proposed restraints as installed will be adequate to prevent undesirable movement of the piping components. Such restraint systems may only be used where and as specifically detailed and scheduled on approved Project Drawings.

1. Thrust Harness

A metal thrust harness of tie rods, pipe clamps or lugs, turnbuckles, etc., may be approved. All carbon steel components of such systems, including nuts and washers, shall be hot-dip galvanized; all other members shall be cast ductile iron. After installation, the entire assembly shall be wrapped with 8-mil polyethylene film, overlapped and taped in place with duct tape to form a continuous protective wrap.

2. Restrained Joints

Piping or fitting systems utilizing integral mechanically restrained joints may be approved. All components of such systems shall be standard manufactured products fabricated from cast ductile iron, hot-dip galvanized steel, brass or other corrosion resistant materials and the entire assembly shall be protected with a continuous film wrap as described for 1. above. Manufacturers of pipe with restrained joints integral to the pipe shall be listed on SPL WW-27F. All pipe and fitting systems with restrained joints shall be identified by applying an adhesive-backed warning tape to the top of the pipe and for the full length of the pipe, regardless of the type of pipe. For plastic pipes the warning tape shall be applied directly to the top of the pipe. For metal pipes and fittings the warning tape shall be applied to the top of the polyethylene film wrap. The warning tape shall conform to 510.2(8)(b)5.

Location, configuration and description of such products shall be specifically detailed on the Drawings. (Add-on attachments such as retainer glands, all-thread rods, etc., are not acceptable.)

(c) Concrete Encasement, Cradles, Caps and Seals

When trench foundation is excessively wet or unstable or installation of water or wastewater pipe will result in less than 30 inches of cover, Contractor shall notify E/A. E/A may require Contractor to install a concrete seal, cradle, cap, encasement or other appropriate action.

All concrete cap, etc., shall be continuous and begin and end within 6 inches of pipe joints. Concrete cap, cradle and encasement shall conform to City of Austin Standard No. 510S-1, "Concrete Trench Cap". The pipe shall be well secured to prevent shifting or flotation while the concrete is being placed.

(d) Anchorage Bulkheads

Concrete bulkheads keyed into the undisturbed earth shall be placed as indicated to support and anchor the pipe and/or backfill against end thrust, slippage on slopes, etc. Concrete material and placement shall be Class A, Item No. 403, "Concrete for Structures".

(e) Trench Caps, Concrete Rip-Rap and Shaped Retards

Where called for by the Contract or as directed by the E/A, concrete trench caps, concrete rip-rap and/or shaped retards shall be placed as detailed by the Drawings as protection against erosion. Concrete material and placement shall be Class B, Item No. 403, "Concrete for Structures".

(23) Wastewater Connections

(a) Connections to Mains 12 Inches and Smaller

All branch connections of new main lines shall be made by use of manholes.

Service stubs shall be installed as indicated. Minimum grade shall be 1 percent downward to main and minimum cover shall be 4½ feet at the curb. Standard plugs shall be installed in the dead end before backfilling.

Where a service connection to a main 12 inches or smaller is indicated, a wye, tee or double wye shall be installed.

Where a service connection to a main 15 inches or larger is indicated, a field tap may be made with the pipes installed crown to crown. The tap should be made conforming to the pipe manufacturer's recommendations with the E/A's approval.

Where not otherwise indicated, (wastewater) service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.

(b) Connections to the Existing System

Unless otherwise specified by the E/A, all connections made to existing mains shall be made at manholes with the crown of the inlet pipe installed at the same elevation as the crown of the existing pipe. Service stubs installed on the existing system shall be installed by use of tapping saddles unless otherwise approved by the E/A. Extreme care shall be exercised to prevent material from depositing in the existing pipe as the taps are being made.

When connections to existing mains are made, a temporary plug approved by the E/A must be installed downstream in the manhole to prevent water and debris from entering the existing system before Final Completion. These plugs shall be removed after the castings are adjusted to finish grade or prior to Final Completion.

(c) Connecting Existing Services to New Mains

Where wastewater services currently exist and are being replaced from the main to the property line, those services shall be physically located at the property line prior to installing any new mains into which the services will be connected. Where wastewater services currently exist but are not being replaced to the property line, those services shall

be physically located at the point of connection between the new and existing pipes prior to installing any new mains into which the services will be connected.

(24) Potable or Reclaimed Water System Connections

All necessary connections of new piping or accessories to the existing potable or reclaimed water system shall be made by, and at the expense of, the Contractor. To minimize any inconvenience from outages, the Contractor shall schedule all such connections in advance and such schedule must be approved by the E/A before beginning any Work.

(a) Shutoffs

The City will make all shutoffs on existing potable or reclaimed water mains. The Contractor shall be required to notify the Owner's Representative in writing a least twenty five (25) Calendar Days prior to the anticipated date for a wet-connection. The Owner's Representative is defined as the City Inspector. The Owner's Representative will notify any affected utility customers at least 48 hours prior to the shutoff. Austin Water (AW) will make the shutoff after ensuring that all appropriate measures have been taken to protect the potable or reclaimed water system, customers and employees.

The City will operate all valves to fill existing mains. Where a newly constructed main has not been placed in service and has only one connection to the potable or reclaimed system, the Contractor may operate one valve to fill the main after approval has been obtained from AW. The operation of the valve is to be conducted under the immediate supervision of the Owner's Representative.

Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

(b) Wet Connections to Existing Potable or Reclaimed Water System

The Contractor shall make all wet connections called for by the Contract or required to complete the Work. Two connections to an existing line performed during the same shutout, at the same time and at a distance less than 50 linear feet apart, will be considered one wet connection. Two connections to an existing line performed during the same shutout, at the same time and at a distance equal to, or greater than 50 linear feet will be considered two wet connections. A wet connection shall include draining and cutting into existing piping and connecting a new pipeline or other extension into the existing pressure piping, forming an addition to the potable or reclaimed water transmission and distribution network.

The Contract price for wet connections shall be full payment for all necessary shutoffs, excavation, removing plugs and fittings, pumping water to drain the lines, cutting in new fittings, blocking and anchoring piping, bedding and backfilling, placing the lines and service and all site cleanup.

No water containing detectable amounts of chlorine may be drained, released or discharged until specific planning and appropriate preparations to handle, dilute and dispose of such chlorinated water are approved in advance by the City and the disposal operations will be witnessed by an authorized representative from the City.

(c) Pressure Taps to Existing Potable or Reclaimed Water System

The Contractor shall make all pressure taps called for by the Contract Documents or required to complete the Work. A pressure tap shall consist of connecting new piping to the existing potable or reclaimed water system by drilling into the existing pipe while it is carrying water under normal pressure without taking the existing piping out of service.

Unless otherwise provided by the Contract, the Contractor shall, at the Contractor's expense, perform all necessary excavation, furnish and install the tapping sleeve, valve and accessories, provide the tapping machine, drill the tap and shall block, anchor and backfill the piping, valve and all accessories, place the new piping in service and perform all site cleanup. When the City makes the tap, City forces are not obligated or expected to perform any Work except to provide tapping machine and drill the actual hole. If City crews are to make the tap, fiscal arrangements must be made in advance at the Taps Office, Waller Creek Center, 625 East 10th Street.

If a private Contractor makes the tap, an AW Inspector must be present. "Size on size" taps will not be permitted, unless made by use of an approved full bodied mechanical joint tapping sleeve. Concrete blocking shall be placed behind and under all tap sleeves 24 hours prior to making the wet tap.

(d) Service Connections

Service connection taps into PVC or AC pipe or into CI or DI pipe 12 inches or smaller shall be made using either a service clamp or saddle or a tapping sleeve as recommended by the pipe manufacturer and as approved by the E/A. Direct tapping of these pipes will not be permitted.

All potable or reclaimed water service connections shall be installed so that the outlet is at an angle of not more than 45 degrees above horizontal at the main line.

Precautions should be taken to ensure that the tapping saddle or sleeve is placed on the pipe straight to prevent any binding or deformation of the PVC pipe. The mounting chain or U-bolt strap must be tight.

Tapping shall be performed with a sharp shell type cutter so designed that it will smoothly penetrate heavy walled PVC DR14 and 200 psi AC and will retain and extract the coupon from the pipe.

(25) Backfilling

(a) General

Special emphasis is placed upon the need to obtain uniform density throughout the backfill material. The maximum lift of backfill shall be determined by the compaction equipment selected and in no case shall it exceed 18 inches, loose measurement.

No heavy equipment, which might damage pipe, will be allowed over the pipe until sufficient cover has been placed and compacted. All internal pipe bracing installed or recommended by the manufacturer shall be kept in place until the pipe bedding and trench backfill have been completed over the braced pipe section. Testing of the completed backfill in streets and under and around structures shall meet the specified density requirements. Initial testing shall not be at Contractor's expense and shall conform to the "General Conditions."

(b) General Corrugated Metal Pipe

After the corrugated metal pipe structure has been completely assembled on the proper line and grade and headwalls constructed where indicated; selected material free from rocks over 8 inches in size from excavation or borrow, as approved by the E/A, shall be placed along both sides of the completed structures equally, in uniform layers not exceeding 6 inches in depth (loose measurement), sprinkled if required and thoroughly compacted between adjacent structures and between the structures and the sides of the trench.

Backfill material shall be compacted to the same density requirements as indicated for the adjoining sections of embankment in accordance with the governing specifications thereof. Above the $\frac{3}{4}$ point of the structure, the fill shall be placed uniformly on each side of the pipe in layers not to exceed 12 inches, loose measure.

Prior to adding each new layer of loose backfill material, until a minimum of 12 inches of cover is obtained over the crown of the pipe, an inspection will be made of the inside periphery of the corrugated metal structure to determine if any floating, local or unequal deformation has occurred as a result of improper construction methods.

(c) Backfill Materials

The Engineer or designated representative may approve any of the following well graded materials as backfill:

1. Select trench material
2. Sand
3. Crushed rock cuttings
4. Rock cuttings
5. Foundation Rock
6. Blasted material with fines and rock
7. Cement stabilized material
8. Borrow

Within the 100-year flood plain, sand will not be permitted for backfilling. The Engineer or designated representative will approve the topsoil for areas to be seeded or sodded.

(d) Backfill in Street Right-of-Way

Placement of backfill under existing or future pavement structures and within 2 feet of any structures shall be compacted to the specified density using any method, type and size of equipment, which will produce the specified compaction without damaging the pipe or bedding. Placement of backfill greater than 2 feet beyond structures in right-of-way shall conform to (g) below.

The thickness of lifts, prior to compaction, shall depend upon the type of sprinkling and compacting equipment used and the test results thereby obtained. Prior to and in conjunction with the compaction operation, each lift shall be brought to the moisture content necessary to obtain the specified density and shall be placed in a uniform thickness to ensure uniform compaction over the entire lift. Testing for density shall be in accordance with Test Method Tex-114-E and Test Method Tex-115-E.

It is highly desirable that the backfill lifts be placed in a flat (or level) configuration; however when approved by the Engineer or designated representative, the backfill lifts may be placed at gradients (percent of vertical rise or fall to horizontal run) that do not exceed 30%.

The proposed gradient for each lift or series of lifts shall be established based on the capabilities of the equipment proposed to attain the required compaction.

Each lift of backfill must provide the density as specified herein. Swelling soils (soils with a minimum Liquid Limit of 50, more than 50% passing a #200 sieve and a plasticity index greater than 22) shall be sprinkled as required to provide not less than optimum moisture nor more than 2 percent over optimum moisture content and compacted to the extent necessary to provide not less than 95 percent nor more than 102 percent of the density as

determined in accordance with Test Method Tex-114-E. Non-swelling soils shall be sprinkled as specified and compacted to the extent necessary to provide not less than 95 percent of the density as determined in accordance with Test Method Tex-114-E.

After each lift of backfill is complete, tests may be made by the Engineer or designated representative. If the material fails to meet the density indicated, the course shall be reworked as necessary to obtain the indicated compaction and the compaction method shall be altered on subsequent Work to obtain indicated density.

At any time, the Engineer or designated representative may order proof rolling to test the uniformity of compaction of the backfill lifts. All irregularities, depressions, weak or soft spots that develop shall be corrected immediately by the Contractor.

If the backfill, due to any reason, loses the specified stability, density or finish before the pavement structure is placed, it shall be recompacted and refinished at the sole expense of the Contractor. Excessive loss of moisture in the subgrade shall be prevented by sprinkling, sealing or covering with a subsequent backfill layer or granular material. Excessive loss of moisture shall be construed to exist when the subgrade soil moisture content is more than 4 percent below the optimum of compaction ratio density. Backfill shall be placed from the top of the bedding material to the existing grade, base course, subgrade or as specified. The remainder of the street backfill shall either be Flexible Base, Concrete or Hot Mix Asphalt Concrete as specified on the drawings or replacement "in kind" to the surface of the materials originally removed for placement of the pipe.

(e) Backfill in County Street or State Highway Right-of-Way

All Work within the right-of-way shall meet the requirements of (d) above, as a minimum and shall meet the requirements of the permit issued by the County when their requirements are more stringent. Prior to the start of construction, the Contractor shall be responsible for contacting the appropriate TxDOT office or County Commissioner's Precinct Office and following the operating procedures in effect for utility cut permits and pavement repair under their jurisdiction. Approval for all completed Work in the State or County right-of-way shall be obtained from the appropriate Official prior to final payment by the Owner.

(f) Backfill in Railroad Right-of-Way

All Work within the railroad right-of-way shall meet the requirements of (d) above, as a minimum and shall meet the requirements of the permit issued by the Railroad Owner when their requirements are more stringent. Approval for all completed Work in the railroad right of way shall be obtained from the Railroad prior to Final Completion.

(g) Backfill in Easements

Where not otherwise indicated, Contractor may select whatever methods and procedures may be necessary to restore entire Work area to a safe, useful and geologically stable condition with a minimum density of 85 percent or a density superior to that prior to construction.

In and near flood plain of all streams and watercourses, under or adjacent to utilities, structures, etc. all backfill shall be compacted to a density of not less than 95 percent conforming to TxDOT Test Method Tex-114-E, unless otherwise directed by E/A.

All soil areas disturbed by construction shall be covered with top soil and seeded conforming to Item No. 604, "Seeding for Erosion Control". All turf, drainways and drainage structures shall be constructed or replaced to their original condition or better. No debris shall remain in the drainways or drainage structures.

(h) Temporary Trench Repair/Surfacing

If details of temporary trench repair/surfacing are not provided in the contract documents, the Contractor shall submit for approval of the E/A (1) a plan for temporary trench repair for areas that will be open to traffic but will be excavated later for full depth repair, and (2) a proposed method for covering trenches to maintain access to properties. The temporary surfacing shall afford a smooth riding surface and shall be maintained by the Contractor the entire time the temporary surface is in place.

(i) Permanent Trench Repair

The Contractor shall install permanent trench repairs conforming to details in the drawings.

(26) Quality Testing for Installed Pipe

(a) Wastewater Pipe Acceptance Testing

After wastewater pipe has been backfilled, the Contractor shall perform infiltration tests, exfiltration tests, or low pressure air tests as determined by the E/A. In addition, the Contractor shall perform deflection tests and shall assist OWNER'S personnel, as directed, in performing pipeline settlement tests. The Contractor shall be responsible for making appropriate repairs to those elements that do not pass any of these tests.

(b) Exfiltration Test

Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

Exfiltration testing shall be performed by the Contractor when determined by the E/A to be the appropriate test method. Exfiltration testing shall conform to requirements of the Texas Commission on Environmental Quality given in the Texas Administrative Code Title 30 Part 1 Chapter 317 Rule §317.2.

(c) Infiltration Test

Infiltration testing shall be performed by the Contractor when determined by the E/A to be the appropriate test method. Infiltration testing shall conform to requirements of the Texas Commission on Environmental Quality given in the Texas Administrative Code Title 30 Part 1 Chapter 317 Rule §317.2.

(d) Pipeline Settlement Test

During the infiltration test or after the exfiltration test, the pipe will be TV inspected for possible settlement. When air testing has been used, water shall be flowed into the pipe to permit meaningful observations. Any pipe settlement which causes excessive ponding of water in the pipe shall be cause for rejection. Excessive ponding shall be defined as a golf ball (1 5/8 " dia.) submerged at any point along the line.

(e) Low Pressure Air Test of Gravity Flow Wastewater Lines

(1) General

Wastewater lines up to 33-inch diameter shall be air tested between manholes. Wastewater lines 36-inch in diameter and larger shall be either air tested between manholes or at pipe joints. Backfilling to grade shall be completed before the test and all laterals and stubs shall be capped or plugged by the Contractor so as not to allow air losses, which could cause an erroneous, test result. Manholes shall be plugged so they are isolated from the pipe and cannot be included in the test.

All plugs used to close the sewer for the air test shall be capable of resisting the internal pressures and must be securely braced. Place all air testing equipment above

ground and allow no one to enter a manhole or trench where a plugged sewer is under pressure. Release all pressure before the plugs are removed. The testing equipment used must include a pressure relief device designed to relieve pressure in the sewer under test at 10 psi or less and must allow continuous monitoring of the test pressures in order to avoid excessive pressure. Use care to avoid the flooding of the air inlet by infiltrated ground water. (Inject the air at the upper plug if possible.) Use only qualified personnel to conduct the test.

(2) Ground Water

Since the presence of ground water will affect the test results, test holes shall be dug to the pipe zone at intervals of not more than 100 feet and the average height of ground water above the pipe (if any) shall be determined before starting the test.

(3) Test Procedure

The E/A may, at any time, require a calibration check of the instrumentation used. Use a pressure gauge having minimum divisions of 0.10 psi and an accuracy of 0.0625 psi. (One ounce per square inch.) All air used shall pass through a single control panel. Clean the sewer to be tested and remove all debris where indicated. Wet the sewer prior to testing. The average back pressure of any groundwater shall be determined (0.433 psi) for each foot of average water depth (if any) above the sewer.

Add air slowly to the section of sewer being tested until the internal air pressure is raised to 3.5 psig greater than the average back pressure of any ground water that may submerge the pipe. After the internal test pressure is reached, allow at least 2 minutes for the air temperature to stabilize, adding only the amount of air required to maintain pressure. After the temperature stabilization period, disconnect the air supply. Determine and record the time in seconds that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig greater than the average backpressure of any ground water that may submerge the pipe.

For pipe less than 36-inch diameter, compare the time recorded with the time computed using the following equation:

$$T = (0.0850 \times D \times K) \div Q, \text{ where}$$

T = time for pressure to drop 1.0 pounds per square inch gauge in seconds;

K = $0.000419 \times D \times L$, but not less than 1.0

D = nominal inside diameter, in inches, as marked on the pipe;

L = length of line of same pipe size in feet; and

Q = rate of loss, 0.0015 cubic feet per minute per square foot of internal surface area (ft³/min/ft sq) shall be used.

Because a K value of less than 1.0 shall not be used, there are minimum test times for each pipe diameter as shown in the following table:

Table For Low Pressure Air Testing of Pipe

Pipe Diameter	Minimum Time	Minimum Time Applies to All Pipes Shorter than	Time for Longer Pipes
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(inches)	(seconds)	(feet)	(seconds)
8	454	298	$1.520 \times L$
10 (See Note 1)	567	239	$2.374 \times L$
12	680	199	$3.419 \times L$
15	850	159	$5.342 \times L$
18	1020	133	$7.693 \times L$
21	1190	114	$10.471 \times L$
24	1360	100	$13.676 \times L$
30	1700	80	$21.369 \times L$

Note 1. 10-inch diameter pipe to be used only by AW maintenance personnel.

Note 2. The test parameter for pipes larger than 30-inch diameter shall be shown on the construction plans.

Any drop in pressure, from 3.5 psig to 2.5 psig (adjusted for groundwater level), in a time less than that required by the above equation or table shall be cause for rejection. When the line tested includes more than one size pipe, the minimum time shall be that given for the largest size pipe included.

When joint testing, the minimum time allowable for the pressure to drop from 3.5 pounds per square inch to 2.5 pounds per square inch gauge during a joint test, regardless of pipe size, shall be twenty (20) seconds. A drop in pressure from 3.5 psig to 2.5 psig (adjusted for groundwater level) in less than twenty seconds shall be cause for rejection.

Manholes must be tested separately and independently. All manholes must be hydrostatically tested with a maximum loss allowance of 0.025 gallon per foot diameter per foot of head per hour.

When lines are air tested, manholes are to be tested separately by exfiltration or vacuum method (see Standard Specification Item No. 506S, "Manholes").

(f) Deflection Test

Deflection tests shall be performed by the Contractor on all flexible and semi-rigid wastewater pipes. The tests shall be conducted after the final backfill has been in place at least 30 days. Testing for in-place deflection shall be with a pipe mandrel at 95% of the inside diameter of the pipe. A second test of flexible and semi-rigid wastewater pipes 18

inch size and larger, also with a pipe mandrel sized at 95% of the inside diameter of the pipe, shall be conducted by the Contractor 30 days before the warranty expires on the Contractor's Work.

Contractor shall submit proposed pipe mandrels to the E/A or the E/A's designated representative for concurrence prior to testing the line.

Test(s) must be performed without mechanical pulling devices and must be witnessed by the E/A or the E/A's designated representative.

Any deficiencies noted shall be corrected by the Contractor and the test(s) shall be redone.

(g) Inspection of Installed Storm Drain Conduits

(1) General

All storm drain conduits (pipe and box culvert) shall be inspected for conformance to the requirements of this specification. Smart Housing, low/moderate income housing, and projects that are 100-percent privately funded are exempt from the cost of the initial video inspection. All deficiencies revealed by inspection shall be corrected. Video re-inspection meeting the requirements of this specification shall be provided at the Contractor's expense to show that deficiencies have been corrected satisfactorily. Further, the contractor shall provide video in complete segments (manhole to manhole) versus specific deficiency locations.

Projects that are not exempt from the cost of the initial video inspection are also subject to the following constraints:

- All inspectors utilized by the Contractor for video inspection shall be NASSCO-PACP certified for a minimum of 3 years.
- The Contractor will be required to inspect, assess, and record the condition of the storm drain pipe using National Association of Sewer Service Companies (NASSCOs) Pipeline Assessment Certification Program (PACP) coding standards.

(2) Video Inspection of Installed Storm Drain Conduits

Contractor shall provide all labor, equipment, material and supplies and perform all operations required to conduct internal closed-circuit television and video recording of all storm drain conduits. Video recording of each storm drain conduit section shall be conducted after the trench has been backfilled and prior to placement of permanent pavement repairs or permanent pavement reconstruction. The video recording shall be provided to the Owner for review. Contractor shall not place permanent pavement repairs or permanent pavement reconstruction over the storm drain conduit until Owner has reviewed the video and agrees that there are no defects in the storm drain conduit installation shown in the video submitted by the Contractor or shown in any video acquired by the Owner through other means. Placement of permanent pavement repair or permanent pavement reconstruction over the installed storm drain conduit before the Owner acknowledges no defects shall be at the Contractor's risk. Any defects revealed by the video inspection shall be corrected at the Contractor's expense and a new video submitted to the Owner for review prior to acceptance of the conduit.

All video work shall be conducted under the direct full-time supervision of a NASSCO-PACP certified operator.

The conduit inspection camera shall have the capability of panning plus/minus 275 degrees and rotating 360 degrees. The television camera shall be specifically designed and constructed for such use. The camera shall be operative in 100% humidity conditions. Camera shall have an accurate footage counter that displays on the monitor the exact distance of the camera (to the nearest tenth of a foot) from the centerline of the starting manhole or access point. Camera shall have height adjustment so that the camera lens is always centered within plus/minus 10% of the center axis of the conduit being videoed. Camera shall provide a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. Camera shall be equipped with a remote iris to control the illumination range for an acceptable picture. Geometrical distortion of the image shall not exceed one percent (1%). The video image produced by each camera shall be calibrated using a Marconi Resolution Chart No. 1 or equivalent.

Lighting for the camera shall be sufficient to allow a clear picture of the entire periphery of the conduit without loss of contrast, flare out of picture or shadowing. A reflector in front of the camera may be required to enhance lighting in dark or large sized conduit. The video camera shall be capable of showing on the digital display the Owner's name, Project name, Contractor name, date, line size and material, conduit identification, and ongoing footage counter. The camera, television monitor, and other components of the video system shall be capable of producing a picture quality satisfactory to the satisfaction of the Owner. The recording of the internal condition of the storm drain conduit shall be clear, accurate, focused and in color. If the recording fails to meet these requirements, the equipment shall be removed and replaced with equipment that is suitable. No payment will be made for an unsatisfactory recording.

If during video inspection, water is encountered inside the conduit, the conduit shall be dewatered by the Contractor. The storm drain section must be dry. Video recording conducted while the camera is floating is not acceptable unless approved by the Owner.

If during video inspection, debris is encountered that prohibits a proper inspection of the conduit, the Contractor shall remove the debris before proceeding.

All video shall be documented using a data logger and reporting system that are PACP compliant and which use codes as established by the National Association of Sewer Service Companies (NASSCO)s - Pipeline Assessment and Certification Program (PACP).

Computer printed location records shall be kept by the Contractor and shall clearly show the location and orientation of all points of significance such as joints, conduit connections, connections at manholes and inlets, and defects. Copy of all records shall be supplied to the Owner. Noted defects shall be documented as color digital files and color hard copy print-outs. Photo logs shall accompany each photo submitted.

The video recording shall supply a visual and audio record of the storm drain conduits that may be replayed. Video recordings shall include an audio track recorded by the video technician during the actual video work describing the parameters of the storm drain conduit being videoed (i.e. location, depth, diameter, pipe material), as well as describing connections, defects and unusual conditions observed during the video work. Video recording playback shall be at the same speed that it was recorded. Slow motion or stop-motion playback features may be supplied at the option of the Contractor. Once videoed, the CDs/DVDs shall be labeled and become the property of the Owner. The Contractor shall have all video and necessary playback equipment readily accessible for review by the Owner while the project is under construction.

Post-installation video shall not be completed until all work is completed on a section of storm drain conduit. Post-installation video work shall be completed by the Contractor in the presence of the Owner. The post-installation video work shall be completed to confirm that the storm drain conduits are free of defects. Provide a color video showing the completed work. Prepare and submit video logs providing location of storm drain conduit along with location of any defects. Manhole and inlet work shall be complete prior to post-installation video work.

For post-installation video, exercise the full capabilities of the camera equipment to document the completion and conformance of the storm drain installation work with the Contract Documents. Provide a full 360-degree view of conduit, all joints, and all connections. The camera shall be moved through the storm drain conduit in either direction at a moderate rate, stopping and slowly panning when necessary to permit proper documentation of the conduit condition at each pipe connection, joint, and defect. In no case shall the camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the storm drain conditions shall be used to move the camera through the storm drain conduit. When manually operated winches are used to pull the camera through the conduit, telephones or other suitable means of communication shall be set up between the two access points of the conduit being videoed to insure good communication between members of the video crew.

Distance measurements shall be provided to an accuracy of one tenth of a foot.

Video shall be continuous for each storm drain conduit segment. Do not show a single segment on more than one CD/DVD, unless specifically allowed by the Owner.

Contractor shall submit to Owner the following:

- A. National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) certification of operators who will be performing video work.
 - B. Compact Disc (CD) or Digital Video Disc (DVD) of recording of storm drain conduits (concrete storm water pipe or box culvert).
 - a. The color CD or DVD shall include a digital color key map in a format acceptable to the Owner with each segment of storm drain conduit labeled with the appropriate inspection ID on the map.
 - b. The file folder for each segment of the storm drain conduit shall have a unique name based on the Owner's approved inspection naming convention and shall contain the following:
 - i. Video files
 - ii. Video inspection logs with information coded in accordance with the PACP
 - iii. Photo logs
 - iv. A report summarizing the results of the video inspection
 - v. A proposed method of repair for any defects discovered.
- (3) Time commitments from City for projects that are exempt from the cost of the initial video inspection

Projects that are exempt from the cost of the initial video inspection are afforded the following time commitments from the City.

- A. Initial inspection - contractor must inform the City of Austin construction inspector assigned to the project in writing that all stormdrain infrastructure for the project has been completed according to the permit and is ready for inspection. The inspector will then notify the Watershed Protection Department (WPD) in writing that the all of the stormdrain infrastructure for the project has been completed and is ready for inspection. The WPD is allowed 15-days to complete inspection from written notification by the inspector. The outcome of this item does not impact the one-year warranty requirements.
- B. Video re-inspection by the contractor for deficient installed stormdrain infrastructure. The contractor must submit the video inspection data as defined in this specification to the City of Austin construction inspector assigned to the project along with a written letter of transmittal certified by a professional engineer stating that all identified stormdrain infrastructure installation deficiencies for the project have been corrected. The inspector will then notify the Watershed Protection Department (WPD) in writing and convey the video inspection data to the WPD. The WPD is allowed 15-days to complete review of the data from the date of delivery by the inspector.

(27) Pressure Pipe Hydrostatic Testing

After the pipe has been installed and backfilled and all service laterals, fire hydrants and other appurtenances installed and connected, a pressure test, followed by a leakage test, will be conducted by the City. The City will furnish the pump and gauges for the tests. The Contractor shall be present and shall furnish all necessary assistance for conducting the tests. The specified test pressures will be based on the elevation of the lowest point of the line or section under test. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points.

All drain hydrant and fire hydrant leads, with the main 6-inch gate valve open, the hydrant valve seats closed and no nozzle caps removed, shall be included in the test.

(a) Pressure Test

The entire project or each valved section shall be tested, at a constant pressure of 200 psi for a sufficient period (approximately 10 minutes) to discover defective materials or substandard work. The Contractor assumes all risks associated with testing against valves. Repairs shall be made by the Contractor to correct any defective materials or substandard work. The Contractor shall pre-test new lines before requesting pressure tests by City Forces. The Contractor shall have new lines pressurized to a minimum of 100 psi, on the date of testing, prior to arrival of City Forces.

(b) Leakage Test

A leakage test will follow the pressure test and will be conducted on the entire project or each valved section. The Contractor assumes all risks associated with testing against valves. The leakage test shall be conducted at 150 psi for at least 2 hours. The test pressure shall not vary by more than ± 5 psi for the duration of the test.

(1) Allowable Leakage

Leakage shall be defined as the quantity of water that must be supplied into any test section of pipe to maintain the specified leakage test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

No pipe installation will be accepted if leakage exceeds the amount given by the following formula:

$$\text{Allowable leakage (gal/hr)} = [L \times D] \div 10,875$$

Where L = length of pipe tested, in feet

D= nominal pipe diameter, in inches, as marked on the pipe

(2) Location and Correction of Leakage

If such testing discloses leakage in excess of this specified allowable, the Contractor, at the Contractor's expense, shall locate and correct all defects in the pipeline until the leakage is within the indicated allowance.

All visible leakage in pipe shall also be corrected by Contractor at the Contractor's expense.

(28) Service Charges for Testing

Initial testing performed by City forces for the Contractor will be at the City's expense. Retesting, by City forces, of Contractor's work that fails initial testing will be at the Contractor's expense. The City's charge for retests will be a base fee plus an hourly rate published in the current AW Fee Schedule. On City-funded projects, the charges incurred by the City for retesting will be deducted from funds due the Contractor. On non-City-funded projects, the charges incurred by the City for retesting will be billed to the Contractor. The City will withhold acceptance of the Contractor's work until the Contractor has paid the City for the retesting costs.

(29) Disinfection of Potable Water Lines

Prior to performing any disinfection of potable water lines, the Contractor shall submit a Disinfection Plan (Plan) and obtain approval in accordance with COA specification 01300, Submittals. The Plan shall comply with AWWA C651 (Disinfecting Water Mains) and AWWA C655 (Field Dechlorination), latest editions, and shall be developed using one of the following templates, unless otherwise approved by the Engineer and/or AW: Disinfection Plan for Tablet/Granule Method, or Disinfection Plan for Continuous-Feed Method. Templates for these two methods are located at <http://www.austintexas.gov/departments/construction-standards>. The Contractor shall decide which disinfection method to use for a given project. The Slug Method and Spray Method are also acceptable if better suited for disinfection. The initial plan shall be submitted for review a minimum of 60 calendar days prior to when the water main is scheduled to be placed into service, or at the preconstruction conference if the project requires that the waterline be placed in service in less than 60 days, as indicated in the Contractor's Construction Schedule. If any appurtenances are required for injection, sampling, or flushing purposes that are not shown in the original plan/profile sheets, then the Contractor shall include the appurtenances in the project Record Drawings. The Contractor shall disinfect potable water lines only in accordance with an approved Plan.

(a) Preventing Contamination

The Contractor shall protect all piping materials from contamination during storage, handling and installation. Prior to disinfection, the pipeline interior shall be clean, dry and unobstructed. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped at the close of the day's work.

(b) Cleaning

Prior to disinfection the Contractor shall clean the pipeline to remove foreign matter. For pipelines 16" in diameter or smaller, cleaning shall consist of flushing the pipeline. For pipelines greater than 16" in diameter, cleaning shall be performed by operating hydrants and blow-offs located at low points in the pipeline, or by mechanical means (sweeping or pigging). Water for the Work shall be metered and furnished by the Contractor in accordance with Section 01500 of the Standard Contract Documents.

(c) Procedure and Dosage

For pipelines 16" or smaller in diameter, the Contractor may use either the AWWA C-651 "Tablet/Granular Method" or the "Continuous Feed Method" for disinfecting the pipeline. The Contractor, at its expense, will supply the test gauges and the Sodium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 5 percent to fifteen percent available chlorine, and will submit for approval a written plan for the disinfection process. Calcium Hypochlorite conforming to ANSI/AWWA B300, which contains approximately 65 percent available chlorine by weight, may be used in granular form or in 5 g tablets for 16" diameter or smaller lines, if it is included as part of the written plan of disinfection that is approved by the City of Austin. The Contractor, at its expense, shall provide all other equipment, supplies and the necessary labor to perform the disinfection under the general supervision of the City.

One connection to the existing system will be allowed with a valve arranged to prevent the strong disinfecting dosage from flowing back into the existing water supply piping. The valve shall be kept closed and locked in a valve box with the lid painted red. No other connection shall be made until the disinfection of the new line is complete and the water samples have met the established criteria. The valve shall remain closed at all times except when filling or flushing the line and must be staffed during these operations. As an option, backflow prevention in the form of a reduced pressure backflow assembly may be provided if the valve is left unattended. The new pipeline shall be filled completely with disinfecting solution by feeding the concentrated chlorine and approved water from the existing system uniformly into the new piping in such proportions that every part of the line has a minimum concentration of 25 mg/liter available chlorine.

The disinfecting solution shall be retained in the piping for at least 16 hours and all valves, hydrants, services, stubs, etc. shall be operated so as to disinfect all their parts. After this retention period, the water shall contain no less than 10 mg/liter chlorine throughout the treated section of the pipeline.

For pipelines larger than 16" in diameter, the Contractor may use the AWWA C-651 "Slug Method" for disinfecting the pipeline. Chlorine shall be fed at a constant rate and at a sufficient concentration at one end of the pipeline to develop a slug of chlorinated water having not less than 100 mg/liter of free chlorine. The Contractor shall move the slug through the main so that all interior surfaces are exposed to the slug for at least three (3) hours. The chlorine concentration in the slug shall be measured as it moves through the pipeline. If the chlorine concentration drops below 50 mg/liter, the Contractor shall stop the slug and feed additional chlorine to the head of the slug to restore the chlorine concentration to at least 100 mg/liter before proceeding. As the slug flows past fittings and valves, related valves and hydrants shall be operated so as to disinfect appurtenances and pipe branches.

Unless otherwise indicated, all quantities specified herein refer to measurements required by the testing procedures included in the current edition of "Standard Methods". The chlorine concentration at each step in the disinfection procedure shall be verified by chlorine residual determinations.

(d) Final Flushing

The heavily chlorinated water shall then be carefully flushed from the potable water line by a dechlorination process until the chlorine concentration is no higher than the residual generally prevailing in the existing distribution system. This is necessary to insure that there is no injury or damage to the public, the water system or the environment. The plans and preparations of the Contractor must be approved by the City before flushing of the line may begin. The Contractor will supply the Dechlorination chemical conforming to ANSI/AWWA C655. Additionally the flushing must be witnessed by an authorized representative of the City.

Approval for discharge of the diluted chlorine water or heavily chlorinated water into the wastewater system must be obtained from AW. The line flushing operations shall be regulated by the Contractor so as not to overload the wastewater system or cause damage to the odor feed systems at the lift stations. The City shall designate its own representative to oversee the work.

Daily notice of line discharging must be reported to the AW Dispatch office.

(e) Bacteriological Testing

After disinfection and final flushing, samples shall be collected per one of the two options. Option A: Before approving a main for release, take an initial set of samples and then resample again after a minimum of 16 hours. Both sets of samples must pass for the main to be approved for release. Option B: Before approving a main for release, let it sit for a minimum of 16 hours without any water use. Then collect two sets of samples a minimum of 15 minutes apart while the sampling taps are left running. Both sets of samples must pass for the main to be approved for release. The two (2) sets of water samples from the line will be tested for bacteriological quality by the City and must be found free of coliform organisms before the pipeline may be placed in service. Each set shall consist of one (1) sample that is drawn from the end of the main, at least one from each branch greater than one pipe length, and additional samples that are collected at intervals of not more than 1,200 feet along the pipeline. All stubs shall be tested before connections are made to existing systems.

The Contractor, at its expense, shall install sufficient sampling taps at proper locations along the pipeline. Each sampling tap shall consist of a standard corporation cock installed in the line and extended with a copper tubing gooseneck assembly. After samples have been collected, the gooseneck assembly may be removed and retained for future use.

Samples for bacteriological analysis will only be collected from suitable sampling taps in sterile bottles treated with sodium thiosulfate. Samples shall not be drawn from hoses or unregulated sources. The City, at its expense, will furnish the sterile sample bottles and may, at its discretion, collect the test samples with City personnel.

If the initial disinfection fails to produce acceptable sample test results, the disinfection procedure shall be repeated at the Contractor's expense. Before the piping may be placed in service, two (2) consecutive sets of acceptable test results must be obtained.

An acceptable test sample is one in which: (1) the chlorine level is similar to the level of the existing distribution system; (2) there is no free chlorine and (3) total coliform organisms are absent. An invalid sample is one, which has excessive free chlorine, silt or non-coliform growth as defined in the current issue of the "Standards Methods." If unacceptable sample results are obtained for any pipe, the Contractor may, with the concurrence of the Inspector, for one time only flush the lines and then collect a second series of test samples for testing by the City. After this flushing sequence is completed, any pipe with one or more failed samples must be disinfected again in accordance with the approved disinfection procedure followed by appropriate sampling and testing of the water.

The City of Austin Water Quality Laboratory will notify the assigned City of Austin Inspector in writing of all test results. The Inspector will subsequently notify the Contractor of all test results. The Water Quality Laboratory will not release test results directly to the Contractor.

(30) Cleanup and Restoration

It shall be the Contractor's responsibility to keep the construction site neat, clean and orderly at all times. Cleanup shall be vigorous and continuous to minimize traffic hazards or obstructions along the streets and to driveways. Trenching, backfill, pavement repair (as necessary), and cleanup shall be coordinated as directed by the City. The E/A will regulate

the amount of open ditch and may halt additional trenching if cleanup is not adequate to allow for orderly traffic flow and access.

Materials at the site shall be stored in a neat and orderly manner so as not to obstruct pedestrian or vehicular traffic. All damaged material shall be removed from the construction site immediately and disposed of in a proper manner. All surplus excavated materials shall become the property of the Contractor for disposal at the Contractor's expense. After trenching, the Contractor shall immediately remove all excavated materials unsuitable for or in excess of, backfill requirements. Immediately following the pipe laying Work as it progresses, the Contractor shall backfill, grade and compact all excavations as provided elsewhere. The backfill placed at that time shall meet all compaction test requirements. The Contractor shall immediately clean up and remove all unused soil, waste and debris and restore all surfaces and improvements to a condition equal or superior to that before construction began and to an appearance which complements the surroundings. The Contractor shall grade and dress the top 6 inches of earth surfaces with soil or other material similar and equal to the surrounding, fill and smooth any visible tracks or ruts, replace and re-establish all damaged or disturbed turf or other vegetation and otherwise make every effort to encourage the return of the entire surface and all improvements to a pleasant appearance and useful condition appropriate and complementary to the surroundings and equal or similar to that before construction began.

Placement of the final lift of permanent pavement, if a pavement is required, shall begin immediately after all testing of each segment of piping is satisfactorily completed.

(31) Valve Turn Walk-through

As part of the acceptance of Water or Reclaimed Water pressure pipe, an AW Valve Walk-through will be performed after an initial inspection by the Owner's Representative to identify any deficient items. If deficient items are present during the AW Valve Walk-Through and the project fails acceptance, a re-inspection fee will apply and must be paid before a re-inspection is scheduled to confirm correction of deficient items. See AW Fee Schedule for the current Distribution Walk-Through Re-inspection Fee.

(32) 2-inch Jumper Hose

During connections to the water distribution system, the Contractor may be required to install a temporary jumper hose between the unpressurized water segment and an adjacent pressurized water segment for the purpose of maintaining water service to customers who can't operate without water service during the connection. The jumper shall include an approved backflow preventer and be of adequate size and pressure rating to maintain service to the customer. It shall be polyethylene tubing meeting the requirements of COA SPL WW-65. The jumper hose and other components in the temporary service shall be disinfected, and bacteriological samples will be taken and pass before the temporary service is provided to the customer. Contractor shall provide adequate protection for the jumper hose in vehicular traffic areas at all times during use.

Source: [Rule No. R161-17.05](#), 5-31-2017; Rule No. [R161-17.19](#), 11-28-2017; [Rule No. R161-18.23](#), 12-8-2018.

510.4 - Measurement

Pipe will be measured by the linear foot for the various types, sizes and classes. Parallel lines will be measured individually.

Where a line ties into an existing system, the length of the new line will be measured from the visible end of the existing system at the completed joint. Unless otherwise indicated, the length of water, reclaimed,

and wastewater lines will be measured along pipe horizontal centerline stationing through fittings, valves, manholes, and other appurtenances.

Ductile iron fittings, whether standard mechanical joint or integral factory restrained joint type, will be measured by the ton and paid for in accordance with the schedule in Standard Products List WW-27C. Bolts, glands and gaskets will not be measured for payment. Steel cylinder concrete pipe fittings and welded steel pipe fittings will not be measured separately and are included in the unit price for the respective pipe bid items.

Factory restrained joint pipe meeting the requirements of Standard Products List WW-27F will be measured by the linear foot. The estimated quantity on the bid form is only for restrained joint pipe having integral mechanically restrained joints.

Connecting a new water, wastewater, or reclaimed water service to an existing, comparable type of private service will be measured by each connection. Service pipe from the main to the service connection will be measured by the linear foot.

The Contractor shall be responsible for removing and treating ground water flowing into a trench up to a baseline flow rate of 350 gpm of sustained flow for each mainline open trench (no more than 300 linear feet open trench per work zone segment is allowed at one time). This baseline flow rate is not a prediction of ground water conditions to be expected on the Project. Rather, it establishes contract terms regarding the quantity of ground water for which the contractor is responsible without extra or separate compensation. The flow rate must exceed 350 gpm continuously for at least 4 consecutive hours to be considered sustained flow. It is expected that trench dewatering for this baseline rate may be accomplished with a single 3-inch trash-type pump per open trench; however, measured flow rate, not pump size, type or characteristics shall be used to determine if the baseline rate has been exceeded. Flow rate shall be determined by measurements made at the discharge point of the water treatment facilities. Surface storm water flowing into a trench shall be the Contractor's responsibility to remove and treat without compensation, regardless of inflow rate or volume.

Adjustment of elevations during construction resulting in changes in flow line elevations of plus or minus two feet or less will not be considered for credit or additional compensation and no measurement for payment will be made.

Stormwater pipe will be measured along the slope of the pipe. Where drainage pipe ties into inlets, headwalls, catch basins, manholes, junction boxes or other structures that length of pipe tying into the structure wall will be included for measurement but no other portion of the structure length or width will be so included.

Excavation and backfill, when included as pipe installation will not be measured as such but shall be included in the unit price bid for constructing pipe and measured as pipe complete in place including excavation and backfill.

When pay items are provided for the other components of the system, measurement will be made as addressed hereunder.

Video inspection of newly installed box culverts and storm drain pipe will be measured per linear foot of pipe videoed.

Jumper hose will be measured per linear foot of hose installed, including all depths, excavation and backfill, complete, and in place.

Source: [Rule No. R161-17.05](#), 5-31-2017.

510.5 - Payment

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot for the various sizes of pipe, of the materials and type indicated, unless unstable material is encountered or trench excavation and backfill is bid as a separate item.

The concrete seal, foundation rock or coarse aggregate when used as directed in unstable material will be paid for at the unit price bid per cubic yard, which shall be full payment for all excavation and removal of unsuitable material and furnishing, placing and compacting the foundation rock, coarse aggregate or other approved material all complete in place.

Excavation and backfill, when included as a separate pay item, will be paid for by Pay Item No. 510-E or 510-F.

No separate payment will be made for dewatering a trench with ground water inflow of less than the baseline rate of 350 gpm of sustained flow as described above. Dewatering of those trenches shall be included in the contract unit price of the Pipe pay item. Payment for dewatering a trench with ground water inflow exceeding 350 gpm of sustained flow shall be agreed by change order. Dewatering of bore pits shall be included in the contract unit price for Bore Entry Pit or Exit Pit regardless of inflow rate or volume unless specified otherwise in the bid item for Bore Entry Pit or Exit Pit.

(1) Pipe

Payment for pipe, measured as prescribed above, will be made at the unit price bid per linear foot complete-in-place as designed and represented in the Drawings and other Contract documents. Restrained joint pipe meeting the requirements of Standard Products List WW-27F will be paid for separately at the unit price bid per linear foot. Unless otherwise provided herein, as separate pay item(s), the bid price per linear foot of pipe shall include the following:

- a. clearing
- b. constructing any necessary embankment
- c. excavation
- d. disposal of surplus or unusable excavated material
- e. furnishing, hauling and placing pipe
- f. field constructed joints, collars, temporary plugs, caps or bulkheads
- g. all necessary lugs, rods or braces
- h. pipe coatings and protection
- i. connections to existing systems or structures, concrete blocking and thrust blocks and restrained joints
- j. preparing, shaping, pumping for dewatering, and shoring of trenches
- k. bedding materials
- l. backfill materials
- m. hauling, placing and preparing bedding materials
- n. particle migration measures
- o. hauling, moving, placing and compacting backfill materials
- p. temporary and permanent pavement repairs and maintenance
- q. temporary removal and replacement of pavement, curb, drainage structures, driveways, sidewalks and any other improvements damaged or removed during construction
- r. cleanup
- s. vertical stack on deep wastewater services

- t. all other incidentals necessary to complete the pipe installation as indicated.
- u. pipe joint restraint devices, where specified or allowed, meeting Standard Products List WW-27A or WW-27G.

No separate payment will be made for thrust restraint measures.

Steel cylinder concrete pipe fittings and welded steel pipe fittings will not be paid for separately. These will be included in the unit price bid for the bid item Pipe.

(2) Concrete Cradles and Seals

When called for in the Bid, concrete cradles and seals will be paid for at the unit Contract price bid per linear foot for the size of pipe specified, complete in place.

(3) Concrete Retards

When called for in the Bid, Concrete retards will be paid under Item No. 593S, Concrete Retards."

(4) Boring or Jacking.

When called for in the Bid, boring or jacking will be paid under Item 501S, "Jacking or Boring Pipe.

(5) Wet Connections to Potable or Reclaimed Water Mains

When called for in the bid, wet connections will be paid at the unit price bid per each, complete in place, according to the size of the main that is in service and shall be full compensation for all Work required to make the connection and place the pipe in service. (See subsection 510.3 'Construction Methods' part (24) (b) 'Wet Connections to Existing Water System').

(6) Fittings

Ductile iron fittings, furnished in accordance with these specifications, will be paid for at the unit price bid per ton, complete in place, according to the schedule of weights in Standard Products List WW-27C. Bolts, glands, and gaskets will not be paid for separately and shall be included in the contract unit price for fittings.

(7) Concrete Trench Cap and Encasement

Where the distance between the top of the concrete encasement and the top of the trench cap is less than 36 inches, the concrete cap and encasement shall be poured as one unit and paid for under this bid item at the Contract price bid per linear foot. When the distance above is greater than 36 inches or when the trench cap is placed separately, the trench cap shall be paid for as a separate item, per linear foot, complete in place.

(8) Cement-Stabilized Backfill

Cement-stabilized backfill will be paid for at the unit price bid per linear foot and shall be full payment to the Contractor for furnishing and installing the required material, mixed, placed and cured complete in place.

(9) Concrete Encasement

When called for in the Bid, Concrete Pipe Encasement will be paid under Item No. 505S, "Encasement and Encasement Pipe".

(10) Pressure Taps

Pressure taps will be paid for at the unit price bid, complete in place, according to the size tap made and the size main tapped and shall be full payment for furnishing all necessary materials,

including tapping sleeve and valve, making the tap, testing and placing the connection in service.

(11) Excavation Safety Systems

When called for in Bid, Trench Safety Systems shall conform to Item No. 509S, "Excavation Safety Systems."

(12) Connecting a New Water, Wastewater, or Reclaimed Water Service to an existing, comparable type of private service will be paid for at the unit price bid, complete in place, according to the size of new service and size of existing private service, and shall be full payment for furnishing and installing all necessary materials, such as cleanouts, pipe, couplings, and fittings, and including excavation and backfill.

(13) Video Inspection

Video Inspection of Newly Installed Box Culverts and Storm Drain Pipe will be paid for at the unit price bid per linear foot and shall be full payment for all labor, equipment, and materials required for video inspection per this specification, including all submittals of CD/DVD as required.

(14) Jumper Hose

Jumper Hose will be paid at the unit bid price, complete and in place, including installation and removal of all materials necessary to provide a fully functional jumper hose. This item shall also include adequate protection for the jumper hose within vehicular traffic areas.

Source: [Rule No. R161-17.05](#), 5-31-2017.

Payment, when included as a Contract pay item, will be made under one of the following:

Pay Item No. 510-AR___Dia.:	Pipe, ___ Dia. ___ Type (all depths), including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-ARRJ___Dia.:	Factory Restrained Joint Pipe, ___ Dia., Class ___ Ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-BR___x___Dia.:	Connecting New ___ Service to Existing Private Service (___ Dia. New Service to ___ Dia. Private Service)	Per Each.
Pay Item No. 510-CR:	Pipe Excavation, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-DR:	Pipe Trench Backfill, ___ Ft. Width	Per Linear Foot.
Pay Item No. 510-ER:	Concrete Seal or Cradle, ___ Dia. Pipe	Per Linear Foot.

Pay Item No. 510-FR:	Concrete Trench Cap, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-GR:	Concrete Cap and Encasement, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-HR:	Cement Stabilized Backfill, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-IR: ____ × ____ Dia.:	Pressure Taps, ____ Dia. × ____ Dia.	Per Each.
Pay Item No. 510-JR: ____ × ____ Dia.:	Wet Connections, ____ Dia. × ____ Dia.	Per Each.
Pay Item No. 510-KR:	Ductile Iron Fittings	Per Ton.
Pay Item No. 510-ASD ____ Dia.:	Pipe, ____ Dia. (all depths), including excavation and backfill	Per Linear Foot.
Pay Item No. 510-CSD:	Pipe Excavation, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-DSB:	Pipe Trench Backfill, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-ESD:	Concrete Seal or Cradle, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-FSD:	Concrete Trench Cap, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-GSD:	Concrete Cap and Encasement, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-HSD:	Cement Stabilized Backfill, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-AW ____ Dia.:	Pipe, ____ Dia. ____ Type (all depths), including excavation and backfill	Per Linear Foot

Pay Item No. 510-AWRJ ____ Dia.:	Factory Restrained Joint Pipe, ____ Dia., Class Ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-BW ____ × ____ Dia.:	Connecting New ____ Service to Existing Private Service (____ Dia. New Service to ____ Dia. Private Service)	Per Each.
Pay Item No. 510-CW:	Pipe Excavation, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-DW:	Pipe Trench Backfill, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-EW:	Concrete Seal or Cradle, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-FW:	Concrete Trench Cap, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-GW:	Concrete Cap and Encasement, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-HW:	Cement Stabilized Backfill, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-IW: ____ × ____ Dia.:	Pressure Taps, ____ Dia. × ____ Dia.	Per Each.
Pay Item No. 510-JW: ____ × ____ Dia.:	Wet Connections, ____ Dia. × ____ Dia.	Per Each.
Pay Item No. 510-KW:	Ductile Iron Fittings	Per Ton.
Pay Item No. 510-AWW: ____ Dia.:	Pipe, ____ Dia. ____ Type (all depths), including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-AWWRJ ____ Dia.:	Factory Restrained Joint Pipe, ____ Dia., Class ductile Iron, (all depths) including Excavation and Backfill	Per Linear Foot.
Pay Item No. 510-BWW ____ × ____ Dia.:	Connecting New ____ Service to Existing Private Service (____ Dia. New Service to ____ Dia. Private Service)	Per Each.

Pay Item No. 510-CWW:	Pipe Excavation, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-DWW:	Pipe Trench Backfill, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-EWW:	Concrete Seal or Cradle, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-FWW:	Concrete Trench Cap, ____ Ft. Width	Per Linear Foot.
Pay Item No. 510-GWW:	Concrete Cap and Encasement, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-HWW:	Cement Stabilized Backfill, ____ Dia. Pipe	Per Linear Foot.
Pay Item No. 510-KWW:	Ductile Iron Fittings	Per Ton.
Pay Item No. 510-VIDEO	Video Inspection of Newly Installed Box Culverts and Storm Drain Pipe	Per Linear Foot.
Pay Item No. 510-JH	2-inch Jumper Hose	Per Linear Foot.

An "R" after the pay item indicates the use for reclaimed water.

An "SD" after the pay item indicates the use for storm drain.

A "W" after the pay item indicates the use for water.

A "WW" after the pay item indicates the use for wastewater.

Source: [Rule No. R161-17.05](#), 5-31-2017.

End

Applicable References:

Standard Specifications Manual: Item Nos. Ref: 102S, 210S, 402S, 403, 501S, 505S, 506, 507S, 509S, 593S, 601S, 604S

Standards Manual: Standard Detail Nos. 510S-1, (520 - series).

Design Criteria Manuals: Utilities Criteria Manual, Section 5.

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ITEM NO. 511S - WATER VALVES 9-26-12**511S.1 - Description**

This item shall govern the valves furnished and installed as indicated on the Drawings. Unless otherwise indicated on the Drawings, all valves 4 inches (102 mm) and larger shall be AWWA-type valves of suitable design and fully equipped for service buried in the earth, without need for further modification and shall be wrapped with 8-mil (0.2 mm) polyethylene film with all edges and laps securely taped to provide a continuous wrap. For reclaimed water piping, the polyethylene film shall be purple. Where not indicated, the Contractor may use valves with any type end-joint allowed for fittings of the pipe class being used. Unless otherwise indicated on the Drawings, all valve stems shall be adjusted to situate the operating nut not more than 24 inches (0.6 meters) below the proposed ground or paving surface of the finished project. Laydown valves shall not be used unless called out on the Drawings. Standard details shall not be used as an indicator of available options.

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

511S.2 - Materials

The Contractor shall submit descriptive information and evidence that the materials and equipment the Contractor proposes for incorporation in the Work is of the kind and quality that satisfies the specified functions and quality. The Austin Water Utility Standard Products Lists (SPL) are considered to form a part of these Specifications. Contractors may, when appropriate, elect to use products from the SPL; however, submittal to the Engineer/Architect (E/A) is still required. If the Contractor elects to use any materials from these lists, each product shall be completely and clearly identified by its corresponding SPL number when making the product submittal. This will expedite the review process in which the E/A, and, if necessary, the Austin Water Utility Standard Products Committee, decide whether the products meet the Contract requirements and the specific use foreseen by the E/A in the design of this engineered Project.

The SPL's should not be interpreted as being a pre-approved list of products necessarily meeting the requirements for a given construction Project. Items contained in the SPL cannot be substituted for items shown on the Drawings, or called for in the specifications, or specified in the Bidding Requirements, Contract Forms and Conditions of Contract, unless approved by the E/A in conjunction with the Water and Wastewater Utility Standard Products Committee. The Standard Product List current at the time of plan approval will govern.

A. Samples, Inspection and Testing Requirements

All tests and inspections called for by the applicable standards shall be performed by the manufacturer. Upon request, results of these tests shall be made available to the purchaser.

B. Other Requirements

Each submittal shall be accompanied by:

1. Complete data covering:
 - a. the operator, including type and size, model number, etc.,
 - b. the name and address of the manufacturer's nearest service facility,
 - c. the number of turns to fully open or close the valve.
2. detailed instructions for calibrating the limit stops for open and closed positions, and
3. any other information, that may be necessary to operate and maintain the operator.

4. Complete dimensional data and installation instructions for the valve assembly as it is to be installed, including the operator.
5. Complete replacement parts lists and drawings, identifying every part for both the valve and operator.

511S.3 - Valves

A. Iron-Body Gate Valves

Resilient-seated gate valves for potable or reclaimed service, including tapping valves, shall conform to AWWA C-509 and Standard Products List item WW-282.

Reduced-wall, resilient-seated gate valves for potable or reclaimed service, including tapping valves, shall conform to AWWA C-515 and Standard Products List item WW-700.

Metal-seated gate valves for potable or reclaimed service, including tapping valves, shall conform to AWWA C-500 and Standard Products List item WW-132.

1. Stem Seals: All valves shall have approved O-ring type stem seals. At least two O-rings shall be in contact with the valve stem where it penetrates the valve body.
2. Operation: All valves shall have non-rising stems with a 2-inch (50 mm) square operating nut, or with a spoke type handwheel when so ordered, turning clockwise to close.
3. Gearing: Gate valves in 24-inch (610 mm) and larger sizes shall be geared and, when necessary for proper bury depth and cover, shall be the horizontal bevel-geared type enclosed in a lubricated gear case.
4. Bypass: Unless otherwise indicated on the Drawings, 30-inch (762 mm) and larger metal-seated gate valves shall be equipped with a bypass of the non-rising stem type which meets the same AWWA standard required for the main valve.
5. Valve Ends: Valve ends shall be push-on, flanged or mechanical joint, as indicated or approved.

Tapping valves shall have inlet flanges conforming to MSS SP-60, with boltholes drilled per ANSI B16.1 Class 125. Seat rings and body casting shall be over-sized as required to accommodate full size cutters; the outlet end shall be constructed and drilled to allow the drilling machine adapter to be attached directly to the valve.
6. Gear Case: All geared valves shall have enclosed gear cases of the extended type, attached to the valve bonnet in a manner that makes it possible to replace the stem seal without disassembly and without disturbing the gears, bearing or gear lubricant. Gear cases shall be designed and fabricated with an opening to atmosphere so that leakage past the stem seal does not enter the gear case.
7. Valve Body: Double disc gate valves in 30-inch (762 mm) and larger sizes installed in the horizontal position shall have bronze rollers, tracks, scrapers, etc. For reclaimed water valves, the body shall be manufactured in purple, factory painted purple, or field painted purple.

B. Butterfly Valves

Unless otherwise indicated, all valves shall conform to the current "AWWA" Standard C-504, "Rubber-Seated Butterfly Valves," Class 150B, except as modified or supplemented herein.

1. Functional Requirements
 - a. Valves shall be the short body design and shall have flanged connections on both ends unless otherwise called for.
 - b. Valves shall be of such design that the valve discs will not vibrate or flutter when operated in a throttled position. Valve discs shall be secured to the shafts by means of keys or pins

so arranged that the valve discs can be readily removed without damage thereto. All keys and pins used in securing valve discs to shafts shall be stainless steel or monel. Valve discs shall be stainless steel or ductile iron, ASTM A 536, Grade 65-45-12 (448-310-12); seating edge shall be stainless steel or other corrosion resistant material.

- c. Valve shafts shall be constructed of wrought stainless steel or monel. The ends of the shaft shall be permanently marked to indicate the position of the disc on the shaft.
- d. All buried valves shall have approved manufacturer's O-ring type or split V type "Chevron" shaft seals. When O-ring seals are used, there shall be at least two O-rings in contact with the valve shaft where it penetrates the valve body.

On 24-inch (635 mm) and larger valves, the seat shall be completely replaceable and/or adjustable with common hand tools without disassembling the valve from the pipeline.

Rubber seats located on the valve disc shall be mechanically secured with stainless steel retainer rings and fasteners.

- e. Unless otherwise indicated, valves shall be provided with manual operators with vertical stems and 2 inches (50 mm) square operating nut turning clockwise to close and equipped with a valve disc position indicator. All keys or pins shall be stainless steel or monel. Buried valves shall have the valve stems extended or adjusted to locate the top of the operating nut no more than 24 inches (0.6 meter) below finish grade.
- f. Unless otherwise indicated, motorized butterfly valves shall be equipped with 230/460 volt, 3-phase reversing motor operators, extended as required to locate the center line of the operator shaft approximately 4 feet to 4 feet, 6 inches (1.2 to 1.4 meters) above finish grade. Operators shall be equipped with cast iron or malleable iron manual override hand wheel with a valve position indicator, local push button controls, lighted status/position indicator, torque and travel limit switches and all switches, relays and controls (except external power and signal wiring) necessary for both local and remote operation.

2. Performance Requirements

- a. Unless otherwise indicated, valve operators shall be sized to seat, unseat, open and close the valve with 150 psi (1 megapascal) shutoff pressure differential across the disk and allow a flow velocity of 16 feet (4.9 meters) per second past the disc in either direction.
- b. Motorized valve motors shall be capable of producing at least 140 percent of the torque required to operate the valves under conditions of maximum non-shock shutoff pressure without exceeding a permissible temperature rise of 1310F over 1040F ambient (55 degrees Celsius over 40 degrees Celsius ambient); they shall have a duty rating of not less than 15 minutes and shall be capable of operating the valve through 4½ cycles against full unbalanced pressure without exceeding the permissible temperature rise. Motors shall be suitable for operating the valve under maximum differential pressure when voltage to motor terminals is 80 percent of nominal voltage. Motor bearings shall be permanently lubricated and sealed.

C. Ball Valves

Ball valves shall be brass, bronze, stainless steel or PVC as indicated on the Drawings or Details or as approved by the Engineer or designated representative.

D. Air-Vacuum Release Valves

- 1. Valves shall be combination air-release, air-vacuum units having small and large orifice units contained and operating within a single body or assembled unit.

The small orifice system shall automatically release small volumes of air while the pipe is operating under normal conditions. The large air-vacuum orifice system shall automatically

exhaust large volumes of air while the pipe is being filled and shall permit immediate re-entry of air while being drained.

Valves shall be rated for at least 150 psi (1 megapascal) {maximum} normal service pressure.

2. Material Requirements

Valve exterior bodies and covers shall be cast iron or reinforced nylon.

Internal bushings, hinge pins, float guide and retaining screws, pins, etc., shall be stainless steel, bronze, nylon, or Buna-N rubber.

Orifice seats shall be Buna-N rubber.

Floats shall be stainless steel, nylon, or Buna-N rubber, rated at 1,000 psi (6.9 megapascals).

Unless otherwise indicated, these valves shall be as included in the Standard Products List (SPL WW-367 for water, WW-462 for wastewater force mains).

E. Fire Hydrants

All fire hydrants shall be Dry Barrel, Traffic Model (break-away), Post Type having Compression Type Main Valves with 5 ¼" (133 mm) opening, closing with line pressure. Approved models are listed on SPL WW-3 of the Austin Water Utility Standard Products List.

1. Applicable Specifications

AWWA C-502 current: "AWWA Standard for Dry-Barrel Fire Hydrants."

NFPA 1963: "National (American) Standard Fire Hose Coupling Screw Thread" and City of Austin 4 inch (102 mm) Fire Hose Connection Standard (Available upon request from the Austin Water Utility's Standards Committee Chairperson at 972-0204).

ANSI A-21.11 current: "American National Standard for Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings."

2. Functional Requirements

Design Working Pressure shall be 200 psi (1.38 megapascals) and a test pressure of 400 psi (2.76 megapascals).

Inlet shall be side connection hub end for mechanical joint (ANSI A-21.11-current). Shoe shall be rigidly designed to prevent breakage.

Lower Barrel shall be rigid to assure above ground break at traffic feature. Bury length of hydrant shall be four (4) feet (1.2 meters) minimum, five (5) feet (1.5 meters) maximum (hydrant lead pipe may be elbowed up from main using restrained joints; flanged joints in lead pipes are not allowed). Flange type connections between hydrant shoe, barrel sections and bonnet shall have minimum of 6 corrosion resistant bolts.

Hydrant Main Valve shall be 5 ¼ inch (133 mm) I.D. Valve stem design shall meet requirements of AWWA C502, with Operating Nut turning clockwise to close. Operating Nut shall be pentagonal, 1½ inch (38 mm) point to flat at base, and 1 7/16 inches (36.5 mm) at top and 1 inch (25 mm) minimum height. Seat ring shall be bronze (bronze to bronze threading), and shall be removable with lightweight stem wrench. Valve mechanisms shall be flushed with each operation of valve; there shall be a minimum of two (2) drain ports.

Traffic Feature shall have replaceable breakaway ferrous metal stem coupling held to stem by readily removable type 302 or 304 stainless steel fastenings. Breakaway flange or frangible lugs

shall be designed to assure aboveground break. Breakaway or frangible bolts will not be acceptable.

Outlet Nozzles shall be located approximately 18 inches (450 mm) above ground. Each hydrant shall have two (2) 2½ inch (63.5 mm) nozzles 180 degrees apart with National (American) Standard Fire Hose Coupling Screw Thread NFPA 1963 and one (1) 4 inch (102 mm) pumper nozzle with City of Austin standard thread-six (6) threads per inch (25 mm) "Higbee" cut, 4.8590 inch (123.4 mm) O.D., 4.6425 inch (117.9 mm) root diameter. Nozzles shall be threaded or cam-locked, O-ring sealed, and shall have type 302 or 304 stainless steel locking devices. Nozzle caps (without chains) and cap gaskets shall be furnished on the hydrant. The cap nut shall have the same configuration as the operating nut.

Hydrants shall be Dry-Top Construction, factory lubricated oil or grease with the lubricant plug readily accessible. The system shall be described for City approval.

A blue Type II-B-B reflectorized pavement marker, conforming to Standard Specification Item No. 863S, shall be placed 2 to 3 feet (0.6 to 0.9 meters) offset from the centerline of paved streets, on the side of and in line with, all newly installed fire hydrants.

Hydrant shall have double O-ring seals in a bronze stem sheath housing to assure separation of lubricant from water and shall have a weather cap or seal, or both, as approved by the Owner, to provide complete weather protection.

3. Material Requirements

All below ground bolts shall be corrosion resistant. The hydrant valve shall be Neoprene, 90 durometer minimum. The seat ring, drain ring, operating nut and nozzles shall be bronze, AWWA C-502 current, containing not over 16 percent zinc. Break-away stem coupling shall be of ferrous material; its retaining pins, bolts, nuts, etc. of type 302 or 304 stainless steel.

Coatings shall be durable and applied to clean surfaces. Exterior surfaces above ground shall receive a coating of the type and color specified in the applicable version of City of Austin SPL WW-3. The coating shall be applied according to coating manufacturer's specifications. Other exposed ferrous metal shall receive asphalt-based varnish, or approved equal, applied according to the coating manufacturer's specifications.

F. Pressure/Flow Control Valves

All control valves to regulate pressure, flow, etc., in City lines shall be models listed in the Austin Water Utility Standard Products List (SPL).

G. Drain Valves

Drain valve materials and installation shall conform to City of Austin Standard Detail No. 511S-9.

H. Valve Stem Extensions:

Valve stem extensions shall consist of a single piece of the required length with a socket on one end and a nut on the other.

511S.4 - Construction Methods

A. Setting Valves, Drains and Air Releases

Unless otherwise indicated, main line valves, drain valves and piping, air and vacuum release assemblies and other miscellaneous accessories shall be set and jointed in the manner described for cleaning, laying, and jointing pipe.

Unless otherwise indicated, valves shall be set at the locations shown on the Drawings and such that their location does not conflict with other appurtenances such as curb ramps. Valves shall be installed so that the tops of operating stems will be at the proper elevation required for the piping at the location indicated above. Valve boxes and valve stem casings shall be firmly supported and maintained, centered and aligned plumb over the valve or operating stem, with the top of the box or casing installed flush with the finished ground or pavement in existing streets, and installed with the top of the box or casing approximately 6 inches (150 mm) below the standard street subgrade in streets which are excavated for paving construction or where such excavation is scheduled or elsewhere as directed by the Engineer or designated representative.

Drainage branches or air blowoffs shall not be connected to any sanitary sewer or submerged in any stream or be installed in any other manner that will permit back siphonage into the distribution system (see City of Austin "Standard Detail Drawings- Series 500/500S"). Every drain line and every air release line shall have a full sized independent gate valve flanged directly to the main. Flap-valves, shear gates, etc., will not be accepted.

B. Setting Fire Hydrants

Fire hydrants shall be located in a manner to provide accessibility and in such a manner that the possibility of damage from vehicles or conflict with pedestrian travel will be minimized. Unless otherwise directed, the setting of any hydrant shall conform to the following:

Hydrants between curb and sidewalk on public streets, shall be installed as shown on Standard 511S-17, with outermost point of large nozzle cap 6 inches to 18 inches (150 mm to 450 mm) behind back of curb. Where walk abuts curb, and in other public areas or in commercial areas, dimension from gutter face of curb to outermost part of any nozzle cap shall be not less than 3 feet (0.9 meters), nor more than 6 feet (1.8 meters), except that no part of a hydrant or its nozzle caps shall be within 6 inches (150 mm) of any sidewalk or pedestrian ramp. Any fire hydrant placed near a street corner shall be no less than 20 feet (6 meters) from the curb line point of tangency. Fire hydrants shall not be installed within nine feet (2.75 meters) vertically or horizontally of any sanitary sewer line regardless of construction.

All hydrants shall stand plumb; those near curbs shall have the 4-inch (102 mm) nozzle facing the curb and perpendicular to it. The hydrant bury mark shall be located at ground or other finish grade; nozzles of all new hydrants shall be approximately 18 inches (450 mm) above grade. Lower barrel length shall not exceed 5 feet (1.5 meters). Barrel extensions are not permitted unless approved by the Engineer or designated representative. Each hydrant shall be connected to the main by 6-inch (152 mm) ductile iron pipe; a 6-inch (152 mm) gate valve shall be installed in the line for individual shutoff of each new hydrant.

Below each hydrant, a drainage pit 2 feet (0.6 meter) in diameter and 2 feet (0.6 meter) deep shall be excavated and filled with compacted coarse gravel or broken stone mixed with coarse sand under and around the bowl of the hydrant, except where thrust blocking is located (City of Austin Specification Item 510 and Standard Detail 510-6 and to a level 6 inches (150 mm) above the hydrant drain opening.

The hydrant drainage pit shall not be connected to a sanitary sewer. The drain gravel shall be covered with filter fabric to prevent blockage of voids in the gravel by migration of backfill material. The bowl of each hydrant shall be well braced against unexcavated earth at the end of the trench with concrete thrust blocking (taking care not to obstruct the hydrant drain holes), or the hydrant shall be tied to the pipe with approved metal harness rods and clamps. The fire line shall be provided with joint restraint from the main line to the fire hydrant. Hydrants shall be thoroughly cleaned of dirt or foreign matter before setting.

Fire hydrants on mains under construction shall be securely wrapped with a poly wrap bag or envelope taped into place. When the mains are accepted and placed in service the bag shall be removed.

C. Pressure Taps: Refer to Section 510.3 (24) of Standard Specification Item Number 510, "Pipe."

D. Plugging Dead Ends

Standard plugs shall be inserted into the bells of all dead ends of pipes, tees or crosses and spigot ends shall be capped. All end plugs or caps shall be secured to the pipe conforming to Section 510.3 (22) of Standard Specification Item Number 510, "Pipe."

E. Protective Covering

Unless otherwise indicated, all flanges, nuts, bolts, threaded outlets and all other steel component shall be coal tar coated and shall be wrapped with standard minimum 8-mil (0.2 mm) low density polyethylene film or a minimum 4-mil (0.1 mm) cross laminated high-density polyethylene meeting ANSI/AWWA Specification C-105-current, with all edges and laps taped securely to provide a continuous and watertight wrap. Repair all punctures of the polyethylene, including those caused in the placement of bedding aggregates, with duct tape to restore the continuous protective wrap before backfilling. For reclaimed water piping, the polyethylene shall be purple.

F. Valve Box, Casing and Cover

Stems of all buried valves shall be protected by valve box assemblies. Valve box castings shall conform to ASTM A 48, Class 30B. Testing shall be verified by the manufacturer at the time of shipment. Each casting shall have cast upon it a distinct mark identifying the manufacturer and the country of origin. Valve boxes and covers for potable water shall be round. Valve boxes and covers for reclaimed water piping shall be square and shall have "Reclaimed Water" indicated on the lid.

G. Drain Valve Installations

Refer to City of Austin Standards 511S-9A.

H. Air Release Assemblies

Refer to City of Austin Standards 511S-1A, 511S-1B, 511S-2A, 511S-2B, 511S-3A and 511S-3B.

I. Pressure/Flow Control Valves

Assemblies shall be installed as indicated.

J. Connections to Existing System

Refer to Item No. 510, "Pipe" for connections to the existing system.

K. Shutoffs

Refer to Item No. 510, "Pipe" for shutoffs.

511S.5 - Measurement

All types of valves will be measured per each. Fire hydrants and drain valve assemblies will be measured per each. Fire Hydrant barrel extensions will be measured per vertical foot (meter: 1 meter equals 3.28 feet). Pressure/Flow control valve assemblies and both manual and automatic air release assemblies will be measured per each. Reflectorized pavement markers for identifying the location of newly installed fire hydrants shall be measured per each, as per Standard Specification Item No. 863S.7.

Bury depths exceeding 5.5 feet (1.68 meters) are defined as Additional Bury Depths. Additional bury depths will only be measured if indicated on the Drawings and identified in the Standard Contract Bid Form 00300U; otherwise, the unit bid price for each completed unit includes all depths.

511S.6 - Payment

Payment shall include full compensation, in accordance with the pay item established in the bid, for excavation, furnishing, hauling and placing valves, drain valve assemblies, fire hydrants and barrel extensions including anchorage and all incidental materials and work; preparing, shaping, dewatering, bedding, placing and compacting backfill materials and for all other incidentals necessary to complete the installation, as indicated in the Drawings, complete in place.

Payment for iron fittings and for wet connections is covered in Section 510.6 of Standard Specification Item 510, "Pipe."

Payment for excavation safety systems is covered in Section 509S.10 of Standard Specification Item 509S, Excavation Safety Systems.

- A. Valves: Valves will be paid for at the unit bid price for the size and type valve installed, including valve stem casing and cover, excavation and backfill, setting, adjusting to grade, anchoring in place, and other appurtenances necessary for proper operation.
- B. Fire Hydrants: Fire Hydrants installation shall be paid for at the unit bid price, which includes all necessary labor and materials to set, adjust to grade and anchor the hydrant body, barrel extensions, concrete block, gravel drain and other appurtenances necessary for proper operation; but shall not include pipe and valve between the main line and fire hydrant base.
- C. Pressure or Flow Control Valve Assemblies: Pressure control and flow control valve assemblies will be paid for at the unit bid price, including box or vault, setting, adjusting to grade, anchoring in place, adjusting the control device to the required conditions, providing other appurtenances necessary for proper operation, and placing in operation.
- D. Drain Valve Assemblies: Drain valve installation shall be paid for at the unit bid price, which includes all necessary labor and materials to set, adjust to grade and anchor the bends, vertical piping, blind flange, joint restraint devices, concrete blocking, concrete pad the drain valve, setting, adjusting to grade, anchoring in place, and other appurtenances necessary for proper operation; but shall not include pipe and valve between the main line and drain valve buried bend.
- E. Manual Air Release Assemblies: Manual air release installations will be paid for at the unit bid price and shall include valves, fittings, pipe, tapping the main, box and cover, and other appurtenances necessary for proper operation.
- F. Automatic Combination Air/Vacuum Release Valve Assembly: Automatic air-vacuum release assemblies will be paid for at the unit bid price and will include the main line tap or outlet, all pipe, valves, fittings, box or vault and cover, and other appurtenances necessary for proper operation.
- G. Additional Bury Depth: Additional bury depth will be paid for at the unit bid price, which will include all work necessary to install units with bury depths exceeding 5.5 feet (1.68 meters).
- H. Fire Hydrant Barrel Extensions: Hydrant barrel extensions will be paid for at the unit bid price which will include necessary hardware and rod extensions.
- I. Reflectorized Pavement Markers: Pavement markers will be paid for at the unit bid price, which will include necessary surface preparation and adhesive, as per Standard Specification Item No. 863S.8.

Payment, when included as a contract pay item, will be made under one of the following:

Pay Item No. 511S-A:	Valves, _____ Type, ____ Diameter	Per Each.
Pay Item No. 511S-B:	Fire Hydrants (See Standard No. 511S-17)	Per Each.

Pay Item No. 511S-C:	Pressure or Flow Control Valve Assemblies	Per Each.
Pay Item No. 511S-D:	Drain Valve Assemblies (See Standard No. 511S-9A)	Per Each.
Pay Item No. 511S-E:	Manual Air Release Assemblies, ____Diameter	Per Each.
Pay Item No. 511S-F:	Automatic Combination Air/Vacuum Release Valve Assembly, ____ Diameter.	Per Each.
Pay Item No. 511S-G:	Additional Bury Depth	Per Vertical Foot.
Pay Item No. 511S-H:	Fire Hydrant Barrel Extensions	Per Vertical foot.

END

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 511S, "Water Valves"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 510	Pipe
Section 510.3 (22)	Pipe Anchorage, Support and Protection
Section 510.3(24)	Water System Connections

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
511S-1A	25 mm (1") - 76 mm (2") Vented Air Release Valve Installation (Type I)
511S-1B	25 mm (1") - 76 mm (2") Non-Vented Air Release Valve Installation (Type I)
511S-2A	Type II - 76 mm (3") or Larger Vented Air/Vacuum Valve Installation
511S-2B	Type II - 76 mm (3") or Larger Non-Vented Air/Vacuum Valve Installation
511S-3A	Type III - 76mm (3") or Larger Vented Air/Vacuum Valve Installation
511S-3B	Type III-76mm (3") or Larger Non-Vented Air/Vacuum Valve Installation
511S-9A	Drain Valve Assembly
511S-17	Standard Fire Hydrant Installation

Austin Water Utility Standard Products

<u>Designation</u>	<u>Description</u>
WW-132	Standard Products List for Metal-Seated Gate Valves, AWWA C-500
WW-282	Standard Products List for Resilient-Seated Gate Valves, AWWA C-509
WW-367	Standard Products List for Air Release Valves for Water
WW-462	Standard Products List for Air Release/Vacuum Relief Valves for Wastewater
WW-700	Standard Products List for Resilient-Seated Gate Valves, AWWA C

ANSI/AWWA Standards

<u>Designation</u>	<u>Description</u>
A-21.11	American National Standard for Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings
C-105	American National Standard for Polyethylene Encasement for Ductile-Iron Pipe
C-500	Metal-Seated Gate Valves for Water Supply Service
C-502	Dry-Barrel Fire Hydrants
C-504	Rubber-Seated Butterfly Valves
C509	Resilient Seated Gate Valves for Water and Sewerage Systems
C-515	Reduced-Wall, Resilient-Seated Gate Valves For Water Supply Service-515
<u>ASTM Standards</u>	
<u>Designation</u>	<u>Description</u>
ASTM A48/A48M	Specification for Gray Iron Castings
ASTM A 536	Specification for Ductile Iron Castings
<u>National Fire Protection Association (NFPA)</u>	
1963 National (American) Standard Fire Hose Coupling Screw Thread	

RELATED CROSS REFERENCE MATERIALSSpecification 511S, "Water Valves"

<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 501S	Jacking or Boring Pipe
Item No. 503S	Frames, Grates, Rings and Covers
Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 506	Manholes
Item No. 507S	Bulkheads
Item No. 508S	Miscellaneous Structures and Appurtenances
Item No. 509S	Trench Safety Systems

ITEM NO. 551 - PIPE UNDERDRAINS 5-16-97

551.1 - Description

This item shall consist of pipe underdrains embedded in filter material, constructed at such places as indicated and in accordance with lines and grades established by Engineer. This item shall also consist of any pumping, bailing, drainage and Item No. 509, "Trench Safety Systems" for trench walls, when indicated.

551.2 - Materials

(1) Pipe

The following materials will be permitted as alternates unless type is indicated. Size indicated shall be inside diameter. Pipe shall meet the following requirements:

Type 1 Vitrified Clay or Concrete Pipe

Pipe may be either thoroughly and perfectly burned or glazed vitrified clay or nonreinforced concrete conforming to ASTM C 14. Vitrified clay pipe shall be of first quality hub and spigot style, sound, without warps or cracks or other imperfections and shall be sufficiently tough so that it may be cut with a chisel and hammer.

Type 2 Clay Drain Tile

Standard clay drain tile shall conform to specifications of AASHTO M 179.

Type 3 Concrete Drain Tile

Butt end concrete drain tile shall conform to ASTM C 412. Tongue and groove concrete drain tile shall conform to ASTM C 118.

Type 4 Porous Concrete Pipe

Porous concrete pipe shall conform to AASHTO M 176.

Type 5 Perforated Clay Pipe

Perforated clay pipe shall conform to specifications for standard strength perforated clay pipe of AASHTO M 65 except that extra strength clay pipe may be substituted for standard strength clay pipe.

Type 6 Perforated Corrugated Metal Pipe

Perforated helically corrugated metal pipe shall be fabricated from corrugated galvanized sheets and shall conform to AASHTO M 36 or corrugated aluminum alloy sheets and shall comply with AASHTO M 196.

Type 7 Perforated Corrugated Metal Pipe (Bituminous Coated)

Pipe shall conform in all particulars to requirements specified above for perforated corrugated metal pipe. Steel pipe shall be uniformly coated inside and out with a bituminous coating to a minimum thickness of 0.05 inch.

Bituminous material used to coat pipe shall meet the following requirements when tested in accordance with TxDOT Test Method Tex-522-C:

Solubility, % by wt. in	
Trichloroethylene	99.5 minimum
Brittleness Test	Pass
Flow, inches	0.25 maximum

Type 8 Perforated Concrete Pipe

Perforated concrete pipe shall conform to ASTM C 444, "Standard Strength Perforated Nonreinforced Concrete Underdrain Pipe", except that "Extra Strength Perforated Nonreinforced Concrete Underdrain Pipe" may be substituted for standard strength pipe.

Type 9 ABS Perforated Pipe

ABS pipe shall be extruded and fittings molded from virgin ABS plastic material conforming to ASTM D 1788, Type 4, except that minimum heat deflection temperature is 180°F. Contractor shall furnish certified test reports as evidence that material used for project meets ASTM requirements. Dimensions of ABS pipe shall be as shown in Table I. Fittings shall conform to manufacturer's standard for particular size of pipe required.

TABLE I

Nominal Size, Inches	Inside Diameter Inches, Minimum	Thickness of Barrel Inches, Minimum
4	3.82	0.19
6	5.70	0.28

Perforations shall conform to requirements for Type 5 pipe underdrains. Crushing strength of ASB pipe shall meet or exceed minimum values in Table II when tested in accordance with flat-plate loading method as outlined in ASTM Designation: D 2412.

TABLE II

Nominal Size, Inch	Minimum Strength lb. Inch
4	179
6	604

Pipe shall withstand at least 35 percent vertical deflection without rupture of pipe wall and stiffness shall equal or exceed valves at 5 percent deflection. Vertical deflection shall be computed as follows:

$$\text{Percent Deflection} = \frac{\text{Reduction Vert. I.D.}}{\text{Nominal I.D.}} \times 100$$

Ends of ABS pipe, couplings and fittings shall be perpendicular or square to longitudinal axis of main body within a maximum angle of 3 degrees. Outer and inner surface of pipe shall be free from blisters, voids and discontinuities.

Type 10 Preformed Corrugated Polyethylene Plastic Tubing

Tubing shall comply with AASHTO M 252.

Type 11 Perforated Polyvinyl Chloride Pipe

Pipe shall be Schedule 40 and conform to ASTM D 1785. Unless otherwise specified, the perforated pipe shall have two rows of holes 13 mm (½ in.) in diameter on 125-mm (5 in.) centers, with allowable tolerances of ± 1 mm (1/16 in.) on the diameter and + 6, -0 mm (+¼, -0 in.) on the spacing, and the rows shall be parallel to the axis of the pipe and 120 ± 5° apart.

(2) Filter Material

(a) Aggregate

Filter material for use in backfilling trenches under, around and over underdrains shall consist of hard, durable, clean, washed gravel or crushed stone, ranging in size from 5/8 to 1 inch and shall be free from organic matter, clay balls or other deleterious matter.

(b) Geotextile

Geotextile shall conform to Item No. 620, "Filter Fabric".

551.3 - Construction Methods

Excavation of each trench shall begin at its outlet and proceed toward its upper end. Trench must not be excavated below proposed grade line and shall be located as indicated or as directed by Engineer and true to line and grade. Trench shall be dressed with a tile hoe or shovel in such manner that will facilitate placement of underdrain. Closed joints shall be coupled with bands, solvent weld couplings or integral joints. Perforated ABS pipe shall be jointed by couplers or solvent welding according to manufacturer's recommendation. No tar paper strips shall be used.

Approved plugs shall be placed in upper ends of pipes and exposed ends of underdrains shall be covered with ½ inch galvanized hardware cloth and filter fabric.

When indicated, concrete riprap or headwalls of dimensions indicated shall be constructed at outlet ends of pipe underdrains. Concrete materials and proportions shall conform to requirements specified for Class B Concrete conforming to Item No. 403, "Concrete for Structures".

When perforated metal pipe is used and trench is founded in pervious material, a thin layer of tamped impervious material shall be placed on bottom of trench as indicated or as directed by Engineer. Sections shall be jointed with band couplers.

When clay or concrete pipe is used and trench is founded in pervious material, a bottom course of specified filter material shall be placed and tamped to a uniform depth of 2 inches. Pipe shall then be firmly embedded in filter material, hub upgrade and spigot firmly centered into adjacent hub end or in the case of butt end type drains with an open joint of approximately 3/8 inch. Open joints shall then be covered with approved 2 ply tar paper strips not less than 6 inches in width and of sufficient length to permit ends being turned outward and laid flat on bottom course of filter material of each side for a distance of 3 inches. When trench is founded in impervious material, the 2 inch bottom course of filter material shall be omitted, pipe laid directly in trench and filter material placed in trench to a depth of 2 inches on each side of pipe. Two ply tar paper strips shall then be placed as specified above.

551.4 - Measurement

Work and accepted materials for "Pipe Underdrains" shall be measured by the linear foot of pipe measured along slope and shall include clearing, excavation, filter material, filter fabric, pipe, length of elbows, wyes, tees and other branches and backfill.

551.5 - Payment

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 per linear foot of "Pipe Underdrains" of type and size specified, which price shall be full compensation for furnishing and placing materials, for underdrain excavation and backfill, for filter materials, for plugs and screens and for labor, tools, equipment and incidentals necessary to complete the work.

Any riprap, headwalls or Trench Safety System indicated will be measured and paid for in accordance with provisions of Item No. 403, "Concrete for Structures", Item No. 410, "Concrete Structures", Item No. 509, "Trench Safety Systems" and Item No. 591, "Riprap for Slope Protection".

Payment will be made under:

Pay Item No. 551:	Pipe Underdrains, In.	Per Linear Foot.
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End

Ref: 403, 410, 509, 591, 620

ITEM NO. 559S - PORTLAND CEMENT CONCRETE BOX CULVERTS 10-3-13**559S.1 - Description**

This item governs the materials used and the constructing, furnishing and placing of concrete box culverts (boxes) on a prepared grade at the location shown on the Drawings and in accordance with Standard Detail 559S-1, "Fabrication Tolerances for Precast Box Culverts". Unless indicated otherwise on the Drawings, the Contractor shall have the option of furnishing cast-in-place, precast (formed) or precast (machine made) concrete box culverts.

When cast-in-place box culverts are used, they shall conform to the details indicated on the Drawings and Standard Detail 559S-1, "Fabrication Tolerances for Precast Box Culverts" along with the requirements for Standard Specification Item No. 403S, "Concrete for Structures" and Standard Specification Item No. 410, "Concrete Structures".

The manufacturing of precast box culverts shall conform to the requirements of the current version of ASTM C1577. When precast box culverts are used under traffic, the design loads shall consist of the impact load, dead load and live load [AASHTO LRFD Bridge Construction Design Specifications - greater of: Truck Axle load (32Kf {identical to HS-20load axial load of 32Kf}) or Tandem Axle load (2 at 25Kf each)].

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.

559S.2 - Submittals

The submittal requirements of this specification item include for both cast-in-place and precast boxes:

- A. The foundation plan and drilling/excavation details;
- B. Class C and S Portland cement concrete mix design for cast-in-place boxes;
- C. Anchor bolt plan and details;
- D. Reinforcing Steel details and placement drawings;
- E. Casting plan and details (if required);
- F. Certification of compliance with HL93 Liveload design standards;
- G. Bedding Material;
- H. Joint design;
- I. List of joint sizes showing the minimum size of sealant material to be used with each size joint, along with complete instructions on recommended installation procedures;
- J. Test results of the hydrostatic performance testing of the joints, if requested by the City;
- K. Box Culvert manufacturer's recommended final joint opening (gap) dimension on the inside of the installed box;
- L. Certification from the QCast Program, which provides a third party certification auditing firm to certify that the manufacturing plant is producing boxes based on the requirements of the National Precast Concrete Association;
- M. Inspection procedures to be used by the manufacturer for quality control and assurance for materials; and
- N. 5000 psi (34.475 mPa) Concrete mix design for machine made boxes.

559S.3 - Quality Control

Manufacturers of concrete boxes shall have a quality management system certified by the QCast Program following the requirements of the American Concrete Pipe Association (ACPA) Plant Certification Manual. Manufacturers of concrete boxes, inlets and storm water manholes shall have a quality control program consisting of one or more of the following: 1) a quality management system certified by the QCast Program following the requirements of the ACPA Plant Certification Manual, 2) a quality management system certified by the National Precast Concrete Association. 3) a quality control program approved by the OWNER prior to submittal of bids for the PROJECT, or 4) an independent, third party quality control testing and inspection firm for testing and inspecting box culverts produced for the PROJECT and approved by the OWNER prior to submittal of bids for the PROJECT.

All such quality control programs shall be paid for by the manufacturer. It is the intent of this requirement that the manufacturer will document all appropriate tests and inspections with sampling and inspection criteria, frequency of testing and inspection, date of testing and inspection and date on which every piece was manufactured. Required testing and inspection, including that by an independent, third party, shall be performed full-time during production of box culverts for the PROJECT. When requested by the OWNER, the manufacturer will provide copies of test data and results and inspection reports with the shipment of box culverts for the PROJECT. Test data and results and inspection reports shall be traceable to specific box culverts lots or pieces. Owner approval of the manufacturer's quality control program will expire after three years, at which time the manufacturer must present a current quality control program for approval.

The quality of materials and, the process of manufacturing and furnishing box culverts shall be subject to inspection and approval by the E/A at the box culvert manufacturing plant and at the project site prior to and during installation. Plant inspections shall be conducted at the discretion of the City Representative. Only manufacturers having a quality control program of the type described above will be considered as approved providers of concrete box culverts and storm water manholes.

559S.4 - Materials**A. Concrete**

Class C Concrete shall be used for cast-in-place and precast (formed) box culverts conforming to the requirements of Standard Specification Item No. 403S, "Concrete Structures" and Standard Specification Item No. 410S, "Concrete for Structures", except that Class S Portland cement Concrete will be required for the top slab of direct traffic boxes.

Portland cement concrete for precast (machine made) boxes shall conform to the current version of ASTM C 1577 and shall have a minimum 28-day compressive strength of 5,000 psi (34.475 mPa).

B. Reinforcement

Reinforcing steel for cast-in place and precast (formed) box culverts shall conform to Standard Specification Item No. 406S, "Reinforcing Steel".

Reinforcing steel for machine made boxes shall in accordance with ASTM C1577

C. Jointing Material

Unless otherwise shown on the drawings, when installing box culverts, the Contractor shall have the option of making joints with preformed flexible joint sealants or with rubber gaskets. Preformed flexible joint sealants for box culvert joints shall comply with ASTM C990, and rubber gaskets for box culvert joints shall comply with ASTM C1677. Mortar shall not be used to seal pre-fabricated joints. Box culvert joint shall be designed to prevent the flow of solids through the joint.

D. Membrane Curing

Materials for membrane curing for cast-in-place and precast (formed) box culverts shall conform to Standard Specification Item No. 409S, "Membrane Curing". Materials for membrane curing for machine made boxes shall be in accordance with ASTM C1577.

E. Admixtures

Admixtures for all box culverts shall conform to Standard Specification Item No. 405S, "Concrete Admixtures". Air entraining admixtures shall be added to the mixture to produce concrete with not less than 4, nor more than 7 percent, air content by volume.

F. Granular Backfill

Materials for Granular Backfill shall conform to Standard Specification Item No. 210S, "Flexible Base".

G. Foundation Rock

Bedding material shall be 1-inch (25 mm) to 3-inch (75mm) diameter clean gravel or crushed gravel or crushed rock in conformance with Standard Specification Item No. 510 "Pipe."

H. Geotextile Filter Fabric for Bedding Material

Geotextile filter fabric for bedding material shall be Webtec, Terra Tex NO 4 (AOS US Standard Sieve 70) geotextile fabric or approved equal.

559S.5 - Fabrication

The fabrication of machine-made precast boxes shall comply with ASTM C1577.

Forms for precast (machine made) boxes shall be made of steel. Forms for precast (formed) boxes may be either wood or steel. Forms shall be mortar-tight and of sufficient strength to prevent bulging or misalignment of adjacent boxes. They shall be constructed to permit their removal without damage to the concrete. Offsets at form joints shall not exceed 1/8 inch (3.2-mm). Forms shall be clean and free of extraneous matter when Portland cement concrete is placed.

Positive means of supporting steel cages in place throughout forming and Portland cement concrete placement will be required and subject to the approval of the Engineer or designated representative. Welding of reinforcing steel will be permitted only where shown on the Drawings. Welding shall be done by a qualified welder.

Precast (machine made) boxes shall be cast by a process, which will provide for uniform placement of the Portland cement concrete in the forms and compaction by mechanical devices, that will assure dense concrete. Portland cement concrete shall be mixed in a central batch plant or other approved batching facility from which the quality and uniformity of the Portland cement concrete can be assured. Transit-mixed concrete will not be acceptable for use in precast (machine made) boxes.

Curing of precast boxes made in a commercial plant shall be by any one or by a combination of the following methods, which are compatible with the joint materials selected or as directed by the Engineer or designated representative.

A. Steam Curing

Boxes will be placed in a curing chamber, free from outside drafts and cured in a moist atmosphere maintained by the injection of steam for such time and temperature as necessary for proper curing. The curing chamber shall be constructed to allow full circulation of steam around the entire box. Steam outlets shall be positioned so that live steam is not applied directly to the Portland cement concrete.

B. Water Curing

Boxes may be water cured by covering with water saturated cotton mats, polyethylene sheeting or polyethylene burlap blankets, by a system of perforated pipe or mechanical sprinklers, by porous hose or by other methods that will keep the boxes moist during the curing period. Water for curing shall conform to Standard Specification Item No. 403S, "Concrete for Structures".

C. Membrane Curing

Type 1 membrane curing compound may be used for interim curing or for complete curing. All surfaces shall be kept moist prior to the application of the curing compound and shall be damp when the compound is applied.

When used for interim curing, the curing compound shall be applied to the outside surface of the box upon removal of forms. It shall also be applied to the inside surface or a suitable covering may be placed over the box opening to protect the inside of the box against rapid drying.

When used for complete curing, curing compound shall be applied to the inside surface of the box when interim curing is applied or when handling strength has been attained, but not later than 24 hours after casting.

Curing shall not be delayed longer than 1 hour after the Portland cement concrete has been placed in the forms or more than ½ hour after removal of forms, unless interim curing is applied.

Precast boxes made in a commercial plant shall be continuously cured for a period of 3 days after reaching handling strength or until the design strength has been attained. Curing may be interrupted for no more than 30 minutes for form removal and no more than 4 hours for removal to a storage area and resumption of curing. All precast boxes shall be protected from freezing during the curing period.

A curing day is a calendar day when the air temperature, taken in the shade away from artificial heat, is above 50°F (10°C) for at least 19 hours or for colder days if satisfactory provisions are made to maintain the temperature at all surfaces of the concrete above 50°F (10°C) for the entire 24 hours.

Test cylinders shall be cured at the same time and in the same manner as the boxes.

Not more than 4 lifting holes may be provided in each box to facilitate handling. They may be cast-in, cut into the fresh Portland cement concrete after form removal or drilled and shall not be more than 2 inches (50-mm) in diameter or 2 inches (50-mm) square. Cutting or displacement of reinforcement will not be permitted. Spalled areas around the holes shall be repaired. Concrete boxes shall be given an ordinary finish conforming to Standard Specification Item No. 410S, "Concrete Structures".

Precast boxes of either type, made in a plant, shall bear the following marking:

The name or trademark of the manufacturer;

The date of manufacture;

The box size and height of fill.

When fitting holes are not provided, one end of each box section shall be clearly marked on the inside and outside walls to indicate the top and/or bottom as it will be installed.

Marking shall be indented into the box or may be painted thereon with waterproof paint.

D. Grout and Bentonite Slurry Injection Holes

Box culvert sections installed by trenchless tunneling and jacking method shall have drilled or fabricated grout injection holes and bentonite slurry injection holes as required by Standard Technical Specification Item No. 501S Jacking or Boring Pipe and its special provision. Injection

holes shall be 1½ inch (38 mm) minimum diameter with plugs cast into the box culvert at the time of manufacture.

559S.6 - Testing

Precast box culverts made in a commercial plant shall be tested and accepted in accordance with ASTM C1577.

Testing of cast-in-place and precast (formed) box culverts shall conform to Standard Specification Item No. 403S, "Concrete for Structures".

559S.7 - Fabricating Tolerances

Tolerances for precast boxes of either type shall conform to the following:

- A. The inside vertical and horizontal dimensions shall not vary from plan requirements more than + ½ inch (12.5-mm).
- B. The horizontal or vertical plane at each end shall not vary from being perpendicular to the top and bottom by more than ½ inch (12.5-mm) when measured diagonally between opposite interior corners of the end section.
- C. The sides of a section at each end shall not vary from being perpendicular to the top and bottom by more than ½ inch (12.5-mm) when measured diagonally between opposite interior corners of the end section.
- D. The thickness of walls and slabs shall not be less than that required by the Drawings, except that an occasional deficiency not greater than ¼ inch (6.3-mm), will be acceptable. If proper jointing is not affected, thick nesses in excess of Drawing requirements are acceptable.
- E. The straightness of the tongue and groove at the mating surface shall not vary by more than ¼ inch (6.3-mm).

Deviations from the above tolerances will be acceptable if the box sections can be fitted at the plant or job site and it is determined that an acceptable joint can be made. For this condition, an acceptable joint is:

When 2 box sections are fitted together on a flat surface in proper alignment and in the position they will be installed, the longitudinal opening at any point shall not exceed 1 inch (50-mm). Box sections accepted in this manner shall be match-marked for installation.

559S.8 - Defects and Repair

Fine cracks or checks on the surface of the member which do not extend to the plane of the nearest reinforcement will not be cause for rejection unless they are numerous and extensive. Cracks, which extend into the plane of the reinforcing steel, but are acceptable otherwise, shall be repaired in an approved manner.

Small damaged or honeycombed areas, which are purely surface in nature, may be repaired. Excessive damage, honeycomb or cracking will be subject to structural review. Repairs shall be sound, properly finished and cured in conformance with the pertinent specifications.

When fine cracks or hairchecks on the surface indicate poor curing practices, further production of precast boxes shall be discontinued until corrections are made and proper curing provided.

559S.9 - Storage and Shipment

Precast boxes shall be stored on level blocking in a manner acceptable to the Engineer or designated representative. No load shall be placed upon them until design strength is reached and curing completed. Shipment of boxes may be made when the design strength and curing requirements have been met.

559S.10 - Construction Methods

Excavation and backfill shall conform to Standard Specification Item No. 401S, "Structural Excavation and Backfill" and Standard Specification Item No. 510, "Pipe", except where tunneling or jacking methods are required or indicated on the Drawings.

Precast concrete boxes shall be bedded on a foundation of firm stable material accurately shaped to conform to their base. When indicated on the Drawings, special bedding materials shall be provided.

The envelope shall extend the full trench width from a depth of 6" (150 mm) and shall rise to at least 12" (300 mm) above the box. Geotextile filter fabric shall be placed within the bedding envelope approximately 8" (200 mm) above the top of the box and covered with a minimum of 4" (100 mm) of bedding material to protect fabric during placement of compaction and backfill. Damaged fabric should be removed and replaced or overlapped at least 12" (300 mm).

Joints sealed with preformed flexible joint sealants shall comply with ASTM C990. Joints sealed with rubber gaskets shall comply with ASTM C1677. Install joint sealants in accordance with the box culvert and joint sealant manufacturers' recommendations. Place the joint sealer so that no dirt or other deleterious materials come in contact with the joint sealing material. Pull or push home the box culvert with enough force to properly seal the joint. Remove any joint material pushed out into the interior of the box culvert to be flush and smooth with the inside surface of the box culvert. Protrusion of joint material greater than 1/8" (3.13 mm) into the interior of the box culvert shall be grounds for rejection of the box as installed. Observe joint sealant manufacturer's recommendations for installation temperature of the joint sealant. Apply joint sealant to box culvert joint immediately before placing box culvert section in trench, and then connect box culvert section to previously laid box culvert section.

Contractor shall provide video recording of installed box culverts, in accordance with the video recording work requirements of Standard Specification Item No. 510.

If video inspections reveals joints where soil infiltration is evident, or where joints or conduits are otherwise defective, then the contractor shall remove and replace all affected conduit or repair joints using joint repair techniques recommended by the manufacturer to achieve a completed system that meets all Contract requirements.

When precast boxes are used to form multiple barrel structures, they shall be placed in conformance with the details indicated on the Drawings. Materials to be used between barrels shall be as indicated on the Drawings.

Connections of precast boxes to cast-in-place boxes or to any required headwalls, wingwalls, riprap or other structures shall conform to the details indicated on the Drawings.

Lifting holes shall be filled with mortar or concrete and cured to the satisfaction of the Engineer or designated representative.

559S.11 - Measurement

A. Cast in Place Box Culverts

The quantities of Portland cement concrete of the various classifications, which will constitute the completed and accepted "Box Culverts" in place will be measured by the cubic yard (cubic meter: 1 cubic meter equals 1.308 cubic yards), based on the dimensions indicated on the Drawings.

B. Precast

Concrete box culverts of each size and type shall be measured by the lineal foot (lineal meter: 1 lineal meter equals 3.28 lineal feet). The measurement will be made between the ends of the box along the central axis. For concrete boxes used in multiple barrel structures, the measured length will be the sum of the lengths of all barrels measured as described above.

559S.12 - Payment

"Concrete Box Culverts" shall be full compensation for constructing, furnishing and transporting boxes; excavation; disposal of surplus or unusable excavated material; providing, hauling, placing, preparing and shaping bedding material and leveling courses; concrete, reinforcing steel; jointing of boxes; connections to existing systems or structures; connections to new systems or structures; preparing, shaping, pumping for dewatering up to 360 gpm; particle migration measures including geotextile filter fabric; hauling, moving, placing and compacting backfill materials; installation and maintenance of temporary pavement repairs; temporary removal and replacement of pavement, curb, drainage structures, driveways, sidewalks, and any other improvements damaged or removed during construction;; and all other items of material, labor, equipment, tools and incidentals necessary to complete this work in accordance with the Drawings and specifications.

Video recording shall be paid for under Standard Specification 510:

Payment will be made under one of the following:

Item No. 559S:	Precast Concrete Box Culverts, ____ Ft. × ____ Ft.	Per Lineal Foot.
Item No. 559S-A:	Cast in Place Concrete Box Culverts	Per Cubic Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 559S, "Concrete Box Culverts"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Detail No. 559S-1	Fabrication Tolerances for Precast Box Culverts

<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 210S	Flexible Base
Item No. 403S	Concrete for Structures
Item No. 405S	Concrete Admixtures
Item No. 406S	Reinforcing Steel
Item No. 409S	Membrane Curing
Item No. 410S	Concrete Structures
Item No. 509S	Trench Safety Systems
Item No. 510	Pipe
<u>American Society for Testing and Materials,</u>	
<u>ASTM Designation</u>	<u>Description</u>
C 1577	Standard Specification for Precast reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD
<u>Texas Department of Transportation, Manual of Testing Procedures</u>	
<u>Test Method</u>	<u>Description</u>
Tex 704-1	Making, Curing, and Testing Compression Test Specimens in Precast Concrete

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Standard Specification Item No. 559S, "Concrete Box Culverts"</u>	
<u>Texas Department of Transportation: Standard Specifications for Construction, Maintenance Of Highways, Streets and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 420	Concrete Structures
Item No. 421	Portland Cement Concrete
Item No. 440	Reinforcing Steel

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ITEM NO. 591S - RIPRAP FOR SLOPE PROTECTION 1-4-16**591S.1 - Description**

This item shall govern the excavation of all materials encountered for placing riprap, disposal of excess material and backfilling around the completed riprap to the grade indicated on the Drawings. The work shall include all pumping and bailing, furnishing and placing riprap of rock or concrete in accordance with the details and to the dimensions 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. The work conducted under this item pertains to riprap for protection of slopes, cuts, fills, drainage facilities and other features susceptible to erosion.

Source: [Rule No. R161-15.14, 1-4-2016](#).

591S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. The type, size, gradation, physical properties and source of rock riprap material; test data for specific gravity, absorption, soundness; and field verification of the rock riprap gradation including a size distribution plot and a list of the measured D15, D50, D85, and D100 (refer to Item No. 591S.3.A).
- B. The type, size, and source of broken concrete riprap material.
- C. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix.
- D. Proposed proportioning of materials for the mortar mix.
- E. Type, details and installation requirements for reinforcement, joint material, tie backs and anchors.
- F. Description of filter fabric including characteristics, test data and manufacturer's recommendations for installation.
- G. The type, size, gradation and source of granular filter material.

Where vegetated soil-riprap is used, and proposed materials differ from the materials already approved for use elsewhere on the project, the submittal requirements also include:

- H. Identification of the seed species, source, mixture, pure live seed (PLS) as listed on the analysis tags, certification tags from all seed bags, and seed calculation worksheet per Item No. 604S, Table 9.
- I. Soil retention blanket material type, evidence that the material is listed on the TxDoT Approved Products List, one (1) full set of manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.
- J. Identification of fill soil class, source, and characteristics of proposed borrow material as described in Item No. 130S Borrow.
- K. Identification of topsoil source and characteristics including textural (clay/silt/sand) percentage.

Source: [Rule No. R161-15.14, 1-4-2016](#).

591S.3 - Materials

- A. Rock

The rock shall be suitable in all respects for the purpose intended. Rock sources shall be selected well in advance of the time the rock will be required and shall be pre-approved by the Engineer. Rock used for riprap shall be hard, durable, and angular in shape and consist of clean field rock or rough unhewn quarry rock as nearly uniform in section as practicable. Neither the width nor the thickness of a single rock shall be less than one-third of its length. The rocks shall be dense, resistant to weathering and water action, and free of overburden, spoils, shale, and organic material. Shale, chalk, and limestone with shale or chalk seams shall not be acceptable. Rounded rock (river rock) shall not be acceptable.

The rock durability shall be evaluated by laboratory tests for specific gravity, absorption, and soundness. The minimum specific gravity shall be 2.4 (150 pounds per cubic foot) and the maximum absorption 4.2% using ASTM D 6473 or Tex-403-A. Soundness shall be tested in accordance with ASTM D 5240 or Tex-411-A and weight loss shall not exceed 18% after 5 cycles of magnesium sulfate solution, nor 14% after 5 cycles of sodium sulfate solution.

The rock riprap material shall be provided as a gradation of larger and smaller rock sizes associated with a rock class or median diameter (D50) as specified in the drawings. Rock diameter for angular material represents the length of the intermediate axis of an individual rock. The material gradation shall conform to table below for the class sizes corresponding to the D50. The D15, D50, D85, and D100 are the rock sizes for which 15%, 50%, 85%, and 100% of the total sample are of equal size or smaller, respectively.

Rock Riprap Gradation Table								
Rock Riprap Class by Median Particle Diameter (D50)		D15 (in)		D50 (in)		D85 (in)		D100 (in)
Class	Diameter (in)	Min	Max	Min	Max	Min	Max	Max
I	6	3.7	5.2	5.7	6.9	7.8	9.2	12.0
II	9	5.5	7.8	8.5	10.5	11.5	14.0	18.0
III	12	7.3	10.5	11.5	14.0	15.5	18.5	24.0
IV	15	9.2	13.0	14.5	17.5	19.5	23.0	30.0
V	18	11.0	15.5	17.0	20.5	23.5	27.5	36.0
VI	21	13.0	18.5	20.0	24.0	27.5	32.5	42.0
VII	24	14.5	21.0	23.0	27.5	31.0	37.0	48.0
VIII	30	18.5	26.0	28.5	34.5	39.0	46.0	60.0
IX	36	22.0	31.5	34.0	41.5	47.0	55.5	72.0

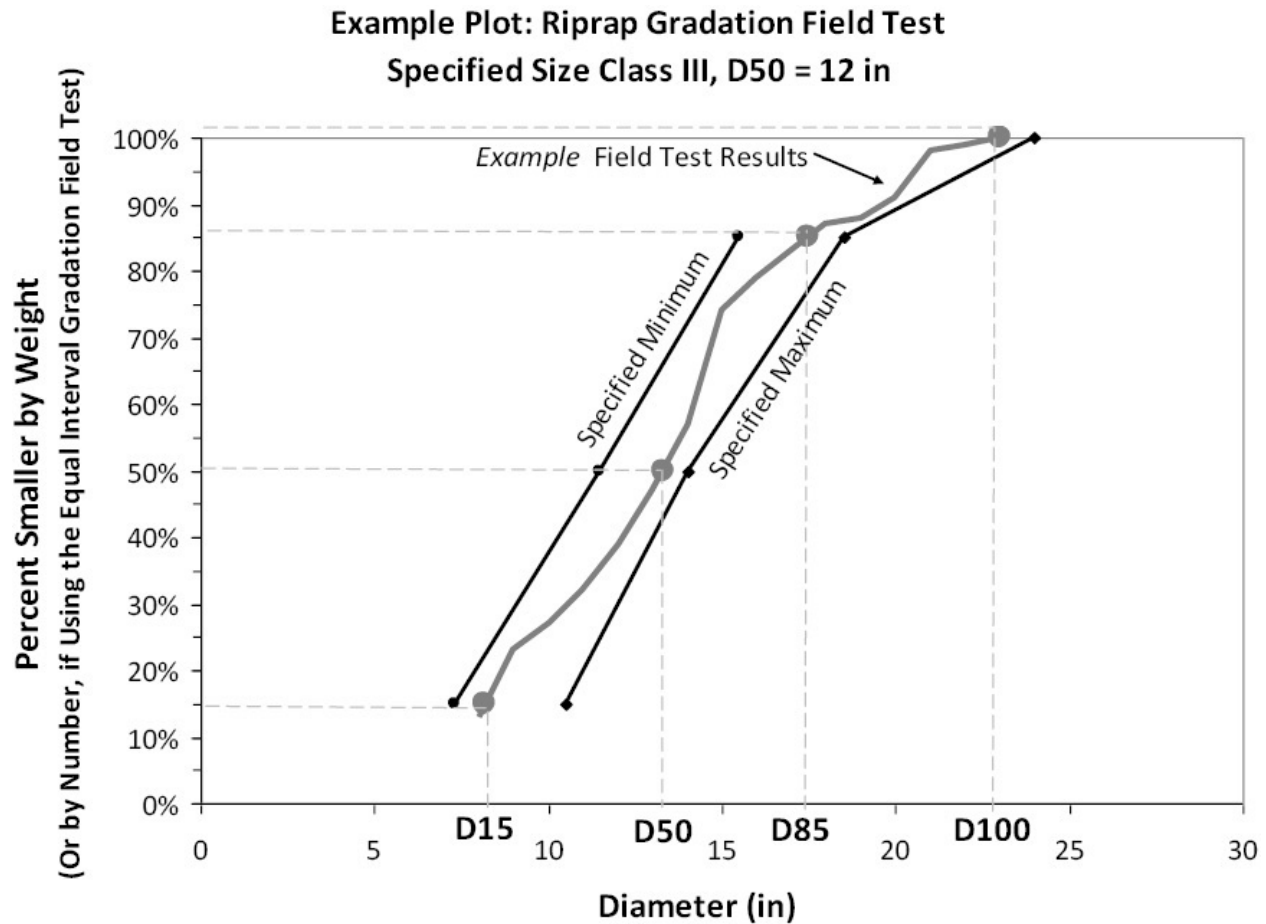
X	42	25.5	36.5	40.0	48.5	54.5	64.5	84.0
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1. Reference: NCHRP Report 568.
2. Conversion to weight-based gradation: $W = 0.0275D^3S_g$ where W is rock size in lbs, D is diameter in inches and S_g is the specific gravity of the rock.

Conformance of rock riprap to the gradation requirements shall be accomplished by field tests for rock sizes that cannot be analyzed via sieve or mechanical sorting machines. In order to perform a field test, the contractor shall provide a sample of the proposed rock riprap material meeting the gradation for the specified size class. Gradation field tests shall follow the equal interval test procedure in NCHRP Report 568, Section 3.2.3, ASTM D 5519, or the modified equal interval method. The general steps of the modified equal interval method are:

1. Spread a representative, well-mixed sample of riprap to form a flat, rectangular pile. The thickness of the pile should be approximately equal to the D100. The length and width of the footprint should be determined based on the rock size and the minimum sample size that is requested by the Engineer.
2. With a tape measure, create a linear transect across the sample pile. Mark each rock that falls directly under the tape measure at an equal interval. The interval should be two feet or greater, depending on the D50, such that no rock is marked more than once.
3. Lay additional transects parallel to the first transect, at a spacing equal to the interval between marked rocks. Repeat Step B for each transect such that the marked rocks form an equally spaced grid across the pile.
4. Measure the diameter of each marked rock across the intermediate (middle or B) axis. The number of rocks measured shall be equal or greater than the minimum sample size.
5. Analyze the data by sorting and plotting a curve of percent smaller by number vs diameter. Identify the diameters.

Gradation tests shall result in: (1) a size distribution plot comparing the measured sample data with the specified diameter ranges for the rock size class (example below), and (2) the calculated D100, D85, D50, and D15 of the rock sample. The sample gradation is acceptable if the calculated diameters fall within the specified ranges of the applicable gradation. The acceptability of rock that falls outside the specified gradation ranges shall be at the discretion of the Engineer.



Approved rock riprap samples shall be stored onsite as a reference for ongoing visual inspection of additional materials supplied. Supplementary tests may be required for supply materials where visual inspection determines there may be a deviation from the required gradation. Labor, equipment and site location needed to assist in checking gradation shall be provided by the contractor at no additional cost to the owner.

B. Broken Concrete

The rock used for mortar riprap may consist of broken concrete removed under the contract or obtained from other approved sources. Broken concrete shall be as nearly uniform in section as practicable and of the sizes indicated in Section 591S.4.A, "Dry Riprap".

C. Concrete

Cast in place concrete shall be Class A Concrete and shall conform to Standard Specification Item No. 403S, "Concrete for Structures".

D. Grout and Mortar

Grout and mortar shall consist of 1 part Portland Cement and 3 parts sand, thoroughly mixed with water. Mortar shall have a consistency such that it can be easily handled and spread by trowel. Grout shall have a consistency such that it will flow into and completely fill all joints.

E. Reinforcement

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

F. Joints

Premolded expansion joint material shall conform to Standard Specification Item No. 408, "Concrete Joint Material".

G. Tie Backs and Anchors

Galvanized tie backs and anchors shall be as indicated on the Drawings.

H. Filter Fabric

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

I. Granular Filter

Aggregate used for granular filters shall conform to Standard Specification Item No. 403S "Concrete for Structures".

J. Soils

For vegetated soil-rock riprap, soil shall be integrated with the rock riprap at 30% soil to 70% rock by volume with minimal voids. Unless specified otherwise in the Drawings, soil that is placed below six inches (6") below the riprap top surface shall be Class A Select Borrow material, as described in Item No. 130S Borrow, and referred to herein as "fill soil." Soil that is placed within the top six inches (6") of the riprap top surface shall be topsoil material as described in Item No. 601S Salvaging and Placing Topsoil, Section 3.

K. Seed

For vegetated soil-rock riprap, the type of seed mix and application rates shall be as specified on the Drawings and within the referenced Standard Specification. If no seed mix is specified, apply according to Item No. 604S Seeding for Erosion Control, Section 6.

L. Soil retention blanket.

For vegetated soil-rock riprap, soil retention blanket shall be TxDOT-approved Class 1 Type C or D, shall be made of 100% biodegradable fibers, unless specified otherwise in the Drawings, Blanket shall comply with the requirements of Item No. 605S Soil Retention Blanket, Section 3.

Source: [Rule No. R161-15.14, 1-4-2016](#).

591S.4 - Construction Methods

Prior to commencement of this work, all required erosion control and tree protection measures (Standard Specification Item 610S, "Preservation of Trees and Other Vegetation") shall be in place and utilities located and protected as set forth in the "General Conditions". Construction equipment shall not be operated within the drip line of trees unless indicated on the Drawings. Construction materials shall not be placed under the canopies of trees. No excavation or embankment shall be placed within the drip line of trees until tree wells (Standard Detail Number 610S-6, "Tree Protection, Tree Wells") are constructed. Spalls and small stones used to fill open joints and voids in rock riprap shall be rocked and wedged to provide a tight fit.

Unsuitable excavated materials or excavation in excess of that needed for construction shall be known as "Waste" and shall become the property of the Contractor and it shall become his sole responsibility to dispose of this material in an environmentally sound manner off the limits of the right of way at a permitted disposal site.

All blasting shall conform to 01550, "Public Safety and Convenience." The Contractor shall comply with all laws, ordinances, applicable safety code requirements, International Fire Code Chapter 27 "Hazardous

Materials General Provisions" and Chapter 33 "Explosives and Fireworks" and any other regulations relative to handling, storage and use of explosives. In all cases, a Blasting Permit must be obtained in advance from the appropriate City agency.

Areas to be protected by rock riprap shall be free of brush, trees, stumps and other objectionable materials and be graded to a smooth compacted surface. All soft or spongy material shall be removed and replaced with appropriate material to the depths shown on the plans or as directed by the engineer. Fill Areas, unless otherwise specified will be compacted in accordance with 132S - Embankment. Unacceptable subgrade conditions shall be reworked according to the Engineer's recommendations. Excavation areas shall be maintained until the riprap is placed.

A. Dry Rock Riprap

The mass of rock riprap shall be placed as to be in conformance with the required gradation mixtures, to the lines, grades and layers thickness that is shown on the drawings.

When the riprap will be placed on an erodible soil, as determined by the Engineer or designated representative, a layer of geotextile filter fabric or a granular filter layer shall be placed, prior to placement of the riprap material. In some cases multiple layers of granular filter material of varying gradations may be required. The median rock riprap size (D50), rock riprap layer thickness, filter type, when applicable the number of granular filter layers, granular filter aggregate gradations (grade/size classification), granular layer thicknesses shall be specified on the plans. The minimum granular filter layer thickness shall be 4 inches (102 mm). Geotextile filter fabric shall conform to Standard Specification No. 620 and be installed with sufficient anchoring and overlap between seams according to the manufacturer's recommendations to ensure full filter barrier protection of the subgrade after riprap installation. When specified on the plans a four (4) inch minimum thickness granular cushion layer of gravel or sand may be placed over the filter fabric to prevent damage the fabric during placement of rock riprap.

Rock riprap shall be machine placed and distributed such that there will be no large accumulations of either larger or smaller sizes. Placing rock riprap by dumping into chutes or similar methods shall not be permitted. The rocks shall be placed in a single layer with close joints. The rock riprap layer thickness shall be no less than the specified maximum stone size (D100) or 1.5 times the D50, whichever produces the greater thickness. In areas exposed to flowing water the rock riprap layer thickness should be no less than 2.0 times the D50. The upright axis of the rocks shall make an angle of approximately 90 degrees with the embankment slope. The courses shall be placed from the bottom of the embankment upward, with the larger rocks being placed on the lower courses. Open joints shall be filled with spalls. Rocks shall be arranged to present a uniform finished top surface such that the variation between tops of adjacent rocks shall not exceed 3 inches (75 mm). Rocks that project more than the allowable amount in the finished work shall be replaced, embedded deeper or chipped.

B. Mortared Rock Riprap

Rock for this purpose, as far as practicable, shall be selected as to size and shape in order to secure fairly large, flat-surfaced rock which may be laid with a true and even surface and a minimum of voids. Fifty percent of the mass rock shall be broad flat rocks, weighing between 100 and 150 pounds (45 and 69 kilograms) each, placed with the flat surface uppermost and parallel to the slope. The largest rock shall be placed near the base of the slope. The spaces between the larger rocks shall be filled with rocks of suitable size, leaving the surface smooth, reasonably tight and conforming to the contour required on the Drawings. In general, the rocks shall be placed with a degree of care that will insure plane surfaces with variation from the true plane of no more than 3 inches in 4 feet (no more than 60 mm per meter). Warped and curved surfaces shall have the same general degree of accuracy as indicated for plane surfaces.

Before placing mortar, the rocks shall be wetted thoroughly and as each of the larger rocks is placed, it shall be surrounded by fresh mortar and adjacent rocks shall be shoved into contact.

After the larger rocks are in place, all of the spaces or opening(s) between them shall be filled with mortar and the smaller rocks then placed by shoving them into position, forcing excess mortar to the surface and insuring that each rock is carefully and firmly embedded laterally. After the work described above has been completed, all excess mortar forced up shall be spread uniformly to completely fill all surface voids. All surface joints then shall be pointed up roughly, either with flush joints or with shallow, smooth raked joints.

C. Vegetated Soil-Rock Riprap

Adjacent stockpiles of rock riprap, fill soil, and topsoil shall be created and there shall be no premixing of fill soil, topsoil and rock prior to placement. Sufficient soil volume shall be provided to result in a final, complete-in-place ratio of 30% soil to 70% rock riprap by volume.

Place underlying filter material and first layer of rock riprap in accordance with 591S.4.A to a thickness equivalent to the D50 rock size or half the design rock layer thickness, whichever is greater. Place a layer of soil over and within the rock voids such that the top of the soil layer is approximately 75% of the rock layer thickness. Work the soil into the rock layer voids by wetting, prodding with a rock bar, and/or vibratory compaction until the soil height is approximately 50% of the rock height. If the soil height becomes less than 50% of the rock height then repeat the previous steps.

Place the second layer of rock riprap per 591S.4.A up to the final design grade. Place soil over and within the rock riprap, working it into the voids as in the previous step and repeating application as needed until the top of the soil layer approximately matches the top surface of the rock riprap. Excess soil shall not be placed in the voids to the extent that the rock riprap is displaced. The resulting soil-riprap surface shall be smooth, with no lumps or depressions greater than two inches ($\pm 2"$) from the final design grade.

Once the soil-rock matrix is placed, the surface of the soil-rock riprap shall be seeded per the Drawings and covered with biodegradable erosion control fabric.

D. Concrete Riprap

Concrete for riprap shall be placed as indicated on the Drawings or as directed by the Engineer or designated representative. Unless otherwise indicated on the Drawings, concrete riprap shall be reinforced using wire or bar reinforcement.

Concrete shall be Class A or as indicated otherwise on the Drawings and shall conform to Standard Specification Item No. 403S, "Concrete for Structures".

When welded wire reinforcement is indicated, it shall be a minimum of 6 × 6 W1.4 × W1.4 (150 × 150 MW9 × MW9) with a minimum lap of 6 inches (150 mm) at all splices. At the edge of the riprap, the wire fabric shall not be less than 1 inch (25 mm) nor more than 3 inches (75 mm) from the edge of the concrete and shall have no wires projecting beyond the last member parallel to the edge of the concrete.

When bar reinforcement is used, the sectional area of steel in each direction shall not be less than the sectional area of the wire fabric described above. The spacing of bar reinforcement shall not exceed 18 inches (450 mm) in each direction and the distance from the edge of concrete to the first parallel bar shall not exceed 6 inches (150 mm).

Reinforcement shall be supported properly throughout the placement to maintain its position approximately equidistant from the top and bottom surface of the slab.

Unless otherwise noted, expansion joints of the size and type indicated on the Drawings shall be provided at intervals not to exceed 40 feet (12.2 meters) and shall extend the full width and depth of the concrete. Marked joints shall be made 3/8 inch (9.5 mm) deep at 10 foot (3 meter)

intervals. All joints shall be perpendicular and at right angles to the forms unless otherwise indicated on the Drawings.

Slopes and bottom of the trench for toe walls shall be compacted and the entire area sprinkled before the concrete is placed.

After the concrete has been placed, consolidated and shaped to conform to the dimensions indicated on the Drawings and has set sufficiently to avoid slumping, the surface shall be finished with a wooden float to secure a reasonably smooth surface.

Immediately following the finishing operation, the riprap shall be cured conforming to Standard Specification Item No. 410S, "Concrete Structures".

E. Pneumatically Placed Concrete Riprap, Type I and Type II

Pneumatically placed concrete for riprap shall be placed as indicated on the Drawings or as established by the Engineer or designated representative. Pneumatically placed concrete shall conform to Standard Specification Item No. 404S, "Pneumatically Placed Concrete". Reinforcement shall conform to the details indicated on the Drawings and Standard Specification Item No. 406S, "Reinforcing Steel". Reinforcement shall be supported properly throughout placement of concrete. All subgrade surfaces shall be moist when concrete is placed.

The surface shall be given a wood float finish or a gun finish as indicated on the Drawings.

The strength and design of Pneumatically Placed Concrete Riprap shall be either Type I or if indicated, Type II conforming to Standard Specification Item No. 404S, "Pneumatically Placed Concrete".

Immediately following the finishing operation, the riprap shall be cured conforming to Standard Specification Item No. 410S, "Concrete Structures".

591S.5 - Measurement

Measurement of acceptable riprap will be made on the basis of the (a) area in square yards (square meters: 1 square meter equals 1.196 square yards) indicated on the Drawings, complete in place or (b) the volume of concrete placed in cubic yards (cubic meters: 1 cubic meters equals 1.308 cubic yards), complete in place as indicated on the Drawings for the thickness specified.

Concrete toe walls will not be measured separately but shall be included in the unit price bid for riprap of the type with which it is placed.

591S.6 - Payment

The riprap quantities, measured as provided above, will be paid for at the unit bid prices per square foot or per cubic yard as indicated for riprap of the various classifications. The Unit Bid Price shall include full compensation for furnishing, hauling and placing all materials, including toe walls, geotextile filter fabric, granular filter material, fill soil and top soil, seed, erosion control fabric, granular cushion, reinforcement and premolded expansion joint material and for all labor, tools, equipment and incidentals necessary to complete the work.

Payment for excavation of toe wall trenches and for all necessary excavation below natural ground or the bottom of excavated drainage channels will be included in the unit bid price for riprap. Excavation, grading and fill materials required to shape drainage channels shall not be included in the unit bid price for riprap.

Payment for excavation required for shaping of slopes for riprap shall be included in the unit bid price for riprap, except for the situation when the header banks upon which the riprap is to be placed are built by prior contract. In this specific case the excavation for shaping of slopes, will be paid for conforming to Standard Specification Item No. 401, "Structural Excavation and Backfill".

Payment will be made under one of the following:

Pay Item No. 591S-A:	Dry Rock Riprap	Per Square Yard.
Pay Item No. 591S-B:	Dry Rock Riprap	Per Cubic Yard.
Pay Item No. 591S-D:	Mortared Rock Riprap	Per Square Yard.
Pay Item No. 591S-F:	Concrete Riprap, ____ In.	Per Square Yard.
Pay Item No. 591S-G:	Concrete Riprap	Per Cubic Yard.
Pay Item No. 591S-I:	Vegetated Soil-Rock Riprap	Per Square Yard.
Pay Item No. 591S-J:	Vegetated Soil-Rock Riprap	Per Cubic Yard.
Pay Item No. 591S-P:	Pneumatically Placed Concrete Riprap, ____ In.	Per Square Yard.

Source: [Rule No. R161-15.14, 1-4-2016](#).

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 591S, "Riprap for Slope Protection"</u>	
<u>International Fire Code</u>	
<u>Designation</u>	<u>Description</u>
Chapter 27	Hazardous Materials
Chapter 33	Explosives and Fireworks

<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
01550	Public Safety and Convenience
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 130S	Borrow
Item No. 403S	Concrete for Structures
Item No. 404S	Pneumatically Placed Concrete
Item No. 406	Reinforcing Steel
Item No. 408	Concrete Joint Material
Item No. 410	Concrete Structures
Item No. 601S	Salvaging and Placing Topsoil
Item No. 604S	Seeding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No.	Preservation of Trees and Other Vegetation

610S	
Item No. 620S	Filter Fabric
<u>American Society for Testing and Materials, ASTM</u>	
<u>Designation</u>	<u>Description</u>
ASTM D 5240	Standard Test Method for Evaluation of Durability of Rock for Erosion Control Using Sodium Sulfate or Magnesium Sulfate
ASTM D 5519	Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM D 6473	Standard Test Method for Specific Gravity and Absorption of Rock for Erosion Control
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-403-A	Test Procedure for Saturated Surface-Dry Specific Gravity and Absorption of Aggregates
Tex-411-A	Soundness of Aggregate Using Sodium Sulfate or Magnesium Sulfate
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 432	Riprap

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 591S, "Riprap for Slope Protection"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 623S	Dry Stack Rock Wall

Engineering Design Manuals

Federal Highway Administration, 1989, Design of Riprap Revetment, Hydraulic Engineering Circular HEC-11, FHWA-1P-89-016.

National Cooperative Highway Research Program, 2006, Riprap Design Criteria, Recommended Specifications, and Design Criteria, NCHRP Report 568.

United States Bureau of Reclamation, 1983, Hydraulic Design of Stilling Basins and Energy Dissipators, Engineering Monograph No. 25.

U.S Department of Agriculture, 1983, Soil Conservation Service, Riprap for Slope Protection Against Wave Action, Technical Release No. 69, February.

US Army Corps of Engineers, 1994. Hydraulic Design of Flood Control Channels, US Army Corps of Engineers Engineer Manual EM 1110-2-1601.

Federal Highway Administration, 1998. "Geosynthetic Design and Construction Guidelines," FHWA-HI-95-038.

ITEM NO. 593S - P.C. CONCRETE RETARDS 2-24-10**593S.1 - Description**

This item governs Portland Cement concrete retards used to anchor underground pipe. Retards shall be constructed as indicated on the Drawings, presented in City of Austin Standard Detail 593S-1 or as directed by the Engineer or designated representative in accordance with these specifications.

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

593S.2 - Submittals

The submittal requirements of this specification item include:

- A. Class D p.c. concrete mix design,
- B. Construction details (i.e. reinforcing steel, curing membrane).

593S.3 - Materials**A. Portland Cement Concrete**

The concrete materials used in construction under this item shall conform to Class D, Standard Specification Item No. 403, "Concrete for Structures".

B. Reinforcement

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

593S.4 - Construction Methods

Prior to placement of Portland cement concrete, excavation for retards shall be made to proper section and depth. If considered necessary by Engineer or designated representative, the bottom of the excavation shall be hand tamped and sprinkled. The excavated area for concrete retards shall be moist when the Portland cement concrete is placed.

After the Portland cement concrete has been placed, consolidated and shaped to conform to the dimensions indicated on the Drawings and after sufficiently set, it shall be given a moderately rough finish by floating with a wood float (Standard Specification Item No. 411S, "Surface Finishes for Concrete").

No mortar or concrete work shall be undertaken, when the ambient temperature is below 350F (10C) and Work shall be protected from freezing. After completion of the concrete retard, exposed surfaces shall be covered with burlap, cotton mats or other approved covering and kept moist for a minimum period of 3 days. White pigmented curing compound conforming to Item No. 409S, "Membrane Curing", Type 2, will be permitted when applied to exposed surfaces.

Unless directed otherwise by the Engineer or designated representative, the material excavated during trenching shall be disposed of at a permitted site.

593S.5 - Measurement

Concrete Retards will be measured either by the cubic yard per Drawing dimensions or on a unit basis complete in place.

593S.6 - Payment

Work performed and materials furnished as prescribed by this Standard Specification item, measured as provided under the "Measurement" section will be paid for by the cubic yard or the unit price bid for "Concrete Retards", as indicated in the Contract Documents. The bid pay item price shall include full compensation for excavation, reinforcing, furnishing, hauling and placing all materials required in the construction, the disposal of excavated material and any manipulation, labor, tools, equipment and incidentals necessary to complete the work.

This item shall also govern any pumping, bailing and dewatering or drainage necessary to complete the work when Concrete Retards are indicated on the Drawings or required by the Engineer or designated representative.

Payment will be made under one of the following:

Pay Item No. 593S-A:	Portland Cement Concrete Retards	Per Cubic Yard.
Pay Item No. 593S-B:	Portland Cement Concrete Retards	Per Each.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 593S, "P.C. Concrete Retards"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures".
Item No. 406S	Reinforcing Steel".
Item No. 409S	Membrane Curing",
Item No. 411S	Surface Finishes for Concrete
Item No. 507S	Trench Safety Systems"

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
No. 593S-1	Concrete Retard

RELATED CROSS REFERENCE MATERIALSSpecification Item No. 593S, "P.C. Concrete Retards"City of Austin Special Specifications

<u>Designation</u>	<u>Description</u>
Item No. 402S	Controlled Low Strength Material
Item No. 405 S	Concrete Admixtures
Item No. 407S	Fibrous Concrete
Item No. 501S	Jacking or Boring Pipe
Item No. 504S	Adjusting Structures
Item No. 505S	Concrete Encasement and Encasement Pipe

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 506S	Manholes
Item No. 507S	Bulkheads
Item No. 510	Pipe

Item No. 511S	Water Valves
<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 421	Portland Cement Concrete
Item 440	Reinforcing Steel
Item 526	Membrane Curing
Item 532	Concrete Erosion Retards

ITEM NO. 601S - SALVAGING AND PLACING TOPSOIL 11-14-16

601S.1 - Description

This item shall govern the removal, storage and placement of approved on-site naturally occurring topsoil and topsoil mix (see 601S.3.A) to the depths and area shown on the Drawings or as directed by the Engineer or Landscape Architect.

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.

Source: [Rule No. R161-16.21, 11-14-16](#).

601S.2 - Submittals

A. Submittals required before construction:

1. Soil test results and soil classification necessary for approval of material as suitable topsoil. Soil test results should include, at minimum, texture; percentage organic matter (OM); salinity (soil salt) level; pH; and amounts of phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), nitrate-nitrogen ($\text{NO}_3\text{-N}$), and sulfate-sulfur ($\text{SO}_4\text{-S}$).
2. For topsoil mixes containing compost, the soil test for shall also include moisture content, C:N ratio and Solvita compost maturity index.
3. A sample (1-gallon) of proposed topsoil or topsoil 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.

B. Submittals/Inspection required during construction:

1. Delivery tickets indicating type/product name, source and quantities of imported topsoil mix or compost (for mixing with salvaged soil).
2. Deliveries of soil to a job site shall be inspected by the project Engineer or Landscape Architect or Owner's construction inspector before placement to verify product compliance with specification.

Source: [Rule No. R161-16.21, 11-14-16](#).

601S.3 - Materials

A. **Topsoil Mix**

1. Topsoil mix shall be composed of 4 parts of soil mixed with 1 part compost, by volume. The soil shall be locally available native soil that meets the following specifications:
 - a) Shall be free of trash, weeds, deleterious materials, rocks and debris.
 - b) 100% shall pass through a 3/8 -inch (9.5 mm) screen.
 - c) Soil to be a black or dark brown loamy material that meets the requirements of the table below in accordance with the USDA textural triangle. Soil known locally as "red death" is not an allowable soil. Textural composition shall meet the following criteria:

Textural Class	Minimum	Maximum
Clay	5%	50%
Silt	10%	50%
Sand	15%	67%

- d) Organic matter percentage shall be at least 5.0% after the addition of compost.
 - e) Salinity shall be below 6.00 mmhos/cm.
 - f) An owner/project designer(s) may propose use of onsite salvaged topsoil which does not meet the soil texture class required above by providing a soil analysis and a written statement from a qualified professional in soils, landscape architecture, or agronomy indicating the onsite topsoil will provide an equivalent growth media and specifying what, if any, soil amendments are required.
2. The compost shall be locally available and shall meet the following specifications:
- a) Shall be well decomposed, stable to very stable, weed-free plant-based material 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".
 - b) Shall be blended and ground leaf, wood and other plant-based material, composted for a minimum of nine (9) months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plants or other materials designed to produce compost high in fungal material. Non-vegetal source materials may be acceptable upon approval by the Owner. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.
 - c) Compost shall be commercially prepared compost and meet US Compost Council STA/TMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".
http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf
 - d) Compost shall comply with the following parameters:

PARAMETERS ¹	REPORTED AS (UNITS OF MEASURE)	GENERAL RANGE
pH	pH units	6.0 - 8.5
Salinity (electric conductivity)	dS/m (mmhos/cm)	Maximum 10

Moisture Content	%, net weight basis	30 - 60%
Organic Matter Content	%, dry weight basis	30 - 65%
Particle Size	% passing a selected mesh size, dry weight basis	98% pass through ¾ inch screen
Stability Carbon Dioxide Evolution Rate	mg CO ₂ -C per g OM per day	<8
Solvita Compost Maturity Test	Solvita units	>6
Physical Contaminants (inerts)	%, dry weight basis	<1%
Chemical Contaminants ²	mg/kg (ppm)	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels
Biological Contaminants Select pathogens Fecal coliform bacteria or Salmonella ³	MPN per gram per dry weight MPN per 4 grams per dry weight	Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

¹ Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council).

² US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels = Arsenic 41 ppm, Cadmium 39 ppm, Copper 1,500 ppm, Lead 300 ppm, Mercury 17 ppm, Molybdenum 75 ppm, Nickel 420 ppm, Selenium 100 ppm, Zinc 2,800 ppm.

³ US EPA Class A standard, 40 CFR § 503.32(a) levels = Salmonella <3 MPN/4grams of total solids or Fecal Coliform <1,000 MPN/gram of total solids.

- e) Compost and other soil amendments shall be worked into the existing on-site topsoil with a disc or tiller to create a well-blended material.
- 2. All disturbed areas to be revegetated are required to provide a minimum of six (6) inches of topsoil. The topsoil shall be able to support the growth of planting (Standard Specification Item No. 608S), Seeding for Erosion Control (Standard Specification Item No. 604S), sodding (Standard Specification Item No. 602S) and Native Seeding and Planting for Restoration (Standard Specification Item No. 609S).

- B. **Water.** Water shall be furnished by the Contractor and shall be clean and free from seed source, pesticide, fertilizer, industrial wastes and other objectionable matter.

Source: [Rule No. R161-16.21, 11-14-16](#).

601S.4 - Sources

The salvaged topsoil may be obtained from the right-of-way at sites of proposed excavation or embankment when shown on the Drawings or identified by the Engineer or Landscape Architect. The approximate quantity of acceptable topsoil to be salvaged from the project will be shown on the Drawings. The topsoil or topsoil mix may also be obtained from approved sources, which are located outside the right-of-way and have been secured by the Contractor.

Source: [Rule No. R161-16.21, 11-14-16](#).

601S.5 - Construction Methods

Tree protection fencing will be maintained at all times to protect all trees in the limits of construction. Where removal of trees is indicated on the Drawings, they shall be marked as directed by the Engineer, Landscape Architect, or certified arborist.

Construction equipment shall not be operated nor construction materials stockpiled within the critical root zone of trees. Tree protection fencing shall remain in place per tree protection plan. Topsoil materials shall not be placed within the critical root zones of trees until tree wells are constructed that conform to Item No. 610S, "Preservation of Trees and Other Vegetation " and Standard Details 591S-1 and 610S-6. The source and stockpile areas shall be kept drained, insofar as practicable, during the period of topsoil removal.

The existing topsoil shall be removed from the area indicated on the Drawings, stockpiled in designated area on the site plan, windrow along the right of way or other designated area outside the 100-year floodplain (as defined in the Drainage Criteria Manual and Land Development Code) or spread over an area that is ready for topsoil application in accordance with the Drawings or as directed by the Engineer or Landscape Architect.

Trash, wood, brush, stumps, rocks over 1½ inches (37.5 mm) in size and other objectionable material encountered shall be removed and disposed of as directed by the Engineer or Landscape Architect prior to beginning of work required by this item. Grass and other herbaceous plant materials may remain. Large clumps shall be broken up.

Where the proposed planting area is compacted more than 85% proctor or 225 p.s.i., the existing soil should be tilled to a minimum depth of six inches before installation of the salvaged topsoil or topsoil mix. In the critical root zone of trees reference 661S.

The topsoil should not be placed if the ground is muddy, saturated, or frozen.

The topsoil should not be placed if the ground is extremely dry. Wet soil enough to prevent dust from leaving the site.

After the grading has been completed to the required alignment, grades and cross-sections and prior to the spreading of the salvaged topsoil, any clay or tight soil surfaces shall be scarified by plowing furrows approximately 4 inches (100 mm) deep along horizontal slope lines at 2 foot (600 mm) vertical intervals. The spreading of the salvaged topsoil or topsoil mix shall be undertaken as soon as the grading has been completed. The topsoil shall be spread so as to form a cover of uniform thickness indicated. After the topsoil has been placed and shaped, it shall be sprinkled with water and rolled to provide a suitable seed bed.

Source: [Rule No. R161-16.21, 11-14-16](#).

601S.6 - Measurement and Payment

Salvaging, removal and/or placing topsoil materials will not be measured for payment, but shall be included in the unit price bid for the item of construction in which these activities are used.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 601S, "Salvaging and Placing Topsoil"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 608S	Planting
Item No. 609S	Native Seeding and Planting For Restoration
Item No. 610S	Preservation of Trees and Other Vegetation
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
591S-1	Dry Stack Rock Wall
610S-6	Typical Tree Well Applications

RELATED CROSS REFERENCE MATERIALS**Specification 601S, "Salvaging and Placing Topsoil"****City of Austin Standard Specification Items**

<u>Designation</u>	<u>Description</u>
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 606S	Fertilizer

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
610S-1	Tree Protection Fence Locations
610S-2	Tree Protection Fence, Type B Chainlink
610S-3	Tree Protection Fence, Type B Wood
610S-4	Tree Protection Fence, Modified Type A
610S-5	Tree Protection Fence, Modified Type B

<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
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

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ITEM NO. 602S - SODDING FOR EROSION CONTROL 6-16-08**602S.1 - Description**

This item shall govern planting of Bermuda grass; St. Augustine or other acceptable grass sod at locations indicated on the Drawings or as directed by the Engineer or designated representative in accordance with this Standard Specification Item.

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

602S.2 - Submittals

The submittal requirements for this specification item shall include the identification of the type and source of sodding, the type of mulch, type of tacking agent and type and rate of application of fertilizer.

602S.3 - Materials**A. Block and Mulch Sod**

The sod shall consist of live, growing Bermuda Grass, St. Augustine grass, when shown on the Drawings, or other acceptable grass sod indicated on the Drawings secured from sources that are approved by the Engineer or designated representative. Bermuda Grass sod, St. Augustine sod or other grass sod as shown on the Drawings shall have a healthy, virile root system of dense, thickly matted roots throughout the soil of the sod for a minimum thickness of 1 inch (25 millimeters). The thickness measure does not include grass. The sod shall be cut in rectangular pieces with its shortest side not less than 12 inches (300 mm). The Contractor shall not use sod from areas where the grass is thinned out nor where the grass roots have been dried out by exposure to the air and sun to such an extent as to damage its ability to grow when transplanted.

The sod shall be substantially free from noxious weeds, Johnson grass or other grasses and shall not contain any matter deleterious to its growth or which might affect its subsistence or hardness when transplanted. Unless the area has been closely pastured, it shall be closely mowed and raked to remove all weeds and long standing stems. Sources from which sod is to be secured shall be approved by the Engineer or designated representative.

Care shall be taken at all times to retain the native soil of the roots of the sod during the process of excavating, hauling and planting. Sod material shall be kept moist from the time it is dug until it is planted. The sod existing at the source shall be watered to the extent required by the Engineer or designated representative prior to excavating.

B. Fertilizer

Fertilizer and the rate of application shall conform to the requirements of Standard Specification Item No. 606S, "Fertilizer".

C. Mulch

Straw mulch shall be oat, wheat or rice straw. Hay mulch may be substituted for straw mulch and shall be Prairie Grass, Bermuda grass or other hay approved by the Engineer or designated representative. The hay or straw mulch shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be molded or rotted.

D. Water

Water shall be furnished by the Contractor and shall be clean and free of industrial wastes and other substances harmful to the growth of sod or to the area irrigated.

E. Tacking Agents

Tacking agents for straw or hay mulch shall be as shown on the Drawings.

602S.4 - Planting Season

All planting shall be done between April and November except as specifically authorized in writing by the Engineer or designated representative.

602S.5 - Construction Methods**A. General**

After the designated areas have been completed to the lines, grade and cross sections indicated on the Drawings, the surface shall be worked to a depth of not less than 4 inches (100 mm) with a disc, tiller or other equipment approved by the Engineer or designated representative. Fertilizer nutrients shall be applied and tilled. Areas that become crusted shall be reworked to an acceptable condition before sodding. Sodding of the type specified shall conform to the requirements of this Specification Item. The Contractor shall give continuous care to the sodded area until the sod is accepted.

B. Placement

The sod shall be placed on the prepared surface with the edges in close contact and alternate courses staggered. In ditches the sod shall be placed with the longer dimension perpendicular to the flow of water in the ditch. On slopes, starting at the bottom of the slope, the sod shall be placed with the longer dimension parallel to the contours of the ground. The exposed edges of sod shall be buried flush with the adjacent soil. On slopes exceeding 3:1 or where the sod may be displaced, the sod shall be pegged with not less than 4 stakes or ground staples per square yard (square meter) with at least 1 stake or ground staple for each piece of sod.

Pegs shall be of wood lath or similar material, pointed and driven with the flat side against the slope, 6 inches (150 mm) into the ground, leaving approximately ½ inch (12.5 mm) of the top above the ground. Ground staples shall not be less than 13 inches (330 mm) in length and shall be constructed of No. 11 gage (3 mm) wire that is bent to form a "U" approximately 1 inch (25 mm) in width.

C. Watering

Immediately after the area is sodded, it shall be watered with a minimum of 5 gallons of water per square yard (22.5 liters per square meter) and at 10 day intervals as needed and as directed by the Engineer or designated representative. Subsequent to the initial application water shall be applied at a minimum rate of 3 gallons per square yard (13.5 liters per square meter), as required on the Drawings or as directed by the Engineer or designated representative until final acceptance by the City or until the grass uniformly reaches a height of 2 ½ inches (62.5 mm).

Availability of water from the Austin Water Utility will be limited as stated under the Water Conservation Standard, City of Austin Land Development Code Chapter 6-2, Article II, "Water Use Management Plan Established".

The use of potable water will be restricted as stated in city of Austin Land Development code Sections 6-4-73, 6-4-54, 6-4-63, 6-4-64, 6-4-65, 6-4-81, 6-4-92, 15-9-37(D) and 15-9-101(B).

D. Finishing

Where applicable, the shoulders, slopes and ditches shall be smoothed after planting has been completed and shaped to conform to the desired cross sections shown on the Drawings. Any excess soil from planting operations shall be spread uniformly over adjacent areas or disposed of as directed by the Engineer or designated representative so that the completed surfaces will present a

neat appearance. All sodded areas shall be rolled after the initial watering application, when sufficiently dry.

602S.6 - Block Sodding

At locations indicated on the Drawings or where directed by the Engineer or designated representative, sod blocks shall be carefully placed on the prepared areas. The fertilizer shall then be applied in accordance with the applicable provisions of Item No. 606S, "Fertilizer" and thoroughly watered. When sufficiently dry, the sodded area shall be rolled or tamped to form a thoroughly compacted, solid mat. Any voids left in the block sodding shall be filled with additional sod and tamped. Surfaces of block sod which, in the opinion of the Engineer or designated representative may slide due to the height and slope of the surface or nature of the soil, shall be pegged with wooden pegs driven through the sod blocks into firm earth sufficiently close to hold the block sod firmly in place. Edges along curbs and drives, walkways, etc., shall be carefully trimmed and maintained until the sodding is accepted.

602S.7 - Mulch Sodding

The sod source shall be disked in 2 directions cutting the sod thoroughly to a depth of not less than 4 inches (100 mm). Sod material shall be excavated to a depth of not more than 2 inches (50 mm) below the existing root system, being careful to avoid having soil containing no grass roots. The disked sod may be windrowed or otherwise handled in a manner satisfactory to the Engineer or designated representative. The material shall be rejected if not kept in a moist condition.

Prior to placement of mulch sod, the cut slopes shall be scarified by plowing furrows 4 inches (100 mm) to 6 inches (150 mm) deep along horizontal slope lines at 2 foot (600 mm) vertical intervals. Excavated material from the furrows shall not protrude more than 3 inches (75 mm) above the original surface of the cut. Fertilizer shall be distributed uniformly over the area in accordance with the applicable provisions of Item No. 606S, "Fertilizer". The sod shall then be deposited upon the prepared area and spread uniformly to the thickness indicated on the Drawings.

Any section that is not true to lines and cross sections shall be remedied by the addition of sod material or by reshaping the material to meet the requirements of "Finishing" [Section 602S.5 (4)]. After the sod material has been spread and shaped, it shall be thoroughly wetted and compacted with a corrugated roller of the "Cultipacker" type. All rolling of slope areas shall be on the contour.

602S.8 - Measurement

Work and acceptable material for "Sodding for Erosion Control" will be measured by the square yard (square meter: 1 square meter is equal to 1.196 square yards) complete in place with a minimum of 95 percent growth with a 2 ½ inch (62.5 mm) stand of grass.

602S.9 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price for Bermuda Block Sodding", "St. Augustine Block Sodding", "Bermuda Mulch Sodding" or "Other Approved Grass Sodding". The prices shall each represent full compensation for completion of the work including all water applications, rolling, pegging and fertilizer as indicated on the Drawings.

Payment will be made under one of the following:

Pay Item No. 602S-A:	Bermuda Block Sodding	Per Square Yard.
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Pay Item No. 602S-B:	St. Augustine Block Sodding	Per Square Yard.
Pay Item No. 602S-C:	Bermuda Mulch Sodding	Per Square Yard.
Pay Item No. 602S-D:	Grass Sodding	Per Square Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 602S, "Sodding for Erosion Control"</u>	
<u>City of Austin Land Development Code</u>	
<u>Designation</u>	<u>Description</u>
Chapter 4-2, Art. II	Emergency and Peak Day Water Use Management
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 606S	Fertilizer
<u>City of Austin Land Development Code</u>	
<u>Designation</u>	<u>Description</u>
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 MATERIALSSpecification 602S, "Sodding for Erosion Control"City of Austin Standard Specification Items

<u>Designation</u>	<u>Description</u>
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 601S	Salvaging and Placing Topsoil
Item No. 604S	Seeding for Erosion Control

Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 160	Furnishing and Placing Topsoil
Item No. 162	Sodding for Erosion Control
Item No. 164	Seeding for Erosion Control
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 204	Sprinkling

ITEM NO. 604S - SEEDING FOR EROSION CONTROL 1-4-16

604S.1 - Description

This item shall govern the preparation of a seed bed for temporary or permanent erosion control; sowing of seeds; fertilizing; mulching with straw, cellulose fiber wood chips, and recycled paper mulch; and other management practices along and across such areas as indicated in the Drawings or as directed by the Landscape Architect, Engineer or designated representative.

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

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

604S.2 - Submittals

The following submittal items are required in writing during construction:

- A. Identification of the seed species, source, mixture, and pure live seed (PLS) of the seed as listed on the analysis tags and certification tags from all seed bags. Seed calculation worksheet per Table 7. PLS is the percentage of seed purity multiplied by the percentage of germination, plus dormant seed. The analysis tag, required on all seed sold in Texas, includes information on quality: kind and variety of seed, lot number, percent pure live seed, percent other crop seed, percent inert matter, percent weed seeds, germination percentage, and date of test. The certification tag also verifies seed quality, an assurance of seed variety and attesting to standards for germination and purity. Information provided includes class of certification, kind of crop, variety, lot number, and name and address of the owner.
- B. If fertilizer is proposed, results of a recent soil test (6 months old or less) of the area to be seeded, before fertilization. Soil samples shall be collected after final grading, when topsoil has been placed. The test results must include soil lab recommended additions of Nitrogen (N), Phosphorus (P), and Potassium (K) for the type of vegetation proposed, as well as soil organic matter percentage and textural class.
- C. Fertilizer formulation and release rate based on a soil test (see B above).
- D. For hydromulch applications, proposed application rate of seed, type of mulch and tacking agent, and other relevant information. An example of the required documentation is in Table 1.
- E. Type of hydraulic seeding equipment and nozzles proposed for use.
- F. If pesticide use is proposed, an IPM plan for pest removal including pesticide label, proposed application rate and timing, and MSDS sheets.
- G. One gallon sample of proposed vegetative mulch.

The following submittal items are required before Substantial Completion:

- A. For hydromulch applications, the complete hydromulch application log, including date, time and quantity of product units placed in the slurry tank. An example of an application log is provided in Table 2. This log may be requested at any time during construction by the Landscape Architect, Engineer, designated representative, or authorized inspector.
- B. Pesticide application tracking log. As of January 1, 2012, documentation of all outdoor pesticide use on city-owned properties is required to demonstrate compliance with the EPA/TCEQ mandated Municipal Stormwater Permit, the TPDES General Pesticide Permit, City Code, and the IPM program.

Table 1: Example of proposed hydromulch application rates

				Hydro Slurry Unit (per acre rates)				
Hydro Mix	Sheet No.	Seed Mix	Acres	Seed (Bags/ac)	Tackifier (Buckets/ac)	Mulch (Bales/ac)	Fertilizer (Bags/ac)	Addl. Amendments (Bags/ac)
1	L2	A	1.0	1	100	1000	50	5
2	L3	A	0.5	2	200	1500	50	5
3	L5	B	3.0	3	300	3000	50	5

Table 2: Example of hydromulch application log

						Hydro Slurry Unit (per acre rates)				
Date	Start Time	Finish Time	ac/Tank	Water (gal)	Seed Mix	Seed (Bags/ac)	Tackifier (Buckets/ac)	Mulch (Bales/ac)	Fertilizer (Bags/ac)	Addl. Amendments (Bags/ac)
4/13	10:30	11:15	1.0	3300	A	1	100	1000	50	5
4/17	2:00	2:30	0.5	3300	A	2	200	1500	50	5
5/20	8:30	10:00	1.2	3300	B	3	300	3000	50	5
					Totals	6	600	5500	127	15

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

604S.3. - Materials

- A. **Seed.** All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing PLS, name and type of seed, and all other required elements of the Analysis and Certification Tags.

The seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within twelve (12) months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers, unless a specific mix is proposed for use. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Landscape Architect, Engineer or designated representative.

The amount of seed planted per square yard (0.84 square meters) or acre (hectare [ha]) shall be of the type specified in Sections 604S.5 and 604S.6.

- B. **Water.** Water shall be clean and free of industrial wastes and other substances harmful to the growth of plant material or the area irrigated.
- C. **Topsoil.** Topsoil shall conform to Item No. 601S.3(A).
- D. **Fertilizer.** The fertilizer shall conform to Item No. 606S, Fertilizer. The type and rate of fertilizer should be based on chemical tests of recent (no older than 6 months before application) representative site soil samples. Fertilizer should be applied only when plants can take them up for growth, during: 1) seed germination and plant establishment and 2) after plant establishment. Fertilizer shall not be applied within 48 hours of a potential rain event.
- E. **Straw Mulch or Hay Mulch.** Straw Mulch shall be oat, wheat or rice straw. Hay mulch shall be prairie grass, or other hay approved by the Landscape Architect, Engineer or designated representative. The straw or hay shall be free of Johnson grass or other noxious weeds and foreign materials. It shall be kept in a dry condition and shall not be moldy or rotted.
- F. **Tackifier.** The tackifier shall be a biodegradable tacking agent, approved by the Landscape Architect, Engineer or designated representative.
- G. **Cellulose Fiber Mulch (Natural Wood).** Cellulose Fiber Mulch shall be natural cellulose fiber mulch produced from grinding clean whole wood chips. The mulch shall be designed for use in conventional mechanical planting, hydraulic planting of seed or hydraulic mulching of grass seed, either alone or with fertilizers and other additives. The mulch shall be such, that when applied, the material shall form a strong, moisture-retaining mat without the need of an asphalt binder.
- H. **Recycled Paper Mulch.** Recycled paper mulch shall be specifically manufactured from post-consumer paper and shall contain a minimum of 85% recycled paper content by weight, shall contain no more than 15% moisture and 1.6% ash, and shall contain no growth inhibiting material or weed seeds. The recycled paper mulch shall be mixed with grass seed and fertilizer (see "fertilizer" above) for hydro-seeding/mulching, erosion control, and a binder over straw mulch. The mulch, when applied, shall form a strong, moisture-retaining mat of a green color without the need of an asphalt binder.
- I. **Mulch.** Mulches, acting as seed coverings, can enhance seed germination and seedling establishment. Characteristics of ideal mulches for seeding are those that protect seeds from wind (drying), excessive solar radiation, high evapotranspiration rates, and erosion, while allowing germination and growth. Relatively coarsely shredded, weed-free vegetative mulch should be used on seed installations, especially in open, sunny areas. These materials shall be clean, free of foreign matter, and dry enough to spread evenly.
- J. **Pesticide.** A least toxic, integrated pest management (IPM) approach shall be used to control weeds. A written request for approval of weed control products and materials shall be submitted to the City of Austin Watershed Protection Department (ERM) IPM program coordinator for approval. Additional information can be found at <http://www.austintexas.gov/ipm>.

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

604S.4 - Construction Methods

- A. **General.** The Contractor shall limit preparation of the seedbed to areas that will be seeded immediately. When seeding for permanent erosion control, weed species listed in Table 3 shall be managed by application of an appropriate herbicide and/or by physical removal by the roots before the seeding operation. The goal of weed management is to facilitate establishment of the permanent vegetative cover. Additionally, the Owner may require removal of any plant species that appears to be out-competing seeded or planted species during the construction period.

Table 3: Weed List

Weed Type	Botanical Name	Common Name
Annual Grass	<i>Cenchrus spp.</i>	Sandbur
Herb	<i>Cnidoscolus texanus</i>	Bull Nettle
Herb	<i>Urtica spp.</i>	Stinging Nettle
Vine	<i>Toxicodendron radicans</i>	Poison Ivy
Perennial Grass	<i>Sorghum halapense</i>	Johnson Grass
Perennial Grass	<i>Arundo donax</i>	Giant Cane
Perennial Grass	<i>Phyllostachys aurea</i>	Golden Bamboo
Summer Annual Herb	<i>Ambrosia trifida</i>	Ragweed
Winter Annual Herb	<i>Rapistrum rugosum</i>	Bastard Cabbage
Winter Annual Herb	<i>Bromus arvensis</i>	Japanese Brome
Winter Annual Herb	<i>Lolium multiflorum</i>	Annual Ryegrass

- B. **Preparing Seed Bed.** After the designated areas have been rough graded to the lines, grades and typical sections indicated in the Drawings or as provided for in other items of this contract and for any other soil area disturbed by the construction, a suitable seedbed shall be prepared. The seedbed shall consist of a minimum of either 6 inches (150 millimeters) of approved topsoil or 6 inches (150 millimeters) of approved salvaged topsoil.

The topsoil or growing medium must be prepared so that compaction is appropriate for plant growth, and to achieve acceptable bulk density or hydrologic function. Rippers and subsoilers may be used to loosen compacted soil and roughen the surface. Disks, plows and excavator attachments are

good for compaction reduction, roughening and incorporating amendments. If tracked machinery is used in seedbed preparation, cleat marks should run with the contour to prevent rills. The optimum depth for seeding shall be 1/8 to 1/4 inch (3 to 6 millimeters).

Water shall be gently applied as required to prepare the seedbed prior to the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements described below.

- C. **Watering.** All watering shall comply with City Code Chapter 6-4 (Water Conservation). All seeded areas regardless of seed type and method of seeding (e.g., broadcast, hydroseed) shall be watered immediately after installation. For seed germination and establishment it is important to keep the seedbed in a moist condition favorable for the growth of plant materials.

Watering applications shall constantly maintain the seedbed in a moist condition favorable for the growth of plant materials. Watering shall continue until the plant material is at least 1½ inches (40 mm) in height and accepted by the Engineer or designated representative. Supplemental watering can be postponed immediately after a half-inch (12.5 mm) or greater rainfall on the site but shall be resumed before the soil dries out.

- D. **Cool Season Cover Crop.** From September 15 to March 1, non-native and native seeding shall include a cool season cover crop at the rate specified in Table 6. Cool season cover crops are not permanent erosion control. If installed separately from the permanent erosion control seed mix, the cool season cover crops shall be mowed to a height of less than one (1) inch after March 1, and the area shall be re-seeded at the specified seeding rate for non-native or native warm-season species (March 1 to September 15).

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

604S.5 - Non-Native Seeding

- A. **Method A - Broadcast Seeding.** The seed or seed mixture in the quantity specified shall be uniformly distributed over the prepared seed bed areas indicated on the Drawings or where directed by the Engineer or designated representative. If the sowing of seed is by hand, rather than by mechanical methods, the seed shall be sown in two directions at right angles to each other. If mechanical equipment is used, all varieties of seed, as well as fertilizer (if required), may be distributed at the same time, provided that each component is uniformly applied at the specified rate. After planting, the planted area shall be rolled with a corrugated roller of the "Cultipacker" type. All rolling of the slope areas shall be on the contour.

Seed Mixture and Rate of Application for Broadcast Seeding:

From March 1 to September 15, seeding shall be with hulled Bermuda Grass at a rate of at least 45 lbs/ac (5.0 kilograms per hectare) with a minimum PLS = 0.83. Fertilizer shall be applied if warranted by a soil test, and shall conform to Item No. 606S, Fertilizer. Bermuda grass is a warm-season grass and is therefore considered permanent erosion control once established.

Method B - Hydraulic Planting. The seedbed shall be prepared as specified above and hydraulic planting equipment, which is capable of placing all materials in a single operation, shall be used. Information about hydromulching for temporary and permanent vegetation stabilization is in the Environmental Criteria Manual (ECM) Section 1.4.7. Hydroseeding equipment shall be clean and free of all previous seeds, fertilizer, mulch, or any hydroseeding products used on prior jobs.

From March 1 to September 15.

Hydraulic planting mixture and minimum rate of application pounds per acre or square yard (kilograms per ha):

Hulled Bermuda Seed (min. PLS=0.83)	Fiber Mulch		Soil Tackifier
	Cellulose	Wood	
45 lbs/ac (50.44 kg/ha)	2000 lbs/ac (2242 kg/ha)		60.98 lbs/ac (68.36 kg/ha)
		2500 lbs/ac (2803 kg/ha)	65.34 lbs/ac (73.25 kg/ha)

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. 161-15.14, 1-4-2016](#) .

604S.6 - Native Grass and Forb Seeding

The seed mixture shall include both grasses and forbs. The dry and moist sites grass mix shall be seeded at rates of at least 23.5 and 17.0 lb/ac (26.32 and 19.04 kg/ha), respectively and the dry and wet site forb mix shall be seeded at a rate of at least 11.5 and 9.0 lb/ac (12.88 and 10.08 kg/ha), for total application rates of 35.00 lb/ac (39.20 and 29.12 kg/ha) [dry site] and 26 lb/ac (29.12 kg/ha) [wet site]. Minimum diversity for dry sites (Table 4) is eight species of grasses and 10 species of forbs. Minimum diversity for wet sites (Table 5) is six species of grasses and seven species of forbs. The species indicated with an asterisk shall be included in all proposed mixes. Application rates may be modified, but no species shall constitute more than 20% of a seed mix. Any species proposed for installation and not included in Tables 4 or 5 shall be by City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative, and shall be native to Central Texas as referenced by the LBJ Wildflower Center plant database (www.wildflower.org) or USDA plant database.

Table 4: Native Grasses and Forbs: Dry Sites

Type	Common Name	Botanical Name	Exposure	Recommended Application Rates	
				lbs/ac	kg/ha
Grass Seed Mix	Sideoats grama*	<i>Bouteloua curtipendula</i>	Full-part sun	7.0	7.8
	Green sprangletop*	<i>Leptochloa dubia</i>	Full sun	6.0	6.7
	Buffalograss	<i>Buchloe dactyloides</i>	Full sun	24.0	27.0
	Blue Grama Grass	<i>Bouteloua gracilis</i>	Full-part sun	10.0	11.2

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	Canada Wild Rye	<i>Elymus canadensis</i>	Full-part sun	10.0	11.2
	Purple Three-Awn	<i>Aristida purpurea</i>	Full sun	4.0	4.5
	Cane Bluestem	<i>Bothriochloa barbinodis</i>	Full sun	3.0	3.3
	Galleta	<i>Pleuraphis jamesii</i>	Full sun	10.0	11.2
	Black Grama*	<i>Bouteloua eripoda</i>	Full sun	10.0	11.2
	Sand Dropseed*	<i>Sporobolus cryptandrus</i>	Full sun	1.0	1.1
	Alkali Sacaton	<i>Sporobolus airoides</i>	Full sun	0.5	1.7
	Curly Mesquite	<i>Hilaria belangeri</i>	Full sun	2.0	2.2
	Sand Lovegrass	<i>Eragrostis trichodes</i>	Full sun	2.0	2.2
	Black-Eyed Susan	<i>Rudbeckia hirta</i>	Full-part sun	2.0	2.2
	Illinois Bundleflower*	<i>Desmanthus illinoensis</i> (legume)	Full-part sun shade	15.0	16.8
	Scarlet Sage	<i>Salvia coccinea</i>	Full-part sun shade	8.0	9.0
	Pink Evening Primrose	<i>Oenothera speciosa</i>	Full-part sun shade	1.0	1.1
	Drummond Phlox	<i>Phlox drummondii</i>	Full-part sun	8.0	9.0
	Plains Coreopsis	<i>Coreopsis tinctoria</i>	Full-part sun	2.0	2.2
	Greenthread	<i>Thelesperma filifolium</i>	Full sun	6.0	6.7
	Purple Prairie Clover*	<i>Dalea purpurea</i>	Full sun	4.0	4.5
	Cutleaf Daisy	<i>Engelmannia</i>	Full-part sun	18.0	20.1

		<i>pinnatifida</i>			
Forb Seed Mix	Partridge Pea*	<i>Chamaecrista fasciculata</i>	Full-part sun	20.0	22.4
	Indian Blanket	<i>Gaillardia pulchella</i>	Full-part sun	10.0	11.2
	Bluebonnet*	<i>Lupinus texensis</i> (legume)	Full sun	20.0	22.4
	Mexican Hat	<i>Ratibida columnaris</i>	Full-part sun	2.0	2.2
	Maximilian Sunflower	<i>Helianthus maximilia</i>	Full-part sun	5.0	5.6
	Prairie Coneflower	<i>Ratibida columnifer</i>	Full-part sun	2.0	2.2
	Clasping Coneflower	<i>Dracopis amplexicaul</i>	Full-part sun	3.0	3.4
	Purple Coneflower	<i>Echinacea purpurea</i>	Full-part sun shade	10.0	11.2
	Lemon Mint	<i>Monarda citriodora</i>	Full-part sun	3.0	3.4
	Huisache Daisy	<i>Amblyolepis setigera</i>	Full-part sun	8.0	9.0
	Texas Yellow Star	<i>Lindheimera texana</i>	Full-part sun	12.0	13.5
	Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>	Full-part sun shade	10.0	11.2
	Bush Sunflower	<i>Simsia calva</i>	Full-part sun	3.0	3.4
	Winecup	<i>Callirhoe involucrata</i>	Full-part sun shade	5.0	5.6
	Antelope horns	<i>Asclepias asperula</i>	Full sun	0.1	0.04
	Green milkweed	<i>Asclepias viridis</i>	Full sun	0.1	0.04

TOTAL

Total seed mix application rate is 35.0 lb/ac (23.5 lb/ac grasses and 11.5 lb/ac forbs), to be composed of at least 8 species from the grass list and 10 species from the forb list to include the required species.

*Required species that must be included in the mix

Table 5: Native Grasses and Forbs: Wet Sites

Type	Common Name	Botanical Name	Exposure	Recommended Application Rates	
				lbs/ac	kg/ha
Grass Seed Mix	White Tridens	<i>Tridens albescens</i>	Full-part sun	0.5	0.56
	Plains Bristlegrass	<i>Setaria leucopila</i>	Full-part sun	6.0	6.7
	Switchgrass	<i>Panicum virgatum</i>	Full-part sun	4.0	4.5
	Inland Sea Oats	<i>Chasmanthium latifolium</i>	Shade	12.0	13.5
	Canada Wild Rye	<i>Elymus canadensis</i>	Full sun - shade	10.0	11.2
	Big Bluestem	<i>Andropogon gerardii</i>	Full sun	4.0	4.5
	Bushy Bluestem	<i>Andropogon glomeratus</i>	Full sun	3.0	3.4
	Green Sprangletop*	<i>Leptochloa dubia</i>	Full sun	2.0	2.2
	Eastern Gamagrass	<i>Tripsacum dactyloides</i>	Full sun - shade	3.0	3.4
Forb Seed Mix	American Basketflower	<i>Centaurea americana</i>	Full sun	10.0	11.2
	Common milkweed	<i>Asclepias syriaca</i>	Full sun	0.1	0.04
	Butterfly weed	<i>Asclepias tuberosa</i>	Full sun	0.1	0.04

Blue Mistflower	<i>Conoclinium coelestinum</i>	Full-part sun	0.5	0.6
Clasping Coneflower	<i>Dracopsis amplexicaulis</i>	Full-part sun	3.0	3.4
Maximilian Sunflower	<i>Helianthus maximiliani</i>	Full-part sun	4.0	4.5
Prairie Blazing Star	<i>Liatris pycnostachya</i>	Full sun	2.0	2.2
Pink Evening Primrose	<i>Oenothera speciosa</i>	Full sun-dappled shade	1.0	1.1
Mexican Hat	<i>Ratibida columnifera</i>	Full-part sun	2.0	2.2
Black-eyed Susan	<i>Rudbeckia hirta</i>	Full sun-dappled shade	2.0	2.2
Illinois Bundleflower	<i>Desmanthus illinoensis</i>	Full sun-dappled shade	15.0	16.8
Obedient Plant	<i>Physostegia virginiana</i>	Full sun-dappled shade	4.0	4.5
Partridge Pea*	<i>Camaecrista fasciculata</i>	Full-part sun	20.0	22.4
Purple Prairie Clover	<i>Dalea purpurea var purpurea</i>	Full sun	4.0	4.5
Pitcher Sage	<i>Salvia azurea</i>	Full-part sun	3.0	3.4
Showy Tick Trefoil	<i>Desmodium canadense</i>	Full sun	0.5	0.6
Winecup*	<i>Callirhoe involucrata</i>	Full-part sun	5.0	5.6
TOTAL				
Total seed mix application rate is 26.0 lb/ac (17.0 lb/ac grasses and 9.0 lb/ac forbs), to be composed of at least 8 species from the grass list and 10 species from the forb list to include the required species.				

Table 6: Cool Season Cover Crop

Common Name	Botanical Name	Exposure	Application rates	
			lbs/ac	kg/ha
Western Wheatgrass	<i>Pascopyrum smithii</i>	Full-pt sun; dappled shade	5.6	6.28
Oats	<i>Avena sativa</i>	Full sun	4.0	4.48
Cereal Rye Grain	<i>Secale cereale</i>	Full sun	34.0	38.11

One cover crop species of the listed species is required to be planted between September 15 to March 1. Contractor must ensure that any seed application requiring a cool season cover crop does not utilize annual ryegrass (*Lolium multiflorum*) or perennial ryegrass (*Lolium perenne*). Only cereal rye grain (*Secale cereale*), oats (*Avena sativa*) and western wheatgrass (*Pascopyrum smithii*) are approved as cool season cover crop.

Species substitution as necessary due to availability shall be approved by the Landscape Architect, Engineer or designated representative. Watering and fertilizer application shall follow procedures outlined above or as otherwise specified on the Drawings.

Seed shall be applied by broadcast, hydromulch, blown compost, or drill method and shall be distributed evenly over the topsoil areas. Mulching shall immediately follow seed application for broadcast and hydromulch applications.

Seed Rate Calculations

The amount of seed needed to be planted on a project shall be calculated before installation to ensure adequate seed is placed, and provided as a submittal. Table 7 is an example worksheet, followed by an example calculation. Information for calculation can be obtained from seed tags or the supplier.

Table 7. Seed Calculation Worksheet

Plant Group	Desired Seeding Rate (lbs/ac)	PLS (pure live seed)	Bulk Rate (lbs/ac)	Seeding Area (ac)	Amt. of Seed to be Installed (lbs)
Grasses					
Forbs					
TOTAL					

FORMULAS:

PLS (pure live seed) = (Purity × Germination) × 100. Can also use average PLS from seed tags.

Bulk Rate (lbs/ac) = Desired Seed Rate (lbs/ac) / PLS

Amt. of Seed to be Installed (lbs) = Bulk Rate (lbs/ac) × Seeding Area (ac)

Example:

Plant Group	Desired Seeding Rate (lbs/ac)	PLS [pure live seed] (% decimal)	Bulk Rate (lbs/ac)	Seeding Area (ac)	Amt. of Seed to be Installed (lbs)
Grasses	131.00	0.81	161.73	1.50*	242.60
Forbs	65.34	0.87	75.10	1.50*	112.70
TOTAL	196.34	0.84 (ave.)	236.83	1.50	355.30

*applied over the same 1.5 ac area

Source: [Rule No. R161-14.29, 12-30-2014](#); [Rule No. R161-15.14, 1-4-2016](#).

604S.7 - Mulch

Mulches may be used to help prevent soil erosion until final stabilization is achieved. Mulch shall be used to cover broadcasted seeds, especially in sunny, open areas, to protect them from drying out during germination.

A. **Straw Mulch.**

Straw mulch shall be spread uniformly over the area indicated or as designated by the Engineer or designated representative at the rate of 2 to 2½ tons of straw per acre (4.5 to 5.6 megagrams of straw per hectare). The actual rate of application will be designated by the Landscape Architect, Engineer or designated representative. Straw may be hand or machine placed and adequately secured.

B. **Hydromulch.**

Refer to ECM Section 1.4.7 for hydromulching applications.

C. **Shredded Brush Mulch.**

Small brush or tree limbs, which have been shredded, may be used for mulching Native Grass seeding.

Source: [Rule No. R161-14.29, 12-30-2014](#).

604S.8 - Management Practices

Management Practices include (1) weed management (pesticide application or mechanical removal) to so that 90 percent of the revegetation area is free of weeds listed in Table 3, and (2) reseeding areas of poor germination to achieve coverage and height per 604S.9, with no bare areas greater than 10 s.f.

Ninety (90) percent of a permanent revegetation area must be free of weeds listed in Table 3. Weeds shall be controlled in the most efficient manner possible. Management of weed species should begin early in the project, before seeding for permanent control, and extend into plant establishment, especially for perennial weeds. Manual removal or application of an appropriate herbicide may be required after the initial seeding if emergence of an annual weed species threatens establishment of sufficient preferred plant cover. Disturbance due to weed management after the initial seeding may necessitate re-seeding of the area to establish sufficient preferred plant coverage. Care should be taken to temporarily stabilize areas where physical removal of weeds has been performed to prevent erosion and sediment runoff.

The entire root system of perennial weeds shall be removed to prevent re-sprouting. Weeds may be controlled with an approved contact, systemic herbicide, provided the product is used with appropriate care and is applied in accordance with label instructions and the following guidelines:

1. Herbicide shall not be applied when the wind is greater than 8 mph (12.9 kph),
2. Herbicide shall not be applied when rainfall is expected within 24 hours,
3. Herbicide shall not contact surface water, i.e. creeks, rivers, and lakes,
4. Herbicide shall not contact desirable vegetation (a wicking method shall be used, if necessary, to accurately contact target weed only during application).

The Landscape Architect, Engineer or designated representative shall be consulted to determine appropriate weed control management when weeds are located in an environmentally sensitive location (e.g. near water or adjacent to a critical environmental feature).

At locations that fail to show an acceptable stand of planting for any reason during the initial seeding, repair and/or reseed locations as determined by the Landscape Architect, Engineer or designated representative. A successful stand of grasses and forbs for erosion control should exhibit the following:

- Seedlings with vigorous green foliage;
- Green leaves remaining throughout the summer, at least at the plant bases;
- Uniform density, with grasses and/or forbs well intermixed;
- Minimum of 95% cover; and
- No exposed soil greater than 10 s.f. in aerial extent.

The Contractor shall meet the requirements of the initial seeding, including seeding method, seed mix, and application rates, unless otherwise agreed to in writing by the Owner. Corrected deficiencies will be re-inspected and approved by the Owner, and final acceptance will be granted upon satisfactory completion.

Source: [Rule No. R161-14.29, 12-30-2014](#); [Rule No. R161-15.14, 1-4-2016](#).

604S.9 - Measurement

Work and acceptable material for Seeding for Erosion Control will be measured by the square yard (meter: 1 meter equals 1.196 square yards) or by the acre (hectare: 1 hectare equals 2.471 acres), complete in place so that all areas of a site that rely on vegetation for stability must be uniformly vegetated with a minimum of 95 percent total coverage for the non-native or native mixes. Bare areas shall not exceed 16 square feet (1.5 square meters), and the average height of vegetation shall stand at a minimum of 1½ inch (40 millimeters). Ninety (90) percent of the re-vegetated area, whether native or non-native re-vegetation, must be free of weeds listed in Table 3. Bare areas greater than 10 s.f. shall be re-prepared and reseeded as required to develop an acceptable stand of plant material.

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

604S.10 - Payment

The work performed and materials furnished and measured will be paid for at the unit bid price for Seeding for Erosion Control of the method specified on the Drawings and type of mulch. The unit bid price shall include full compensation for furnishing all materials, including all topsoil, water, seed, tackifier, fertilizer or mulch and for performing all operations necessary to complete the work.

All fertilizer will be measured and paid for conforming to Item No. 606S, Fertilizer.

Payment will be made under one of the following:

Pay Item No. 604S-A:	Non-Native Seeding for Erosion Control Method, Hydraulic Planting Per Square Yard
Pay Item No. 604S-B:	Non-Native Seeding for Erosion Control, Broadcast Seeding, Per Square Yard
Pay Item No. 604S-C:	Non-Native Seeding for Erosion Control Method, Hydraulic Planting Per Acre
Pay Item No. 604S-D:	Native Seeding for Erosion Control Method, Hydraulic Planting Per Square Yard
Pay Item No. 604S-E:	Native Seeding for Erosion Control, Broadcast Seeding, Per Square Yard
Pay Item No. 604S-F:	Native Seeding for Erosion Control Method, Hydraulic Planting Per Acre
Pay Item No. 604S-G:	Mulch, Per Square Yard
Pay Item No. 604S-H:	Mulch, Per Acre
Pay Item No. 604S-I:	Topsoil and Seedbed Preparation, Per Square Yard
Pay Item No. 604S-J:	Topsoil and Seedbed Preparation, Per Acre
Pay Item No. 604S-K:	Watering, Per 1000 gal (Kgal)

Pay Item No. 604S-L:	Management Practices, Per Square Yard
Pay Item No. 604S-M:	Management Practices, Per Acre

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 604S Seeding for Erosion Control</u>	
<u>City of Austin Technical Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 130S	Borrow
Item No. 601S	Salvaging and Placing Topsoil
Item No. 606S	Fertilizer
<u>City of Austin Land Development Code</u>	
<u>Designation</u>	<u>Description</u>
Section 6-4	Water Conservation

<u>RELATED CROSS REFERENCE MATERIALS</u>
<u>Specification Item 604S Seeding for Erosion Control</u>

<u>City of Austin Technical Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 601S	Salvaging and Placing Topsoil
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 607S	Slope Stabilization
Item No. 608S	Planting
<u>City of Austin Standards (Details)</u>	
<u>Designation</u>	<u>Description</u>
627S-1	Grass Lined Swale
633S-1	Landgrading
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 160	Topsoil
Item No. 162	Sodding for Erosion Control
Item No. 164	Seeding for Erosion Control

SEEDING FOR EROSION CONTROLItem No. 604S

Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 180	Wildflower Seeding
Item No. 192	Landscape Planting

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ITEM NO. 605S - SOIL RETENTION BLANKET 6-21-07**605S.1 - Description**

This item shall govern the provision and placement of wood, straw or coconut fibert mat, synthetic mat, paper mat, jute mesh or other material as a soil retention blanket for erosion control on slopes or ditches or short-term or long-term protection of seeded or sodded areas indicated on the Drawings or as specified by the Engineer or designated representative.

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

605S.2 - Submittals

The submittal requirements for this specification item shall include the soil retention blanket material type and sample, evidence that the material is listed on TxDOT/TTI Approved Products List, one (1) full set of Manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.

605S.3 - Materials**A. Soil Retention Blankets.**

All soil retention blankets must be listed on TxDOT Approved Products List or approved by the Engineer or designated representative.

The soil retention blanket shall be one (1) of the following classes and types as shown on the Drawings:

1. Class 1. Slope Protection
 - (a) Type A Slopes 3:1 or flatter - Clay soils
 - (b) Type B Slopes 3:1 or flatter - Sandy soils
 - (c) Type C Slopes steeper than 3:1 - Clay soils
 - (d) Type D Slopes steeper than 3:1 - Sandy soils
2. Class 2. Flexible Channel Liner
 - (a) Type E Short-term duration (Up to 2 years)
Shear Stress (t_d) < 2.0 pound per square foot [psf]
 - (b) Type F Short-term duration (Up to 2 years)
Shear Stress (t_d) ≤ 4.0 psf
 - (c) Type G Long-term duration (Longer than 2 years)
Shear Stress (t_d) ≤ 6.0 psf
 - (d) Type H Long-term duration (Longer than 2 years)
Shear Stress (t_d) ≤ 8.0 psf

B. Fasteners

The fasteners shall conform to the recommendations of the manufacturer for the selected soil retention blanket.

Source: [Rule No. R161-14.29, 12-30-2014](#).

605S.4 - Construction Methods

A. General.

The soil retention blanket shall conform to the class and type shown on the Drawings. The Contractor has the option of selecting an approved soil retention blanket conforming to the class and type shown on the Drawings which is included on the Approved Products List published by TxDOT/TTI Hydraulics and Erosion Control Laboratory.

B. Site Preparation.

Prior to placement of the soil retention blanket, the seedbed area to be covered shall be relatively free of all clods and rocks over 1 ½ inches (37.5 mm) in maximum dimension and all sticks or other foreign matter that will prevent close contact of the preparation mat with the soil surface. The area shall be smooth and free of ruts and other depressions. If the prepared seedbed becomes crusted or eroded as a result of rain or if any eroded places, ruts or depressions exist for any reason, the Contractor shall be required to rework the soil until it is smooth and to reseed or resod the area at the Contractor's own expense. After the area has been properly prepared, the blanket shall be laid out flat, even and smooth, without stretching or crimping the material.

C. Installation.

The Soil Retention Blanket, whether installed as slope protection or as flexible channel liner in accordance with the TxDOT/TTI Approved Products List, shall be placed within 24 hours after seeding (Standard Specification Item No. 604S), sodding (Standard Specification Item No. 602S) or native grassland seeding and planting (Standard Specification Item No. 609S) erosion control operations have been completed, or as approved by the Engineer or designated representative. The soil retention blanket shall be installed and anchored in accordance with the Manufacturer's recommendations. The Contractor shall contact the Engineer or designated representative three (3) days prior to the installation of the soil retention blanket to allow for inspection of the installation by City of Austin personnel.

605S.5 - Measurement

This work and acceptable material for "Soil Retention Blanket" will be measured by the square yard (square meter: 1 square meter is equal to 1.196 square yards) of surface area covered, complete in place.

605S.6 - Payment

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit bid price for "Soil Retention Blanket" of the class shown on the Drawings or approved by the Engineer or designated representative. The unit price shall include full compensation for furnishing all materials, labor, tools, equipment and incidentals necessary to complete the work. Anchors, checks, terminal and wire staples will not be paid for directly, but will be included in the unit price bid for this specification item.

Payment will be made under the following:

Pay Item No. 605S-A:	Soil Retention Blanket Class ____; Type ____	Per Square Yard.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 605S, "Soil Retention Blanket"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 609S	Native Grassland Seeding and Planting for Erosion Control

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 605S, "Soil Retention Blanket"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right-of-Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 132S	Embankment

Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 162	Sodding for Erosion Control
Item No. 164	Seeding for Erosion Control
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 606S - FERTILIZER 6-21-07

606S.1 - Description

This item shall govern the provision and incorporation of fertilizer into the soil on areas of proposed seeding, sodding, or other planting areas indicated on the Drawings and in accordance with these specifications.

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

Source: [Rule No. R161-14.29, 12-30-2014](#).

606S.2 - Submittals

The following submittals are required for this specification item during construction:

- A. Analysis of native soil or introduced soil, including nutrient (N-P-K) content, textural class and soil organic matter percentage.
- B. Type(s) of re-vegetation (seeding, sodding, etc.) proposed.
- C. Fertilizer labels, for all type(s) of fertilizer proposed, including chemical analysis.
- D. Proposed rate(s) of application of fertilizer.
- E. Schedule of proposed fertilizer applications.

Source: [Rule No. R161-14.29, 12-30-2014](#).

606S.3 - Materials

All fertilizer used on site shall be delivered in bags or containers that are clearly labeled according to the Association of American Plant Food Control Officials (AAPFCO) protocol. Five required components must appear on a fertilizer's label, including the brand, the grade, guaranteed analysis, net weight, and name and address of the registrant or licensee. The fertilizer may be subject to testing by the Texas State Chemist in accordance with the Texas Commercial Fertilizer Rules or Texas Fertilizer Control Act.

The fertilizer type and rate of application should be based on chemical tests of representative soil samples taken after completion of construction and ground work, but before installation of plant materials.

A pelleted or granulated fertilizer shall be used. Fifty percent or greater of the Nitrogen required shall be in the form of Nitrate Nitrogen (NO_3^-). The remaining Nitrogen required may be in the form of Urea Nitrogen [$\text{CO}(\text{NH}_2)_2$].

The total amount of nutrients furnished and applied per acre (hectare: 1 hectare equals 2.471 acres) shall equal or exceed that specified for each nutrient.

Chemical fertilizer shall not be applied within the Critical Water Quality Zone (CWQZ).

Source: [Rule No. R161-14.29, 12-30-2014](#).

606S.4 - Construction Methods

General requirements and criterion for vegetative activities, including fertilizing are presented in Environmental Criteria Manual Section 1.4.7, Vegetative Practices.

Pelleted or granulated fertilizer shall be applied uniformly into the soil at time of seedbed preparation to a depth of 4 inches (100 mm) over the area to be fertilized and in the manner directed for the particular item of work. The fertilizer shall be applied at the rate recommended by soil tests. The fertilizer shall be dry and in good physical condition. Fertilizer that is powdered or caked will be rejected. Distribution of the fertilizer for the particular item of work shall meet the approval of the Landscape Architect, Engineer or Designated Representative.

Fertilizer should be applied (1) during seed germination and plant establishment and (2) after plant establishment. To minimize potential nutrient leaching to groundwater, fertilizer shall not be applied during plant dormancy or within 48 hours of a potential rain event. If needed, maintenance fertilizing shall be applied every 6 months after the new sod, grass or seeding is placed or until the work is accepted by the City.

The fertilizer may also be applied with the hydromulch.

Source: [Rule No. R161-14.29, 12-30-2014](#).

606S.5 - Measurement

Work and acceptable material for "Fertilizer" will be measured by the normal ton of 2,000 pounds (megagrams: 1 megagram equals 1.1023 tons) or by the 100 pounds (50 kilograms: 1 kilogram equals 2.205 pounds) as determined by approved scales or guaranteed weight of sacks shown by the manufacturer.

Source: [Rule No. R161-14.29, 12-30-2014](#).

606S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" shall be included in the unit price bid for the item of construction in which fertilizer is used, unless specified in the Drawings as a Pay Item.

When fertilizer is specified on the Drawings as a pay item or included in the contract bid form, the work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price for "Fertilizer" of the analysis specified on the Drawings. The unit bid price shall include full compensation for furnishing all materials and performing all operations necessary to complete the work.

Source: [Rule No. R161-14.29, 12-30-2014](#).

Payment, when specified, will be made under one of the following:

Pay Item No. 606S-A:	Fertilizer	Per Ton.
Pay Item No. 606S-B:	Fertilizer	Per 100 Pounds.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 606S "Fertilizer"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.7.A.5	Vegetative Practices, Temporary Vegetative Stabilization of Disturbed Areas
Section 1.4.7.B.6	Vegetative Practices, Permanent Vegetative Stabilization of Disturbed Area

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 606S "Fertilizer"</u>	
<u>City of Austin Technical Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 601S	Salvaging and Placing Topsoil
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 607S	Slope Stabilization
Item No. 608S	Planting
Item No. 609S	Native Seeding and Planting Restoration

Item No. 610S	Preservation of Trees and Other Vegetation
<u>City of Austin Standard Details</u>	
Standard No.	Description
626S-1	Grass Lined Swale
627S-1	Grass Lined Swale W/ Stone Center
633S-1	Landgrading
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 162	Sodding for Erosion Control
Item No. 164	Seeding for Erosion Control
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering

Item No. 169	Soil Retention Blanket
Item No. 180	Wildflower Seeding
Item No. 192	Roadside Planting and Establishment
Item No. 204	Sprinkling

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ITEM NO. 607S - SLOPE STABILIZATION APPLICATIONS FOR EROSION CONTROL 5-23-00**607S.1 - Description**

This item shall govern the construction of slope stabilization devices, where plant growth cannot be readily established or sustained without slope stabilization measures, in conformance with this Specification Item and in accordance with locations, lines and grades indicated on the Drawings or as directed by the Engineer or designated representative.

This Standard Specification Item shall apply to erosion control measures only and shall not apply to structural stabilization of slopes.

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

607S.2 - Submittals

The submittal requirements for this specification item shall include the soil retention blanket material type and sample, evidence that the material is listed on the current version of TxDOT/TTI's Approved Products List, one (1) full set of manufacturer's literature and installation recommendations, and any necessary special details.

607S.3 - Materials**A. Precast Concrete Units.**

Concrete units shall be precast concrete blocks with a 12 to 16 inch (300 to 400 mm) module and shall be 4 or 6 inches (100 or 150 mm) thick, as indicated on the Drawings. The concrete shall attain a minimum 28-day compressive strength of 4000 psi (27.5 megaPascals) in conformance to Class S of Standard Specification Item No. 403, "Concrete for Structures". Each precast concrete unit will weigh at least 30 pounds per cubic foot (480 kilograms per cubic meter) and the open void area will range from 20 to 25 percent.

The Filter/carrier fabric shall conform to Item No. 620S, "Filter Fabric". The fabric shall be of sufficient strength to support not less than 1 ½ times the weight (mass) of the mat when slung by lifting at both ends.

B. GeoGrid

GeoGrid shall consist of polypropylene base and shall be: 1) resistant to all natural occurring alkaline and acidic soil conditions, 2) resistant to attack by bacteria and fungi, and 3) ultraviolet stable. The plastic grid shall have a thermal stability range from -60o F to 175 o F (-50°C to 80 °C) and a Melt Index of 0.2 grams/10 minutes.

Geogrid shall have a density between 75 to 106 pounds per cubic feet (1.2 to 1.7 megagrams per cubic meter) and thickness shall be 0.15 to 0.25 inch (4 to 6 mm). Tensile strength shall be 860 to 1230 pounds per square foot (41 to 59 mPa) across the roll.

C. Earth Reinforcement System

A patented earth reinforcement system shall consist of interlocking precast reinforced concrete units of the size, shape and texture indicated on the Drawings, placed on a concrete foundation. All precast concrete shall be Class S, with a minimum 28 day compressive strength of 4000 psi (27.5 mPa), cast-in-place concrete shall be Class A, conforming to Item No. 403, "Concrete for Structures". All joints shall be caulked and protected with a filter fabric as indicated on the Drawings. All reinforcing steel shall conform to Item No. 406, "Reinforcing Steel". All tie back and reinforcing mesh shall be in accordance with manufacturer's recommendations.

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

D. Gabions and Revet Mattresses

Gabions shall be assembled and placed as directed on the Drawings in accordance with Standard Specification Item No. 594S, " Gabions and Revet Mattresses".

E. Additional Materials and Methods

In addition to those systems described above, the following items may be used in combinations or separately, as indicated on the Drawings:

Standard Specification Subject	Item No
Concrete for Structures	403S
Concrete Structures	410
Riprap for Slope Protection	591S
Concrete Retards	593S
Sodding for Slope Stabilization	602S
Seeding for Slope Stabilization	604S
Salvaging and Placing Topsoil	601S
Soil Retention Blanket	605S
Filter Fabric	620S
Dry Stack Wall (DS)	623S
Rock Berm (RB)	639S
Mortared Rock Wall (RW)	640S

Additional Products not mentioned herein may be indicated on the Drawings.

607S.4 - Construction Methods**A. Precast Concrete Units****1. Subgrade Preparation.**

The slope on which the units are to be placed shall be constructed according to lines and grades indicated on the Drawings. Fill materials shall be placed in lifts, which do not exceed 8 inch (200 mm) loose measure, and compacted to a minimum of 95 percent of maximum dry density as determined in accordance with TxDOT Test Method Tex-114-E or as approved by the Engineer or designated representative.

2. Placing the Units.

The precast concrete units shall be placed on a concrete foundation in accordance with the manufacturer's recommendations. Filter fabric will be required.

3. Backfill.

Backfill shall consist of fine granular material or topsoil as indicated on the Drawings or as approved by the Engineer or designated representative. Seeding or sodding, when required, shall be placed directly over topsoil and shall conform to Item No. 604S, "Seeding for Erosion Control" and Item No. 602S, "Sodding for Erosion Control".

B. GeoGrid**1. Subgrade Preparation.**

The compacted slope on which the plastic grids are to be placed shall be constructed according to the lines and grades indicated on the Drawings. Prior to placement the grid, pieces of wood, rock, concrete, brick or other objects that might damage the plastic grid shall be removed.

2. Placement of the Geo Grid.

The grid shall be placed directly on the ground surface. Adjacent and adjoining rolls shall be overlapped and tied in accordance with manufacturer's recommendations by a minimum of 1 and 6 feet (0.3 to 1.8 meters) respectively. The grid shall be installed and anchored in accordance with manufacturer's recommendations and details indicated on the Drawings.

Any damage to the fabric as a result of Contractor's vehicles, equipment or operations shall be repaired at Contractor's own expense.

The amount of grid placed shall be limited to that which can be covered with backfill within the succeeding 72 hours.

3. Backfill.

A minimum thickness of 4 inches (100 mm) of fine granular material shall be placed directly over the plastic grid and compacted to a minimum of 95 percent of the maximum dry density as determined in accordance with TxDOT Test Method Tex-114-E. Seeding or sodding shall be placed on areas backfilled as indicated on the Drawings and shall conform to Item No. 604S, "Seeding for Erosion Control" or Item No. 602S, "Sodding for Erosion Control".

C. Earth Reinforcement System**1. Excavation.**

Excavation shall conform to applicable requirements of Standard Specification Item No. 111S, "Excavation" and Standard Specification Item No. 401, "Structural Excavation and Backfill" in accordance with limits and construction stages indicated on the Drawings. Any foundation soils found to be unsuitable shall be removed and replaced with acceptable backfill material.

2. Foundation.

The foundation subbase for the structure, approved by the Engineer or designated representative, shall be graded and then compacted to 95 percent of the maximum dry density as determined in accordance with TxDOT Test Method Tex-114-E. The leveling pad shall be constructed of Class A concrete conforming to Standard Specification Item No. 403S, "Concrete for Structures", along the lines and grades indicated on the Drawings.

3. Wall Erection.

The wall modules, joint filler and leveling pads shall be placed as indicated on the Drawings in accordance with the manufacturer's recommendations. Special care shall be taken in setting the bottom course of units to true line and grade.

All modular units above the first course level shall interlock with lower courses. Vertical joints shall be staggered with each successive course. The vertical joints on the front face of the wall shall not exceed $\frac{3}{4}$ inch (19 mm) tolerance. Joint filler shall be installed in all joints and filter fabric shall be installed behind the wall as indicated on the Drawings. The overall vertical tolerance of wall plumbness (from top to bottom) shall not exceed $\frac{1}{2}$ inch per 10 feet (4 mm per meter) from the dimensions indicated on the Drawings.

4. Drainage. Drainage shall conform to Standard Specification Item No. 551, "Pipe Underdrains" and to the details indicated on the Drawings.**5. Backfill.**

The placement of the backfill shall follow closely behind the erection of each lift of panels. The maximum lift thickness shall not exceed 8 inches (200 mm), loose measure. At each reinforcing mesh level, the backfill shall be roughly leveled before placing and attaching mesh. Reinforcing mesh or straps shall be placed normal to the face of the wall.

Backfill compaction shall be accomplished without disturbance or distortion of reinforcing mesh, filter fabric and face panels. All backfill shall be compacted to 95 percent maximum dry density as determined in accordance with TxDOT Test Method Tex-114-E. The Contractor shall decrease the lift thickness, if necessary, to obtain the specified density. During backfill compaction the moisture content may not exceed a value 2 percent greater than maximum dry density (i.e. optimum as determined by TxDOT Test Method Tex-114-E).

Compaction of the backfill shall not be accomplished by sheep foot, grid rollers or any other type of equipment employing a foot, which in the opinion of the Engineer or designated representative could damage the reinforcing mesh. At the end of each day's operation, the Contractor shall shape the backfill to drain away from the face of the wall.

All backfill material used adjacent to the structure shall be crushed stone, that is free from organic or otherwise deleterious materials, and the grading of the backfill material established in accordance with TxDOT Test Method Tex-110-E shall conform to the following gradation limits.

Sieve Size		
US	SI	Percent Passing
6 inches	150 mm	100
3 inches	75 mm	75 - 100
No. 200	75mm	0 - 15

607S.5 - Measurement

Work and accepted material for "Slope Stabilization" will be measured by the square yard (square meter: 1 square meter is equal to 1.196 square yards), complete in place from the top of the foundation to the top of the slope stabilization erosion control. Foundations will not be measured for payment.

607S.6 - Payment

Work performed and materials furnished as prescribed by this Specification Item and measured under "Measurement" will be paid for at unit bid price per square yard for "Slope Stabilization for Erosion Control". The unit bid price shall include full compensation for: a) all excavation, foundation installation, subgrade preparation, placement of filter fabric, underdrains, precast blocks and tie backs, and b) all labor, tools, equipment and incidentals necessary to complete the backfilling operations.

Payment will be made under:

Pay Item No. 607S-A:	Precast Concrete Unit	Per Square Yard.
Pay Item No. 607S-B:	GeoGrid, _____	Per Square Yard.
Pay Item No. 607S-C:	Earth Reinforcement System	Per Square Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 607S, "Slope Stabilization Applications For Erosion Control"</u>	

SLOPE STABILIZATION APPLICATIONS FOR EROSION CONTROL

Item No. 607S

<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 111S	Excavation
Item No. 401	Structural Excavation and Backfill
Item No. 403S	Concrete for Structures
Item No. 406	Reinforcing Steel
Item No. 410	Concrete Structures
Item No. 551	Pipe Underdrains
Item No. 591S	Riprap for Slope Protection
Item No. 593S	Concrete Retards
Item No. 594S	Gabions and Revet Mattresses
Item No. 601S	Salvaging and Placing Topsoil
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 620S	Filter Fabric
Item No. 623S	Dry Stack Wall (DS)
Item No. 639S	Rock Berm (RB)
Item No. 640S	Mortared Rock Wall (RW)

Texas Department of Transportation: Manual of Testing Procedures

<u>Designation</u>	<u>Description</u>
Item No. 110-E	Surveying and Sampling Soils for Highways
Item No. 114-E	Laboratory Compaction Characteristics & Moisture-Density Relationship of Subgrade & Embankment Soil

TxDOT/TTI Hydraulics and Erosion Control Laboratory

<u>Designation</u>	<u>Description</u>
Annual Report	Approved Products List

RELATED CROSS REFERENCE MATERIALSSpecification 607S, "Slope Stabilization Applications For Erosion Control"City of Austin Standard Specification Items

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right-of-Way
Item No. 102S	Clearing and Grubbing
Item No. 120S	Channel Excavation
Item No. 132S	Embankment

SLOPE STABILIZATION APPLICATIONS FOR EROSION CONTROL

Item No. 607S

Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 160	Furnishing and Placing Topsoil
Item No. 162	Sodding for Erosion Control
Item No. 164	Seeding for Erosion Control
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 608S - PLANTING 9-26-12

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 ($\frac{3}{4}$) 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 $\frac{3}{4}$ inch (20 mm) that have not completely callused.
14. Plants that do not possess 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 ($\frac{3}{4}$) 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 ($\frac{1}{2}$) 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, seedlings, 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 $\frac{3}{4}$ 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 $\frac{1}{4}$ 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 $\frac{3}{4}$ fine sandy loam, $\frac{1}{8}$ peat moss and $\frac{1}{8}$ 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 × 2 × 18 inch (50 × 50 × 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 ½ inch (12.5 mm) diameter reinforced plastic or rubber hose trunk bushings and yellow plastic flagging.

L. Bracing

Bracing shall be 2 × 4 inch (50×100 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 1¼ inches (38 mm) and greater in caliper shall be adequately braced immediately after the plants have settled. Unless otherwise indicated on the Drawings, trees 1¼ to 2 inches (38 to 50 mm) in diameter shall be braced with 1 brace of sawed lumber, 2 × 2 inches (50 × 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, whichever 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

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 608S, "Planting"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 606S	Fertilizer
<u>City of Austin Land Development Code</u>	
<u>Designation</u>	<u>Description</u>
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

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 608S, "Planting"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
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
Section 2.7.2.G	Irrigation

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
<u>City of Austin Transportation Criteria Manual</u>	

<u>Designation</u>	<u>Description</u>
Section 1.4.3	Classification Design Criteria
Section 6.2.3	Transportation Criteria for Landscaping
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 111S	Excavation
Item No. 601S	Salvaging and Placing Topsoil
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
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

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ITEM NO. 609S - NATIVE SEEDING AND PLANTING FOR RESTORATION 1-4-16

609S.1 - Description

This item shall govern the preparation of a seeding and planting area to the lines and grades indicated on the Drawings. This may include seedbed preparation, sowing of seeds, planting of rooted plants, watering, hydromulch, compost and other management practices, as indicated in the Drawings or as directed by the Landscape Architect, Engineer or designated representative.

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

Source: [Rule No. R161-14.29, 12-30-2014](#).

609S.2 - Submittals

The following submittal items are required in writing during construction:

- A. For seed, provide identification of the species, source, mixture, and pure live seed (PLS) of the seed as listed on each seed bag to be used. Copies of the analysis tags and certification tags from all seed bags shall be submitted.
- B. Type of mulch or compost.
- C. Watering frequency and amount as shown on an irrigation watering schedule.
- D. Type of management practices (e.g., hand-weeding, pesticide application, etc.) proposed, with a proposed schedule for observation and treatment.
- E. For hydromulch applications, the proposed application rate of seed, type of mulch and tacking agent, and other relevant information. An example of the required documentation is in Table 1.
- F. Type of hydraulic seeding equipment and nozzles proposed for use.
- G. If pesticide use is proposed, an IPM plan for pest control including pesticide label, proposed application rate and timing, and MSDS sheets.
- H. One gallon sample of proposed mulch or compost.
- I. The following submittal items are required before Substantial Completion:
 - A. For hydromulch applications, submit the complete hydromulch application log, including date, time and quantity of product units placed in the slurry tank. An example of an application log is in Table 2.
 - B. Pesticide and fertilizer application tracking log. As of January 1, 2012, documentation of all outdoor pesticide and fertilizer use on city-owned properties is required to demonstrate compliance with the EPA/TCEQ mandated Municipal Stormwater Permit, the TPDES General Pesticide Permit, City Code, and the IPM program.

Table 1: Example of proposed hydromulch application rates

Hydro Mix	Sheet No.	Seed Mix	Acres	Hydro Slurry Unit (per acre rates)				
				Seed (Bags/ac)	Tackifier (Buckets/ac)	Mulch (Bales/ac)	Fertilizer (Bags/ac)	Addl. Amendments

								(Bags/ac)
1	L2	A	1.0	1	100	1000	50	5
2	L3	A	0.5	2	200	1500	50	5
3	L5	B	3.0	3	300	3000	50	5

Table 2: Example of hydromulch application log

Date	Start Time	Finish Time	ac/Tank	Water (gal)	Seed Mix	Hydro Slurry Unit (per acre rates)				
						Seed (Bags/ac)	Tackifier (Buckets/ac)	Mulch (Bales/ac)	Fertilizer (Bags/ac)	Addl. Amendments (Bags/ac)
4/13	10:30	11:15	1.0	3300	A	1	100	1000	50	5
4/17	2:00	2:30	0.5	3300	A	2	200	1500	50	5
5/20	8:30	10:00	1.2	3300	B	3	300	3000	50	5
					Totals	6	600	5500	127	15

Source: [Rule No. R161-14.29, 12-30-2014](#); [Rule No. R161-15.14, 1-4-2016](#).

609S.3. - Materials

A. Seed.

All seed must meet the requirements of the Texas Seed Law including the labeling requirements for showing PLS, name and type of seed, and all other required elements of the Analysis and Certification Tags. The seed furnished shall be of the previous season's crop and the date of analysis shown on each bag shall be within 12 months of the time of delivery to the project. Each variety of seed shall be furnished and delivered in separate bags or containers, unless a specific mix is proposed for use. A sample of each variety of seed shall be furnished for analysis and testing when directed by the Landscape Architect, Engineer or designated representative.

The amount of seed planted per square yard (.84 square meters) or acre (hectare) shall be of the type specified in Section 609S.5.

- B. **Water.** Water shall be clean and free of industrial wastes and other substances harmful to the growth of plant materials in the area irrigated.
- C. **Topsoil.** Topsoil shall conform to Standard Specification Item No. 601S.3(A).
- D. **Pesticide.** A least toxic, integrated pest management (IPM) approach shall be used to control weeds. A written request for approval of weed control product(s) and/or materials shall be submitted to the City of Austin Watershed Protection Department (ERM) IPM program coordinator for approval. Additional information can be found at <http://www.austintexas.gov/ipm>.
- E. **Fertilizer.** If fertilizer used is deemed necessary, the fertilizer shall conform to Standard Specification Item No. 606S, Fertilizer. The type and rate of fertilizer should be based on chemical tests of recent (no older than 6 months before application) representative site soil samples. Fertilizer should be applied only when plants can take them up for growth, during: 1) seed germination and plant establishment and 2) after plant establishment. Fertilizer shall not be applied within 48 hours of a potential rain event.
- F. **Tackifier.** The tacking agent shall be a biodegradable material approved by the Landscape Architect, Engineer, or designated representative.
- G. **Mulch.** Mulch may be used to help prevent soil erosion until preferred plant establishment, whether the mulch be hydraulically applied or shredded vegetative matter. Hydromulching for temporary and permanent vegetation stabilization shall conform to Environmental Criteria Section 1.4.7.
- H. **Hydroseeding Equipment.** Hydroseeding equipment shall be clean and free of all previous seeds, fertilizer, mulch, or any hydroseeding products used on prior jobs.
- I. **Rooted Plants.** Where proposed, rooted plants shall conform to the requirements of Standard Specification 608S, Planting.

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

609S.4 - Construction Methods

A. **General.**

The Contractor shall limit preparation to areas that will be seeded/planted immediately. All weedy species (Table 3) shall be controlled by application of an herbicide and/or by physical removal (by the roots) prior to, during the planting operation, and through establishment. The specified weedy species shall be maintained at ten (10) percent or less of total cover after seeding. Additionally, the Landscape Architect, Engineer, or qualified landscape professional may require removal of any plant species that appears to be out-competing seeded or planted species during construction or the establishment period.

Seeds and fruits of non-native woody invasive species should be separated from the rest of the removed plants before mulching or hauling off the material. It must be bagged and disposed of in a landfill to prevent unintentional reintroduction to the site or elsewhere.

Table 3: Weed List

Weed Type	Botanical Name	Common Name
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NATIVE SEEDING AND PLANTING FOR RESTORATION

Item No. 609S

Summer Annual Herb	<i>Ambrosia spp.</i>	Ragweed
Perennial Grass	<i>Bothriochloa ischaemum</i>	K.R. Bluestem
Annual Grass	<i>Cenchrus spp.</i>	Sandbur
Herb	<i>Cnidoscolus texanus</i>	Bull Nettle
Perennial Grass	<i>Sorghum halapense</i>	Johnson Grass
Perennial Grass	<i>Arundo donax</i>	Giant Cane
Perennial Grass	<i>Phllostachys aurea</i>	Golden Bamboo
Vine	<i>Toxicodendron radicans</i>	Poison Ivy
Herb	<i>Urtica spp.</i>	Stinging Nettle
Winter Annual Herb	<i>Rapistrum rugosum</i>	Bastard Cabbage
Winter Annual Grass	<i>Bromus arvensis</i>	Japanese Brome
Winter Annual Grass	<i>Lolium multiflorum</i>	Annual Ryegrass
Tree	<i>Triadica sebifera</i>	Chinese Tallow
Tree	<i>Ligustrum sp.</i>	Privet
Tree	<i>Melia azedarach</i>	Chinaberry
Tree	<i>Lonicera japonica</i>	Japanese Honeysuckle
Shrub	<i>Nandina domestica</i>	Heavenly Bamboo
Shrub	<i>Photinia sp.</i>	Photinia

B. Plant Bed Preparation.

After the designated seeding/planting areas have been rough graded, a suitable planting area shall be prepared. In areas where cut or fill is required, a minimum of 6 inches (150 mm) of topsoil (see Section 609S.3.C) shall be placed or use approved existing soil (that is not infested with invasive or noxious plant rootstock [e.g., *Arundo donax* rhizomes]) stockpiled over the entire planting area.

The topsoil or growing medium must be prepared so that compaction is appropriate for plant growth, and to achieve acceptable bulk density or hydrologic function. Ripper and subsoilers may be used to loosen compacted soil and roughen the surface. Disks, plows and excavator attachments are good for compaction reduction, roughening, and for incorporating amendments. If tracked machinery is used in seedbed preparation, cleat marks should run with the contour to prevent rills.

In areas with no soil disturbance, the weeds shall be eliminated and a minimum of 6 inches (150 mm) of topsoil, if none currently exists, shall be placed. The seedbed shall be prepared with limited irregularities, lumps or soil clods and the surface shall be raked or rolled to facilitate seed to soil contact.

Water shall be gently applied as required to prepare the seedbed before the planting operation either by broadcast seeding or hydraulic planting. Seeding shall be performed in accordance with the requirements hereinafter described.

C. Watering.

All watering shall comply with City Code Chapter 6-4 (Water Conservation). Water the seeded/planted areas immediately after installation to achieve germination and a healthy stand of native plants that can ultimately survive without supplemental water.

Apply the water uniformly to the planted areas without causing displacement or erosion of the materials or soil.

Watering applications shall insure that the plantbed is maintained in a moist condition favorable for the growth of plant materials. Watering shall continue until minimum coverage is achieved and accepted by the Landscape Architect, Engineer or designated representative. Watering may be postponed immediately after a half-inch inch (12.5 mm) or greater rainfall on the site but shall be resumed before the soil dries out.

D. Cool Season Cover Crop.

From September 15 to March 1, non-native and native seeding shall include a cool season cover crop at the rate specified in Tables 4, 5, or 6. Cool season cover crops are not permanent erosion control. If installed separately from the proposed seed mix, the cool season cover crops shall be mowed to a height of less than one (1) inch after March 1, and the area shall be re-seeded at the specified seeding rate for native warm-season species (March 1 to September 15).

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

609S.5 - Native Seeding and Planting

Seeding and planting shall be performed in accordance with the requirements described below. The optimum depth for seeding shall be 1/4 inch (6 millimeters). Seed shall be applied by a method that achieves consistent distribution across a site and proper seed to soil contact (i.e. hand broadcasting, hydromulch, or drill method).

Rooted plants should be strategically and thoughtfully placed on a site. They need not be installed at a consistent, regular pattern across the plantable area(s) of a site but can be clustered or placed irregularly. The goal is to place the rooted plants where they will have the greatest or best effect or impact, and where there is sufficient space (e.g., root space, space off of utilities) and proper conditions (e.g., soil depth, moisture, light) for their long-term success. Installation of rooted plants shall comply with Standard

Specification 608S, but rooted plants must not be spaced closer than three-feet (3') on center. Mulching around seed and rooted plants is not required, but it is a good technique for protecting plants during germination and establishment. Figure 609S.5-1 is an example of rooted plant layout on a hypothetical site.

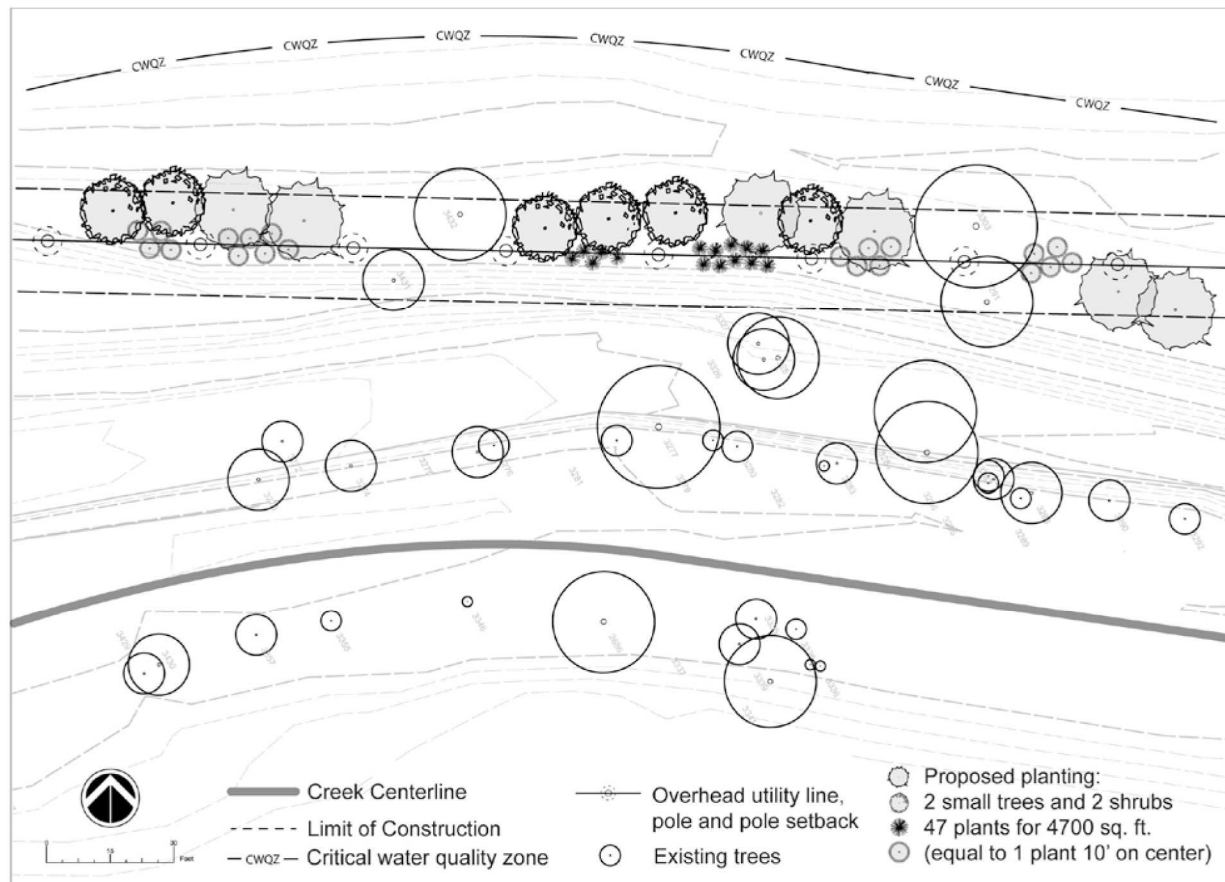


Figure 609S.5-1: Example of Rooted Plant Layout and Calculation

Rooted Plants such as trees, ornamentals, and shrubs are prohibited from being installed within fifteen (15) feet of any Austin Water Utility (AWU) infrastructure and/or within any easement dedicated for AWU infrastructure. Rooted plants such as grasses, succulents and/or ground cover are permitted within fifteen (15) of any AWU infrastructure and/or within any easement dedicated for AWU infrastructure.

Species substitution, when necessary due to availability, shall be approved by City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. Only native or adapted species suitable for the designated environmental conditions shall be allowed as substitutes. Shorter growing natives such as Buffalograss should be sodded around manholes or other structures requiring higher visibility for access.

If the plant materials are being installed during the cool season (September 15 to March 1), a cool season cover crop species (as listed below) shall be included in the seed mix or installed separately.

The seed and rooted plant mixtures shall be applied in accordance with appropriate growing environments (Upland Full Sun-Table 4, Upland Shade-Dappled-Table 5 and Facultative Moderate to High Moisture-Table 6). Grasses shall constitute 67 percent of the seed mix, with forbs comprising 33 percent. No species shall constitute more than 20% of a seed mix.

Table 4. Upland Species, Full Sun Areas

Type	Common Name	Botanical Name	Recommended Application rate lbs/ac (kg/ha)	Rooted Plants Species, Diversity, Quantity & Size
Grass Seed Mix**	Buffalograss	<i>Buchloe dactyloides</i>	24.0 (27.0)	A minimum of two (2) native species of small or large trees, and two (2) native species of shrubs with Very Low or Low (VL or L) water needs and Sun or Sun/Part Shade light needs as listed in the current Grow Green Native and Adapted Landscape Plants guidance document***. Plants must be a minimum size of 1-gallon (see Table 8, equivalency chart) and minimum of 1 plant per 100 square feet.
	Blue Grama	<i>Bouteloua gracilis</i>	10.0 (11.2)	
	Green Sprangletop	<i>Leptochloa dubia</i>	2.0 (2.2)	
	Sand Dropseed	<i>Sporobolus cryptandrus</i>	1.0 (1.1)	
	Galleta	<i>Pleuraphis jamesii</i>	10.0 (11.2)	
	Canada Wild Rye	<i>Elymus canadensis</i>	10.0 (11.2)	
	Purple Threawn	<i>Aristida purpurea</i>	4.0 (4.5)	
	Sideoats Grama	<i>Bouteloua curtipendula</i>	7.0 (7.8)	
Forb Seed Mix**	Bluebonnet	<i>Lupinus texensis</i>	20.0 (22.4)	
	Purple Prairie Clover	<i>Dalea purpurea</i>	4.0 (4.5)	
	Plains Coreopsis	<i>Coreopsis tinctoria</i>	2.0 (2.2)	
	Partridge Pea	<i>Chamaecrista</i>	20.0 (22.4)	

		<i>fasciculata</i>		
	Greenthread	<i>Thelesperma filifolium</i>	6.0 (6.7)	
	Indian Blanket	<i>Gaillardia pulchella</i>	10.0 (11.2)	
	Lemon Mint	<i>Monarda citriodora</i>	3.0 (3.4)	
	Mexican Hat	<i>Ratibida columnaris</i>	2.0 (2.2)	
	Pink Evening Primrose	<i>Oenothera speciosa</i>	1.0 (1.1)	
	Sunflower (Common)	<i>Helianthus annuus</i>	5.0 (5.6)	
	Milkweed (Antelope Horn or Green milkweed)	<i>Asclepias asperula or Asclepias viridis</i>	0.1 (0.04)	
Total				
Total recommended seed mix application rate is 35 lbs/ac (23.5 lbs/ac grass, 11.5 lbs/ac forbs).				
Cool Season Cover Grasses	Cereal rye grain*	<i>Secale cereale</i>	34.0 (38.1)	Add at least one of the cool season grasses to the warm-season mix between September 15 and March 1.
	Oats*	<i>Avena sativa</i>	4.0 (4.5)	
	Western Wheatgrass*	<i>Pascopyrum smithii</i>	5.6 (6.3)	

* Plant only between. September 15 to March 1. Non-persistent winter cover crop for erosion control. Only one cool season species is required per installation.

** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by an authorized City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. The total pounds/acre (lbs/ac) of the proposed seed mix can be calculated based on the desired percentage of each seed in a mix.

*** www.austintexas.gov/departments/grow-green/plant-guide

Table 5. Upland Species, Shade-Dappled Light Areas

Type	Common Name	Botanical Name	Recommended Application rate lbs/ac (kg/ha)	Rooted Plants Species, Diversity, Quantity & Size
Grass Seed Mix***	Inland Seaots**	<i>Chasmanthium latifolium</i>	12.0 (13.5)	A minimum of two (2) native species of small or large trees, and two (2) native species of shrubs with very low (VL), low (L), or low- medium (L-M) water needs and Sun /Part Shade light needs as listed in the current Grow Green Native and Adapted Landscape Plants guidance document****. Plants must be a minimum size of 1-gallon (see Table 8, equivalency chart) and minimum of 1 plant per 100 square feet.
	Canada Wildrye	<i>Elymus canadensis</i>	10.0 (11.2)	
	Sideoats Grama	<i>Bouteloua curtipendula</i>	7.0 (7.8)	
Forb Seed Mix***	Purple Coneflower	<i>Echinacea purpurea</i>	10.0 (11.2)	
	Lanceleaf Coreopsis	<i>Coreopsis lanceolata</i>	10.0 (11.2)	
	Scarlet Sage	<i>Salvia coccinea</i>	8.0 (9.0)	
	Drummond Phlox	<i>Phlox drummondii</i>	8.0 (9.0)	
	Black-Eyed Susan	<i>Rudbeckia hirta</i>	2.0 (2.2)	
	Cutleaf Daisy	<i>Engelmannia pinnatifida</i>	18.0 (20.2)	
	Tall Aster	<i>Aster praealtus</i>	1.0 (1.1)	
	Illinois bundleflower	<i>Desmanthus illinoensis</i>	15.0 (16.8)	

	Standing cypress	<i>Ipomopsis rubra</i>	6.0 (6.7)	
	Winecup	<i>Callirhoe involucrata</i>	5 (5.6)	
	Milkweed (Butterfly Weed or Showy Milkweed)	<i>Asclepias tuberosa</i> or <i>Asclepias speciosa</i>	0.1 (0.04)	
Total				
Total recommended seed mix application rate is 35 lbs/ac (23.5 lbs/ac grass, 11.5 lbs/ac forbs).				
Cool Season Cover Grasses	Cereal rye grain***	<i>Secale cereale</i>	34.0 (38.1)	Add at least one of the cool season grasses to the warm-season mix between September 15 and March 1.
	Oats***	<i>Avena sativa</i>	4.0 (4.5)	
	Western Wheatgrass***	<i>Pascopyrum smithii</i>	5.6 (6.3)	

** If unavailable replace with Prairie Wild Rye.

*** Plant only between September 15 to March 1. Non-persistent winter cover crop for erosion control. Only one cool-season species is required per installation.

**** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by an authorized City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. The total pounds/acre (lbs/ac) of the proposed seed mix shall be calculated based on the desired percentage of each seed in a mix.

**** www.austintexas.gov/department/grow-green/plant-guide

Table 6. Facultative Species, Moderate - High Moisture Areas

Type	Common Name	Botanical Name	Recommended Application rate lbs/ac (kg/ha)	Rooted Plants Species, Diversity, Quantity & Size
Grass Seed	Big Bluestem	<i>Andropogon gerardii</i>	8.0 (9.0)	A minimum of two (2) native species of small or large trees, and two (2) native

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Mix**	Big Muhuly (Lindhiemers)	<i>Muhlenbergia lindheimeri</i>	6.0 (6.7)	species of shrubs with low (L), low-medium (L-M), or medium (M) water needs and Sun/Part Shade or Shade light needs as listed in the current Grow Green Native and Adapted Landscape Plants guidance document***. Plants must be a minimum size of 1-gallon (see Table 8, equivalency chart) and minimum of 1 plant per 100 square feet.
	Bushy Bluestem	<i>Andropogon glomeratus</i>	6.0 (6.7)	
	Eastern Gamagrass	<i>Tripsacum dactyloides</i>	12.0 (13.5)	
	Indiangrass	<i>Sorghastrum nutans</i>	6.0 (6.7)	
	Inland Seaoats	<i>Chasmanthium latifolium</i>	12.0 (13.5)	
	Canada Wildrye	<i>Elymus canadensis</i>	10.0 (11.2)	
	Sand Lovegrass	<i>Eragrostis trichodes</i>	2.0 (2.2)	
	Switchgrass	<i>Panicum virgatum</i>	4.0 (4.5)	
Forb Seed Mix**	Black-Eyed Susan	<i>Rudbeckia hirta</i>	2.0 (2.2)	
	Illinois Bundleflower	<i>Desmanthus illinoensis</i>	15.0 (16.8)	
	Purple Prairie Clover	<i>Dalea purpurea</i>	4.0 (4.5)	
	Clasping Coneflower	<i>Dracopis amplexicaulis</i>	3.0 (3.4)	
	Plains Coreopsis	<i>Coreopsis tinctoria</i>	2.0 (2.2)	
	Goldenrod	<i>Solidago</i>	1.0 (1.1)	

		<i>altissima</i>		
	Lazy Daisy	<i>Aphanostephus</i> <i>sp.</i>	1.0 (1.1)	
	Lemon Mint	<i>Monarda</i> <i>citriodora</i>	3.0 (3.4)	
	Sunflower (Common)	<i>Helianthus</i> <i>annuus</i>	5.0 (5.6)	
	Sunflower (Maximilian)	<i>Helianthus</i> <i>maximiliana</i>	4.0 (4.5)	
	Milkweed (common or Butterfly Milkweed)	<i>Asclepias syriaca</i> or <i>Asclepia</i> <i>tuberosa</i>	0.1 (0.04)	
Total				
Total recommended seed mix application rate is 26.0 lbs/ac (17.0 lbs/ac grass, 9.0 lbs/ac forbs).				
Cool Season Cover Grasses	Cereal rye grain*	<i>Secale cereale</i>	34.0 (38.1)	Add at least one of the cool season grasses to the warm-season mix between September 15 and March 1.
	Oats*	<i>Avena sativa</i>	4.0 (4.5)	
	Western Wheatgrass*	<i>Pascopyrum</i> <i>smithii</i>	5.6 (6.3)	

* Plant only between September 15 to March 1. Non-persistent winter cover crop for erosion control.

** Any unavailable species can be substituted with the same quantity of another species from this list or another species approved by an authorized City of Austin representative including Environmental Reviewer, Environmental Inspector, or Watershed Protection Department representative. The total pounds/acre (lbs/ac) of the proposed seed mix can be calculated based on the desired percentage of each seed in a mix.

*** www.austintexas.gov/department/grow-green/plant-guide

Table 7. Rooted Plant Size Equivalents

Potential Substitute		Equivalent To	
Quantity	Plant Size	Quantity	Plant Size
1	5-gallon	4	One-gallon
1	Two- or Three-gallon	2	One-gallon
4	4" pots or quarts	1	One-gallon
8	Plugs, live roots, saplings	1	One-gallon

Table 8. Seed Rate Calculation

Multiple species native seed mixes require careful calculations to ensure proper planting rates. The example below is for illustrative purposes only.

Species	Seeding Rate (lbs/ac)	Desired proportion of a species in the total mix (%)	Total quantity of seed in mix (lbs/ac)
Grass 1	7	.20	1.40
Grass 2	2	.20	0.40
Grass 3	24	.20	4.80
Forb 1	10	.20	2.00
Forb 2	8	.20	1.60
TOTALS	--	1.0 (100%)	10.2

Table 9. Seed Calculation Worksheet

The amount of seed needed to be planted on a project shall be calculated before installation to ensure adequate seed is placed, and provided as a submittal. Table 9 is an example worksheet, followed by an example calculation. Information for calculation can be obtained from seed tags or the supplier.

Plant Group	Desired Seeding Rate (lbs/ac)	PLS (pure live seed)	Bulk Rate (lbs/ac)	Seeding Area (ac)	Amt. of Seed to be Installed (lbs)
Grasses					
Forbs					
TOTAL					

FORMULAS:

PLS (pure live seed) = (Purity × Germination) × 100. Can also use average PLS from seed tags.

Bulk Rate (lbs/ac) = Desired Seed Rate (lbs/ac) / PLS

Amt. of Seed to be Installed (lbs) = Bulk Rate (lbs/ac) × Seeding Area (ac)

Example:

Plant Group	Desired Seeding Rate (lbs/ac)	PLS [pure live seed] (% decimal)	Bulk Rate (lbs/ac)	Seeding Area (ac)	Amt. of Seed to be Installed (lbs)
Grasses	131.00	0.81	161.73	1.50*	242.60
Forbs	65.34	0.87	75.10	1.50*	112.70
TOTAL	196.34	0.84 (ave.)	236.83	1.50	355.30

*Applied over the same 1.5 ac area.

Source: [Rule No. R161-14.29, 12-30-2014](#); [Rule No. R161-15.14, 1-4-2016](#).

609S.6 - Management Practices

Management Practices include (1) weed management (pesticide application or mechanical removal) to so that 90 percent of the revegetation area is free of weeds listed in Table 3, (2) reseeding areas of poor germination to achieve coverage and height per 609S.8, with no bare areas greater than 10 s.f., and (3) replacement and replanting of rooted plants per 608S.5(O) [Plant Material Removal and Replacement] and 608S.7 (Acceptability of Plants).

Weeds, as defined in the Weed List (Table 3), shall be controlled in the most efficient manner possible. The timing of weed control may occur prior to soil disturbance, just before the installation of seed, and/or during the period of plant establishment. Weed control shall be introduced at one or all of these times, so that the greatest control is achieved. The preferred method of control is to remove weeds, either by physical or mechanical means, when the site is conducive (e.g. when the ground is moist) to this approach.

The entire root system of perennial weeds shall be removed to prevent re-sprouting. Table 9 provides management practices for woody invasive vegetation. Weeds may be controlled with an approved contact, systemic herbicide, provided the product is used with appropriate care and is applied in accordance with label instructions and the following guidelines:

1. Herbicide shall not be applied when the wind is greater than 8 mph (12.9 kph),
2. Herbicide shall not be applied when rainfall is expected within 24 hours,
3. Herbicide shall not contact surface water, i.e. creeks, rivers, and lakes,
4. Herbicide shall not contact desirable vegetation (a wicking method shall be used, if necessary, to accurately contact target weed only during application).

Table 10. Management Practices for Woody Invasive Vegetation

Before Seeding	
Stems ≤1 inch	Pull with weed wrench
Stems >1 inch	Cut at base and spray stump with appropriate herbicide within five minutes. Bag and dispose of seeds and fruit in landfill.
After Seeding	
Seedlings	Hand pull
Sprouts	Foliar application of appropriate herbicide

The Landscape Architect, Engineer or designated representative shall be consulted to determine appropriate weed control management when weeds are located in an environmentally sensitive location (e.g. near water or adjacent to a critical environmental feature).

Source: [Rule No. R161-14.29, 12-30-2014](#); Rule R161-15.14, 1-4-2016.

609S.7 - Reseeding/Replanting

At locations that fail to show an acceptable stand of planting for any reason during the initial seeding, repair and/or reseed, replant locations as determined by the Landscape Architect, Engineer or designated representative. A successful stand of grasses and forbs should exhibit the following:

- Seedlings with vigorous green foliage;
- Green leaves remaining throughout the summer, at least at the plant bases;
- Uniform density, with grasses and/or forbs well intermixed;
- Minimum of 95% cover; and
- No patches of exposed soil greater than 10 s.f. in aerial extent.

The Owner or designated representative will inspect the seeding/planting during April of the calendar year following the year of initial seeding/planting and determine the necessity and extent of over seeding reseeding, or replanting required. Contractor shall ideally complete any required reseeding/replanting before May 15 of that year. This date may be extended if, in the opinion of the Owner and qualified landscape professional, the weather conditions before May 15 are not suitable for reseeding work. If the timing is bad, an annual cover crop can be over-seeded in a deficient area to temporarily provide coverage until a suitable time for seeding or planting perennial seed or rooted plants. If vegetation fails to grow and thrive, the soil must be tested to determine whether nutrient imbalances are responsible and, if so, an appropriate course of nutrient remediation (e.g., fertilizers, composts, topsoils, or other organic amendments) as recommended by a landscape professional must be implemented by the Contractor.

The Contractor shall meet the requirements for initial seeding and planting, including seeding method, seed mix, application rates, and slope texturing as applicable, unless otherwise agreed to in writing by the Owner and/or City staff. Corrected deficiencies will be re-inspected and approved by the Owner and designated representative, and final acceptance will be granted only upon satisfactory completion.

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

609S.8 - Measurement

Work and acceptable material for Native Seed and Planting for Restoration will be measured by the square yard (square meter: 1 square meter equals 1.196 square yards) or by the acre (hectare: 1 hectare equals 2.471 acres), complete in place, so that all areas of a site that rely on vegetation for stability must be uniformly vegetated with a minimum of 95 percent total coverage with no bare areas exceeding 10 square feet (1.5 square meters) and a 1½ inch tall (40 millimeters) successful stand of plant materials. Ninety (90) percent of the overall planted area must be free of weeds listed in Table 3. Bare areas shall be re-prepared and reseeded as required by the Landscape Architect, Engineer or designated representative to develop an acceptable stand of vegetation.

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

609S.9 - Payment

The work performed and materials furnished and measured will be paid for at the unit bid price for Native Seeding and Planting for Restoration of the method specified on the Drawings.

The unit bid price shall include full compensation for furnishing all materials, including all topsoil, water, seed, or fertilizer or mulch and for performing all operations necessary to complete the work.

Payment will be made under one or more of the following pay items:

NATIVE SEEDING AND PLANTING FOR RESTORATION

Item No. 609S

Pay Item No. 609S-A:	Topsoil and Seedbed Preparation	Per Square Yard.
Pay Item No. 609S-B:	Topsoil and Seedbed Preparation	Per Acre.
Pay Item No. 609S-C:	Native Seeding	Per Square Yard.
Pay Item No. 609S-D:	Native Seeding	Per Acre.
Pay Item No. 609S-E:	Rooted Plants	Per each.
Pay Item No. 609S-F:	Watering	Per 1,000 Gallons (Kgal).
Pay Item No. 609S-G:	Management Practices	Per Square Yard.
Pay Item No. 609S-H:	Management Practices	Per Acre.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 609S Native Grassland Seeding and Planting for Erosion Control</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 130S	Borrow
Item No. 601S	Salvaging and Placing Topsoil
Item No. 606S	Fertilizer
<u>City of Austin Land Development Code</u>	

<u>Designation</u>	<u>Description</u>
Section 6-4	Water Conservation

RELATED CROSS REFERENCE MATERIALSSpecification Item 609S Native Grassland Seeding and Planting for Erosion Control

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City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 607S	Slope Stabilization
Item No. 608S	Planting

City of Austin Standards (Details)

Standard No.	Description
627S-1	Grass Lined Swale
627S-2	Grass Lined Swale W/Stone Center
633S-1	Landgrading

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

<u>Designation</u>	<u>Description</u>
Item No. 160	Topsoil
Item No. 162	Sodding for Erosion Control
Item No. 164	Seeding for Erosion Control
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blankets
Item No. 180	Wildflower Seeding
Item No. 192	Landscape Planting

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ITEM NO. 610S - PRESERVATION OF TREES AND OTHER VEGETATION 12-7-18

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 by steel pipe, tee posts, U posts or 2" x 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	Protective Fencing Type C Other Materials (Limited Application-minimal)	Per Lineal

PRESERVATION OF TREES AND OTHER VEGETATION

Item No. 610S

610S-C:	damage potential)	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**

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 610S, "Preservation of Trees and Other Vegetation"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item No. 606S	Fertilizer
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
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
<u>City of Austin Transportation Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.3.1.C.6	Sight Distance
Section 6.2.3.A.4	Clearance Height
Figure 1-6	Desirable Sight Triangle
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
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

<u>City of Austin Land Development Code</u>	
<u>Designation</u>	<u>Description</u>
Section 25-8-603	Tree Protection Administration
Section 25-8-623	Inspection by City Arborist
<u>ASTM, American Society for Testing and Materials</u>	
<u>Designation</u>	<u>Description</u>
D-2729	Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

RELATED CROSS REFERENCE MATERIALS

Specification 610S, "Preservation of Trees and Other Vegetation"

<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
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

<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
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

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ITEM NO. 614S – INVASIVE SPECIES MANAGEMENT**614.1 Description**

This item shall govern the treatment of invasive species on site, including initial treatment and invasive species management throughout the duration of the project.

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

614.2 - Submittals

The submittal requirements of this specification item shall include:

A. Required submittals before construction:

1. Documentation of current pesticide applicator license.
2. Specific information for each pesticide proposed, including:
 - Manufacturer,
 - Product name,
 - Description of chemical composition,
 - Handling, storage and mixing requirements,
 - MSDS sheets
3. An invasive species management plan, including:
 - List of species to be treated,
 - Treatment methods to be used for each species,
 - Herbicide application rates, mixing formulations, and procedures for application,
 - Times of year for application,
 - Special circumstances

B. Required submittals during construction:

1. Information on the root barrier system, if proposed, including product information and manufacturer's recommended installation instructions.

C. Required submittals before substantial completion:**1. Pesticide Application Tracking Log**

Applicator shall submit records of each pesticide application twice yearly, regardless of the use classification of the pesticide applied. (See attachment A.) Information Required:

- a. Date and time of application
- b. Person for whom application was made
- c. Location of land
- d. Product name
- e. EPA registration number
- f. Rate of product per unit
- g. Total volume applied per unit

- h. Pest treated
 - i. Site treated
 - j. Total acres or volume of acre treated (e.g. acre, square feet, number of head)
 - k. Wind direction and velocity and air temperature
 - l. FAA "N" number of aerial equipment; ID number of other application equipment
 - m. Applicator name and license number and/or person making the application
- 2. Maintenance shall be provided by the Installing Contractor. Provide contact information for primary maintenance contact.
 - 3. Schedule of visits and tasks for the first year.

Submittals of any of the above information may be requested by the Landscape Architect at any point throughout the project or the maintenance/warranty period.

D. Required Submittals during the Maintenance / Warranty Period:

- 1. Monthly schedule of maintenance activities submitted to designated Owner's Representative, one week prior to the beginning of each month.
- 2. Documentation of maintenance visits and activities performed to designated Owner's Representative, within one week of visit as indicated on submitted maintenance schedule.
- 3. Quarterly reports to the Project Landscape Architect and Owner, according to schedule submitted at Substantial Completion.

614S.3 -General

Contractor shall have experience with conservation and natural resources and endangered species habitat management. Contractor shall have experience with Invasive species management and riparian restoration

Unless otherwise stated, the IPM standards from the City of Austin Grow Green program and the procedures provided in the City of Austin Invasive Species

Management Plan Field Resources document apply.

http://www.austintexas.gov/watershed_protection/publications/document.cfm?id=202217

614S.4 - Materials

A. Herbicides

Any herbicides used in the riparian zone must be approved for aquatic applications.

B. Plant material disposal

Large woody species such as ligustrum, chinaberry and similar species can be chipped and spread over newly planted areas on site as mulch, with approval from the Landscape Architect. If plants have set fruit, they shall be taken off site and disposed of in a landfill.

Large grasses such as golden bamboo or giant cane and smaller woody species shall be disposed of at a composting facility.

C. Rhizome barrier

High Density Polyethylene (HDPE), 40 mil thickness or high-impact polystyrene (HIPS) with rubberizer added and UV inhibitor, 0.040-inch to 0.060-inch thickness, 24" depth minimum. Barrier clamps: stainless steel, including nuts and bolts or extrusion welding.

614S.5 – Construction Methods

All invasive species identified in the project Invasive Species Management Plan Field shall be treated at the start of the project, regardless of whether they are identified in the Drawings. The diameter and depth of test hole or holes shall be as indicated or as directed by the Engineer or designated representative.

The following general guidelines apply to specific species. The Contractor shall submit an Invasive Species Management Plan for all species to be treated.

A. Woody tree species (ligustrum, chinaberry, etc.)

1. For trees and shrubs one-inch (1") caliper and above, use one of the following methods
 - a. Manual Removal – Remove using Weed Wrench or similar approved product. Do not use where work may impact slope stability or lead to erosion/sedimentation issues.
 - b. Cut-Stump - Cut plants four inches (4") from ground and paint edge of cut surface (cambium) with 44% a.i. (active ingredient) triclopyr solution approved for areas near water (Garlon 3A or approved equal) within 30 seconds of cut.
 - c. Hack and Squirt - Girdle or frill (make evenly-spaced hatchet cuts) around plant trunks and apply 44% a.i. triclopyr solution approved for areas near water (Garlon 3A or approved equal) within 30 seconds.
2. Recheck for new growth for one growing season (growing seasons include spring and fall). Treat as necessary.
3. After cutting, woody tree species shall be chipped and spread as mulch on site if no fruit is visible.
 - d. For shrubs and trees below one-inch (1") caliper, use Manual Removal (A.a.i above) to remove and dispose of in a composting facility.

B. Golden Bamboo (*Phyllostachys aurea*)

1. Cut stalks to ground and immediately (within 60 seconds) treat the cut stumps with undiluted glyphosate product approved for areas near water (Rodeo or approved equal). Allow to regrow to a height of two (2') to three (3') feet. Treat with foliar spray of 5% a.i. glyphosate solution approved for areas near water and appropriate dye and surfactant per label directions.
2. Check for new growth every 2 weeks for 4 growing seasons (growing seasons include spring and fall). Spot treat as necessary.
3. In areas designated for root barrier in the Drawings, install barrier per manufacturer's recommendations.

C. Giant Cane (*Arundo donax*)

1. Treat at full height during growing season after initiation of flowering (August to October) with an imazamox solution approved for areas near water (5% Clearcast or similar approved product). Repeat treatments over a 3-year period. If control is needed in a shorter timeframe, utilize method for Golden Bamboo.

D. Rhizome Barrier

1. Install barrier in accordance with the manufacturer's recommendations at the location(s) indicated on the Drawings or per Owner's instructions. Barrier should extend two inches above the finished grade. Minimize the number of seams and overlap barrier at least 12" at any seam, ensuring there is no soil between the overlapping layers. Strap and bolt or tape the overlapping layers with moisture-resistant HDPE tape.

614S.6 - Measurement

Work and acceptable material for "Invasive Species Management" will be measured by the following: for invasive tree removal, in cost per plant; for shrub and large grass removal, in cost per square yard. Successful removal will be measured by visual inspection for complete absence of invasive plants within the Limits of Construction. Payment shall be made after the indicated number of growing seasons have passed without regrowth of invasive material. Rhizome barrier will be measured per linear foot of installed barrier.

614S.7 - 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 for each plant removed or in the case of a large grass colony, in removal per square yard. Payment shall be made when the indicated number of growing seasons have passed without regrowth of invasive material. The unit bid price shall include full compensation for furnishing all labor, herbicide application, removal of plant material and spreading of mulch on the project site, materials, tools, equipment, supplies, maintenance and incidentals necessary to complete the work.

Pay Item No. 614S-A:	Invasive woody plant control, <1", Manual Removal
Pay Item No. 614S-B:	Invasive woody plant control, >1", Manual Removal
Pay Item No. 614S-C:	Invasive woody plant control, >1", Girdling
Pay Item No. 614S-D:	Invasive woody plant control, >1", Cut-stump herbicide method
Pay Item No. 614S-E:	Invasive woody plant control, >1", Hack-and-squirt herbicide method
Pay Item No. 614S-F:	Invasive bamboo control
Pay Item No. 614S-G:	Invasive giant cane control

Pay Item No. 614S-H	Invasive non-woody grass and shrub control
Pay Item No. 614S-I	Rhizome barrier, installed

END

ITEM NO. 620S - FILTER FABRIC 1-4-16

620S.1 - Description

This item shall govern the furnishing of materials and for placement of filter fabric as indicated on the Drawings or directed by the Engineer or designated representative. Filter Fabric shall have the capability for allowing the passage of ground water or stormwater through it without transporting the soil or medium placed around the filter fabric.

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.

620S.2 - Submittals

The submittal requirements of this specification item include:

- A. catalog cuts,
- B. samples of material selected,
- C. testing results,
- D. manufacturer's recommended installation procedures, and
- E. manufacturer certification of compliance with this specification.

620S.3 - Materials

A. General

The fabric shall be constructed exclusively of synthetic thermoplastic fibers and may be either woven or non-woven to form a mat of uniform quality. Fabric fibers may be either continuous or discontinuous and oriented in either a random or an aligned pattern throughout the fabric. The fabric shall be mildew resistant, rot proof and shall be satisfactory for use in a wet soil and aggregate environment. The fabric shall contain ultraviolet stabilizers and shall have non-raveling edges.

B. Physical Requirements

The fabric shall meet the requirements of Table 1, when sampled and tested in accordance with the methods indicated in the table below.

For applications such as water quality facility underdrain wrappings that require a high flow-through rate, or when specified by the engineer, the fabric shall be woven mono-filament and meet the requirements of Table 2.

All material shall be shipped with suitable wrapping to protect the fabric during shipping and storage at the job site.

Source: [Rule No. R161-15.14, 1-4-2016](#).

620S.4 - Construction Methods

The submittal requirements shall be completed before any materials are ordered.

The "Filter Fabric" shall be installed in accordance with the manufacturer's recommendations, as indicated on the Drawings or as directed by the Engineer or designated representative. When lapping is required, it shall be in accordance with the manufacturer's recommendations. Backfilling around the Filter

Fabric shall be done in such a manner that the Filter Fabric material will not be damaged during the placement.

TABLE 1: FILTER FABRIC REQUIREMENTS		
Original Physical Properties	Test Method	Requirements
Fabric weight (mass), on an ambient temperature air-dried tension free sample, expressed in oz/ sq. yd (grams/square meter)	TxDoT Tex-616-J*	Slope Stabilization 4.0 (135) minimum
		Gabions and Revet Mattresses 6.0 (200) minimum
Water flow rate by falling head method, 7.9 inches (20 cm) to 3.9 inches (10 cm) on 2 inch (50 mm) ID cylinder with 1 inch (25 mm) diameter orifice, with flow rate expressed in gal/sq.ft/minute (liters/square meter/minute).	TxDoT Tex-616-J*	80 (3,260) minimum
Breaking load in either machine or cross-machine direction, expressed in pounds (newtons)	ASTM D-1682 grab method G**	100 (445) minimum
Equivalent opening size for US Standard (SI) sieves.	CW-02215	70 to 100 (212 to 150mm)
"Apparent elongation" at breaking load in either machine or cross-machine direction, expressed as percent	ASTM D-1682 grab method G**	100 maximum

* TxDoT Tex-616-J, "Testing of Construction Fibers

** ASTM D 1682 grab method G, "Test Methods for Breaking Load and Elongation of Textile Fabrics"* as modified by TxDoT Test Method Tex-616-J

*** CW-02215, US Army Corps of Engineers, Civil Works Construction Guide Specification "Plastic Filter Fabric".

TABLE 2: HIGH FLOW FILTER FABRIC REQUIREMENTS		
Property	Test Method	Requirements
Fabric Weight	>D 3776	3.0 ounces/square yard minimum
Ultraviolet (UV) Radiation Stability	D 4355	70% strength retained minimum, After 500 hours in xenon arc device
Mullen Burst Strength	D 3786	120 pound per square inch minimum
Water Flow Rate	D 4491	275 gallons/minute/square feet minimum

Source: [Rule No. R161-15.14, 1-4-2016](#).)

620S.5 - Measurement

Work and acceptable material for "Filter Fabric" and "High Flow Filter Fabric" will be measured by the square yard (square meter: 1 square meter equals 1.196 square yards), complete in place.

Source: [Rule No. R161-15.14, 1-4-2016](#).)

620S.6 - Payment

The work performed and the materials furnished and measured as provided under "Measurement" will be paid at the unit bid price for "Filter Fabric". The unit bid price, when included in the contract as a pay item, shall include full compensation for all materials, excavation and backfilling and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

Pay Item No. 620S-A:	Filter Fabric	Per Square Yard.
Pay Item No. 620S-B:	High Flow Filter Fabric	Per Square Yard.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 620S, "Filter Fabric"</u>	
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
D 1682	Test Methods for Breaking Load and Elongation of Textile Fabrics
D 3776	Standard Test Method for Mass Per Unit Area (Weight) of Fabric
D 4355	Test Method for Deterioration of Geotextiles by Exposure to Ultraviolet Light, Moisture, and Heat in a Xenon Arc Type Apparatus
D 3786	Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
D 4491	Standard Test Method for Water Permeability of Geotextiles by Permittivity
<u>Texas Department of Transportation Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-616-J	Testing of Construction Fabrics

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 620S, "Filter Fabric"</u>	
<u>City of Austin Environmental Criteria Manual</u>	

<u>Designation</u>	<u>Description</u>
Section 1.4.2.E	Rock Berm
Section 1.6.5.A.4	Sand Filtration Bed Details
Section 1.6.7.C	Biofiltration
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 639S-1	Rock Berm
Number 661-1	Sand Bed Filtration Configurations Using Geomembrane Liner
Number 661-2	Sand Bed Filtration Configurations Using Clay Liner/No Liner Required
Number 661-3	Biofiltration Bed Configurations Using Geomembrane/Clay Liner
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401	Structural Excavation and Backfill
Item No. 602S	Sodding for Erosion Control

Item No. 604S	Seeding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 621S - DIVERSION (TEMPORARY) 11-26-01**621S.1 - Description**

This item shall govern providing and placing earthen berms, channels or a combination thereof along such areas as indicated on the Drawings in accordance with these specifications and Standard Detail No. 621S-1, "Diversion". This method shall only be used during construction and its purpose shall be to temporarily control soil loss by intercepting and conveying the runoff to a stable outlet. This item shall also include the subsequent removal of the diversion device and re-vegetation of the area.

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

621S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Characteristics (LL, PI, maximum density, etc.) of proposed embankment material,
- B. Identification of the type, source, mixture, pure live seed (PLS) and rate of application of the seeding,
- C. Type of mulch,
- D. Type of tacking agent, and
- E. Type, chemical analysis and rate of application of fertilizer.

621S.3 - Materials**A. Berm**

The berm shall consist of earthen materials conforming to Standard Specification Item No. 130S, "Borrow", Class A and shall be free of brush, debris and stones larger than 6 inches (150 mm). The liquid limit (LL) of the borrow material shall not exceed 45 and the plasticity index (PI) shall not exceed 15 (TxDoT Test Methods Tex 103-E, Tex-104-E and Tex-106-E).

B. Seeding

Seeding shall conform to Standard Specification Item No. 604S, "Seeding for Erosion Control".

621S.4 - Construction Methods

Diversion shall not be used where the slope of existing ground exceeds 15 percent.

All brush, stumps and debris shall be removed from the diversion area before construction. Diversion berms shall be constructed to the height and length indicated or as directed by the Engineer or designated representative. The height shall include a minimum of 1-foot (0.3 meter) freeboard above the design high water elevation. The berms shall have a minimum width of 4 feet (1.2 meters) at the top with maximum side slopes of 3:1 unless otherwise specified by the Engineer or designated representative.

The earthen material shall be placed in successive 6-inch (150 mm) layers and compacted by rolling with construction equipment or other approved methods to provide not less than 95 percent of the maximum dry density as determined in accordance with TxDoT Test Methods Tex-114-E and Tex-115-E. The top 4 inches (100 mm) shall only be compacted to 85 percent of the maximum density to facilitate seeding. Berms, channels and any area disturbed shall be seeded. Seeding shall conform to Item No. 604S, "Seeding for Erosion Control", except that topsoil will not be required on the berm.

Berms and channels shall be maintained and silt accumulation removed when necessary or as directed by the Engineer or designated representative. After completion of construction or when directed by the

Engineer or designated representative, the berm and channel shall be removed and the site restored either to its natural condition, to the lines and grades indicated on the Drawings or as determined by the Engineer or designated representative.

621S.5 - Measurement

The work performed and the materials furnished as prescribed by this item will be measured by the lineal foot (lineal meter: 1 meter equals 3.281 feet) of diversion, complete in place.

621S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot for Diversion as indicated on the Drawings. The unit bid price shall include: a) full compensation for furnishing, hauling and placing all materials; b) all labor, tools, seeding, equipment and incidentals needed to complete the work, c) any repair, replacement and seeding of materials to maintain the Diversion d) removal and disposal of all materials at the completion of construction and e) reseeding the areas disturbed by the removal of the temporary Diversion.

Payment will be made under:

Pay Item No. 621S:	Diversion	Per Lineal Foot.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 621S "Diversion (Temporary)"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 130S	Borrow
Item No. 604S	Seeding for Erosion Control
Item No. 606S	Fertilizer

<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 621S-1	Diversion
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-114-E	Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade & Embankment Soil
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 621S "Diversion (Temporary)"</u>	
<u>City of Austin Land Development Code</u>	
<u>Designation</u>	<u>Description</u>

Chapter 25	Drainage
Section 25-7-61	Criteria for Approval of Plats, Construction Plans, And Site Plans
Section 25-7-61 (A) (4)	"temporary and permanent measures to control erosion..."
Section 25-7-65	Fiscal Security
Article 5	Erosion and Sedimentation Control; Overland Flow
Section 25-8-181	Erosion and Sedimentation Control
Section 25-8-182	Development Completion
Section 25-8-183	Modification of Erosion Control and Construction Sequencing Plans
Section 25-8-323	Temporary Storage Areas; Topsoil Protection
Section 25-8-341 (B)	"A cut must be restored and stabilized"
Section 25-8-342 (B)	"A fill must be restored and stabilized"
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.0	Erosion and Sedimentation Control Criteria
Section 1.4.1	Introduction
Section 1.4.1.2	Project Management
Section 1.4.2	Temporary Structural Practices
Section 1.4.2.B	Diversion, Interceptor and Perimeter Dikes

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 132S	Embankment
Item No. 201S	Subgrade Preparation
Item No. 601S	Salvaging and Placing Topsoil
Item No. 605S	Soil Retention Blanket
Item No. 607S	Slope Stabilization

City of Austin Standards (Details)

Standard No.	Description
No. 627S-1	Grass Lined Swale
No. 627S-2	Grass Lined Swale W/ Stone Center
No. 633S-1	Landgrading

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

<u>Designation</u>	<u>Description</u>
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Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket

ITEM NO. 625S - TEMPORARY GRADE STABILIZATION STRUCTURE 6-21-07**625S.1 - Description**

This item shall govern for construction of a temporary channel lined with Hot Mix Asphaltic Concrete, Portland Cement concrete or comparable non-erodable material. The lining shall be placed to extend from the top of a slope to the bottom of a slope and to convey surface runoff safely down-slopes without causing erosion (Environmental Criteria Manual Section 1.4.2, "Temporary Structural Practices"). The removal of the entire structure and the revegetation of the area after the permanent facilities are in place shall also be included in this item.

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.

625S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Aggregate types, gradations and physical characteristics for the Portland cement concrete mix,
- B. Aggregate types, gradations and physical characteristics for the Hot Mix Asphaltic Concrete mix,
- C. Submittal items required in Standard Specification Item 591S, "Riprap for Slope Protection".
- D. Re-vegetation program including:
 - 1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
 - 2. Type of mulch.
 - 3. Type of tacking agent.
 - 4. Type and rate of application of fertilizer

625S.3 - Materials

- A. Concrete

Portland Cement concrete shall conform to Class A, Item No. 403S, "Concrete for Structures".
- B. Hot Mix Asphaltic Concrete

Asphaltic concrete shall conform to Item No. 340S, "Hot Mix Asphaltic Concrete Pavement".
- C. Riprap

Rock or broken concrete riprap for energy dissipation shall not exceed 5 pounds each and shall conform to Item No. 591S, "Riprap for Slope Protection".
- D. Seeding

Seeding shall conform to Item No. 604S, "Seeding for Erosion Control".

625S.4 - Construction Methods

The Contractor shall minimize the area disturbed during construction. Prior to placement of the Grade Stabilization Structure, all clearing, grubbing and subgrade preparation operations shall be completed conforming to Item No. 111S, "Excavation".

Hot Mix Asphaltic Concrete work shall conform to Item No. 340S, "Hot Mix Asphaltic Concrete".

Concrete work shall conform to Item No. 403S, "Concrete for Structures" and to Item No. 591S, "Riprap for Slope Protection".

At such time as the structure is no longer needed and with the approval of the Engineer or designated representative, the Contractor shall remove the entire structure and revegetate the disturbed area.

625S.5 - Measurement

Acceptable work performed as prescribed by this Standard Specification Item will be measured along the chute or flume in lineal feet (lineal meters: a lineal meter is equal to 3.281 lineal feet).

625S.6 - Payment

Work performed and materials furnished for this item will be paid at the unit bid price per linear foot of chute. The unit bid price shall include all clearing, excavation, materials, placement, maintenance, removal and revegetation of disturbed areas.

Payment will be made under:

Pay Item No. 625S:	Grade Stabilization Structure	Per Linear Foot.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 625S, "Temporary Grade Stabilization Structure"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.2.B.5	Diversion Interceptor and Perimeter Dikes: Outlet
Section 1.4.2.C.5	Interceptor and Perimeter Swales: Outlet
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>

TEMPORARY GRADE STABILIZATION STRUCTURE

Item No. 625S

Item No. 111S	Excavation
Item No. 340S	Hot Mix Asphaltic Concrete Pavement
Item No. 403S	Concrete for Structures
Item No. 591S	Riprap for Slope Protection
Item No. 604S	Seeding for Erosion Control

RELATED CROSS REFERENCE MATERIALSSpecification 625S, "Temporary Grade Stabilization Structure"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right-of-Way
Item No. 102S	Clearing and Grubbing
Item No. 120S	Channel Excavation
Item No. 132S	Embankment
Item No. 401S	Structural Excavation and Backfill
Item No. 404S	Pneumatically Placed Concrete
Item No. 406S	Reinforcing Steel
Item No. 408	Concrete Joint Material
Item No. 410S	Concrete Structures

TEMPORARY GRADE STABILIZATION STRUCTURE

Item No. 625S

Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 627S - GRASS-LINED SWALE 9-26-12**627S.1 - Description**

This item governs natural or constructed drainageways of parabolic or trapezoidal cross section that are located below adjacent ground level and is stabilized by suitable vegetation (Environmental Criteria Manual Section 1.4.3.B). The flow is normally wide and shallow and conveys the runoff down the slope.

A grass-lined swale shall be used when it is necessary to convey runoff only without causing erosion. In cases where there is base flow involved, it shall be handled by the addition of a subsurface drain or a stone or gabion mattress lined low flow channel to the grass-lined swale.

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.

627S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. The submittal requirements (if necessary) for Standard Specification Item Numbers 594S, Gabions and Revet Mattresses", 602S, "Sodding for Erosion Control", 604S, "Seeding for Erosion Control" and 605S, "Soil retention Blanket".
- B. Aggregate types, gradations and physical characteristics for the Portland Cement Concrete mix,

627S.3 - Materials**A. Grass-lined Swale****1. Seed and Mulch**

Seed and mulch shall conform to Item No. 604S, "Seeding for Erosion Control".

2. Sod

Sodding shall conform to Item No. 602S, "Sodding for Erosion Control".

3. Soil Retention Blanket

The soil retention blanket shall conform to Standard Specification Item No. 605S, "Soil Retention Blanket".

627S.4 - Construction Methods

Except as indicated on the Drawings or directed by the Engineer or designated representative, all trees, brush, stumps, obstructions and other objectionable material shall be removed and disposed of so as not to interfere with the proper functioning of the waterway.

The waterway shall be excavated or shaped to line, grade, typical sections and cross-section indicated on the Drawings and shall be free of bank projections or other irregularities, which could impede normal flow.

Fill shall conform to Standard Specification Item No. 132S, "Embankment".

All soil and materials not needed to complete the swale shall be removed.

627S.5 - Measurement

Acceptable work performed as prescribed by this item shall be measured by lineal feet (lineal meters: 1 lineal meter equals 3.281 lineal feet) along the centerline of the stone center "pilot" channel.

627S.6 - Payment

Work performed and materials furnished for this item shall be paid at the unit bid price per linear foot.

Payment will be made under:

Pay Item No. 627S-GSS:	Grass-Lined Swale	Per Lineal Foot
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 627S, "Grass-Lined Swale"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.4 B.4	Permanent Erosion and Sedimentation Control
Section 1.4.6.B	Standards for Grass-Lined Swales
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 132S	Embankment
Item No. 403S	Concrete for Structures
Item No. 594S	Gabions and Revet Mattresses
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control

Item No. 605S	Soil Retention Blanket
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
No. 627S-1	Grass-Lined Swale

RELATED CROSS REFERENCE MATERIALSSpecification 627S, "Grass-Lined Swale"

<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401	Structural Excavation and Backfill
Item No. 404S	Pneumatically Placed Concrete
Item No. 406	Reinforcing Steel
Item No. 408	Concrete Joint Material
Item No. 410	Concrete Structures

Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 628S - SEDIMENT CONTAINMENT DIKES 12-31-13**628S.1 - Description**

This item shall govern the provision and placement of temporary filtration dikes along or across such areas as indicated on the Drawings. This method shall be used during construction only and its purpose shall be to temporarily control erosion by intercepting and retaining sediment.

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

628S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Locations and Types of containment dikes (hay Bales or Triangular Sediment Filter Dike).
- B. Seeding
 - 1. Identification of the type, source, mixture, pure live seed (PLS) and rate of application of the seeding.
 - 2. Type of mulch.
 - 3. Type of tacking agent.
 - 4. Type and rate of application of fertilizer.

628S.3 - Materials**A. Hay Bales**

"Hay Bales" shall be free of Johnson Grass or other noxious weeds. The bales shall consist of either hay or straw in good condition and be securely tied with wire. Stakes for anchoring bales shall be #4 (10M) reinforcing bars, ½ inch (12.5 mm) steel pickets or 2 x 2 inch (50 x 50 mm) wooden stakes. Hay bales shall be limited to drainage areas less than 2,500 square feet (0.02 hectares).

B. Filter Dike

"Filter Dike" shall be prefabricated from 6x6-D2.9xD2.9 (150x150-MW19xMW19) WWF and 4.5 oz. (127 grams) non-woven polyester filter fabric securely fastened to WWF with galvanized shoat rings or j-clips. A 12-inch (300-mm) skirt shall be a continuous extension of the filter fabric on the upstream face.

The filter fabric shall extend beyond the dike joints to provide a 3-inch (75-mm) overlap. Ends of dike not lapped with filter fabric shall be plugged with filter fabric.

628S.4 - Construction Methods

The Contractor may select the material for the dikes, unless otherwise indicated, conforming to the details on the Drawings and Standard Detail Numbers 628S and 628S-1.

Bales shall be placed with ends tightly abutting the adjacent bales. Each bale shall be embedded in the soil a minimum of 4 inches (100 mm) and a maximum of 6 inches (150 mm). Bales shall be securely anchored in place by a minimum of 2 stakes per bale. The first stake in each bale shall be angled toward the previously placed bale to force the bales together. Stakes shall be embedded in the soil a minimum of 1 ½ feet (0.45 meters). Bales that are not able to be imbedded and are placed on impervious cover should be placed level with the concrete and have all bales butted end to end with no voids or gaps

between them. Bales shall be bound by either wire or nylon string. Bales shall be replaced every 2 months or more often during wet periods.

For filter dikes the filters shall be placed with ends tightly abutting the adjacent filter. Each filter and skirt shall be securely anchored in place using 6 inch (150 mm) staples at a maximum spacing of 12 inches (300 mm) on center. Anchoring on impervious areas shall be accomplished with sand/gravel bags placed at 18 inches (450 mm) on center or with a nominal 1 inch by 4 inch (25 mm by 100 mm) board nailed at 18 inches (450 mm) on center.

Silt accumulation behind hay bales and triangular sediment filter dikes shall be removed at a maximum depth of 6 inches (150 mm) or when, in the opinion of the Engineer or designated representative, the structure ceases to function as intended.

All dikes shall be inspected by the Contractor at least monthly and after each rainfall. Dikes shall be repaired or replaced when necessary or as directed by the Engineer or designated representative.

After completion of construction or when directed by the Engineer or designated representative the dike shall be removed and the site re-graded to the final grades. Any depression shall be filled and any accumulations of silt shall be spread or removed to a permitted disposal area. After removal of the dike the area shall be graded and seeded conforming to Item No. 604S, "Seeding for Erosion Control".

628S.5 - Measurement

The work performed and the materials furnished as prescribed by this item will be measured by the lineal foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) of "Sediment Containment Dikes", complete in place.

628S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Sediment Containment Dikes" indicated on the Drawings. The Unit bid price shall include full compensation for: (a) furnishing, hauling and placing all materials including all labor, tools, equipment and incidentals needed to complete the work, (b) the repair and/or replacement of materials, (c) the removal and disposal of all silt and debris and (d) the removal of all dikes, silt and debris after completion of construction or when directed by the Engineer or designated representative.

When indicated on the Drawings, payment for sediment containment will be made under:

Pay Item No. 628S-A:	Sediment Containment Dikes with hay bales	Per Lineal Foot.
Pay Item No. 628S-B:	Sediment Containment Dikes with filter fabric	Per Lineal Foot.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>
<u>Specification 628S, "Sediment Containment Dike"</u>

<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 628S	Triangular Sediment Filter Dike
Number 628S-1	Hay Bale Dike
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 604S	Seeding for Erosion Control
<u>City of Austin Standard Contract</u>	
<u>Section</u>	<u>Description</u>
00300U	Bid Form (Unit Prices)

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 628S, "Sediment Containment Dike"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way

Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401S	Structural Excavation and Backfill
Item No. 406S	Reinforcing Steel
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer

SEDIMENT CONTAINMENT DIKESItem No. 628S

Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 632S - STORM INLET SEDIMENT TRAP 11-26-01**632S.1 - Description**

This item governs the construction of a temporary silt basin around a drainage structure, the maintenance of the trap, the removal of silt accumulations until the trap is no longer required, the restoration of the area to the final grade and the re-vegetation of the disturbed area.

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

632S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Locations and Types of inlet traps (yard or curb drain).
- B. Seeding
 - 1. Identification of the type, source, mixture, pure Live Seed (PLS) and rate of application,
 - 2. Type of mulch,
 - 3. Type of tacking agent, and
 - 4. Type and rate of application of fertilizer.

632S.3 - Materials

- A. Seeding

Seeding for re-vegetation shall conform to Standard Specification Item No. 604S, "Seeding for Erosion Control".
- B. Embankment

Embankment shall conform to Standard Specification Item No. 132S, "Embankment".

632S.4 - Construction Methods

The area under the embankment shall be cleared, grubbed and stripped of any vegetation and root material in conformance with Standard Specification Item 102S, "Clearing and Grubbing".

Construction operations shall be carried out in such a manner that erosion and water pollution shall be minimized.

Sediment shall be removed and the trap shall be restored to its original dimensions when the sediment has accumulated to $\frac{1}{2}$ the design depth of the trap. The sediment, that is removed, shall be deposited in an approved area and in such a manner that it will not erode.

The structure shall be inspected monthly and after each rain and repairs made as needed by the Contractor throughout the duration of this contract or until the Engineer or designated representative provides written permission to remove the structure.

When the trap is no longer required, the Contractor shall remove the silt accumulation and backfill the trap in accordance with Standard Specification Item No. 130S, "Borrow" or Standard Specification Item No. 132S, "Embankment". Any material placed shall be compacted in 8-inch (200 mm) lifts, loose measure and compacted to the required density by mechanical means.

The temporary Storm Inlet Sediment Trap shall be removed, when directed by the Engineer or designated representative, and the area leveled off and protected by erosion control measures appropriate for the terrain as indicated on the Drawings and/or Standard Detail Number 632S-1, "Storm Inlet Sediment Trap". Permanent Storm Inlet Sediment Traps shall be seeded and comply with all the requirements for Item No. 604S, "Seeding for Erosion Control".

632S.5 - Measurement

Acceptable work performed as prescribed by this item will be measured by the cubic foot (cubic meter: 1 cubic meter equals 35.31 cubic feet) of sediment trap complete in place.

632S.6 - Payment

The Work performed and the materials furnished for this item as provided under "Measurement" will be paid for at the unit bid price per cubic foot of sediment trap constructed. The Unit Bid Price shall include full compensation for: (a) furnishing, hauling and placing all materials including all labor, tools, equipment and the incidentals needed to complete the work, (b) maintaining the trap, (c) removing any silt accumulations, (d) removing, regrading and disposing of all silt and debris, (e) regrading and placing embankment and (f) re-vegetation of area upon removal of the trap.

Payment will be made under:

Pay Item No. 632S:	Storm Inlet Sediment Trap	Per Cubic Foot.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 632S, "Storm Inlet Sediment Trap"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 632S-1	Storm Inlet Sediment Trap
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>

Item No. 102S	Clearing and Grubbing
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 604S	Seeding for Erosion Control

RELATED CROSS REFERENCE MATERIALSSpecification 632S, "Storm Inlet Sediment Trap"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401	Structural Excavation and Backfill
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation

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<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 633S - LANDGRADING 11-26-01

633S.1 - Description

This item shall govern reshaping the existing topography in accordance with the Drawings and Standard Detail 633S-1, "Landgrading". The purpose of landgrading is to provide for erosion control and vegetation establishment on those areas where the existing topography is to be reshaped by grading.

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.

633S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Sediment control plan
- B. Seeding plan including:
 - 1. Identification of the type, source, mixture, pure live seed (PLS) and rate of application of the seeding,
 - 2. Type of mulch,
 - 3. Type of tacking agent, and
 - 4. Type and rate of application of fertilizer.

633S.3 - Materials

- A. Seeding

Seeding shall conform to Item No. 604S, "Seeding for Erosion Control".
- B. Pipe Underdrains

Pipe underdrains shall conform to Item No. 551, "Pipe Underdrains".

633S.4 - Construction Methods

All sediment control practices and measures shall be constructed and in place before proceeding with the construction of "Landgrading". The sediment control practices and measures shall be maintained in accordance with the sediment control plan. Topsoil and fill materials, which are stripped for the establishment of vegetation, shall be stockpiled in amounts necessary to complete finished grading of all exposed areas. Temporary stockpiles, borrow areas and permitted spoil areas shall be shown on the Drawings and no other areas shall be used for these purposes. Cleared areas, that are to receive fill materials, shall be grubbed to remove trees, vegetation, roots and other objectionable material as required by Standard Specification Item No. 102S, "Clearing and Grubbing". Seeps or springs encountered during construction shall be intercepted and diverted to a pipe underdrain conforming to Standard Specification Item No. 551, "Pipe Underdrains" and Standard Detail No. 551-1.

Except for approved landfills, fill material shall be free of brush, rubbish, rocks, logs, stumps, building debris and other objectionable materials that would interfere with or prevent construction of satisfactory fills. All fills shall be compacted as required by the Drawings and Standard Detail 633S-1 to reduce erosion, slippage, settlement, subsidence or other related problems. Fill intended to support buildings, structures and conduits, etc., shall be compacted in accordance with Standard Specification Item No. 132S, "Embankment". All graded areas shall be permanently stabilized and seeded immediately following finished grading.

633S.5 - Measurement

Acceptable work performed as prescribed by this item will be measured by either square feet (square meters: 1 square meter equals 1.196 square feet) or acres (hectares; 1 hectare equals 2.471 acres) of the area to be graded, which will include stabilization and groundcover re-establishment.

633S.6 - Payment

Work performed and material furnished for this item will be paid for at the unit bid price per square foot or acre of the area graded. Pipe Underdrains, when required, will be paid for in accordance with Item No. 551, "Pipe Underdrains".

Payment will be made under:

Pay Item No. 633S-A:	Landgrading	Per Square Foot.
Pay Item No. 633S-B:	Landgrading	Per Acre.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 633S, "Landgrading (LG)"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 633S-1	Landgrading
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 102S	Clearing and Grubbing
Item No. 132S	Embankment

Item No. 551	Pipe Underdrains
Item No. 604S	Seeding for Erosion Control

RELATED CROSS REFERENCE MATERIALSSpecification 633S, "Landgrading (LG)"City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	

<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 634S - LEVEL SPREADER 6-21-07**634S.1 - Description**

This item governs furnishing and installing an entrance channel conversion to sheet flow without causing erosion to the existing vegetation. This item shall include the re-vegetation of the area.

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

634S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. The source, material type and classification, density and moisture requirements of the embankment materials
- B. The soil retention blanket material type and sample, evidence that the material is listed on TxDOT/TTI's Approved Products List, one (1) full set of Manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.
- C. Re-vegetation program, including:
 - 1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
 - 2. Type of mulch.
 - 3. Type of tacking agent.
 - 4. Type and rate of application of fertilizer.

634S.3 - Materials

- A. Filter Fabric
Filter Fabric shall conform to Item No. 620S, "Filter Fabric".
- B. Backfill
Fill shall conform to Item No. 132S, "Embankment".

634S.4 - Construction Methods

Level Spreader shall be constructed level to insure uniform spreading of sediment-free runoff. The Level Spreader shall be constructed on undisturbed soil. A filter fabric erosion stop shall be placed vertically at least 6 inches (150 mm) deep in a silt trench 1 foot (300 mm) back from the level lip and parallel to the lip. The entire level lip area shall be protected by 2 strips of "Soil Retention Blanket" (Standard Specification Item 605S). The entrance channel shall not exceed a 1 percent grade before extending the spreader. All groundcover shall be re-established and construction areas stabilized.

The structure shall be inspected monthly and after each rainfall. Repairs shall be made by the Contractor, as needed, throughout the duration of the contract or until the Engineer or designated representative provides written permission to remove the structure.

634S.5 - Measurement

Measurement of the Level Spreader as prescribed by this item will be by the square foot (square meters: 1 square meter equals 10.764 square feet) of the bottom channel.

634S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Level Spreader". The price shall include full compensation for furnishing, hauling and placing all materials, labor, tools, equipment and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating of existing fencing, removal of silt and removal and disposal of all materials at the completion of construction and re-vegetation of disturbed areas.

Payment will be made under:

Pay Item No. 634S:	Level Spreader	Per Square Foot of Bottom Channel.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 634S, "Level Spreader"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 634S-1	Level Spreader
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 132S	Embankment
Item No. 605S	Soil Retention Blanket
Item No. 620S	Filter Fabric

RELATED CROSS REFERENCE MATERIALSSpecification 634S, "Level Spreader"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right-of-Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation

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

<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right-of-Way
Item No. 110	Excavation

Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

ITEM NO. 639S - ROCK BERM 8-18-10

639S.1 - Description

This item shall govern the construction of a temporary berm of open graded rock that is installed at the toe of a slope on the perimeter of a developing area. Rock berms are appropriate for use as flow diverters, energy dissipators, grade control, and level spreaders to release the water in sheet flow (Environmental Criteria Manual Section 1.4.5.E). This item shall also govern the removal of the "Rock Berm" and re-vegetation of the area.

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

639S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Function (flow diversion, grade control, energy dissipator, level spreader, or other) and dimensions of the rock berm
- B. Source, type and gradation of rock
- C. Re-vegetation program, including:
 - 1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
 - 2. Type of mulch.
 - 3. Type of tacking agent.
 - 4. Type and rate of application of fertilizer.

639S.3 - Design Criteria

A detailed design is not required for the installation of a rock berm; however, the following criteria shall be observed:

Drainage area	-	less than 5 acres (2 hectares).
Height	-	18 inches (450 mm) minimum height, measured vertically from the top of the existing ground at the upslope toe to the top of the berm.
Top width	-	2 feet (0.6 meter) minimum.
Side slopes	-	2:1 or flatter.
Grade	-	Berms will be built along a contour as near possible to a 0 percent grade.

639S.4 - Materials

Surplus rock excavated from utility trenches or from other excavations may be used in construction of these berms. In general, the rocks shall be sound with a minimum of 3 inches (75 mm) in smallest dimension and shall weigh between 10 and 30 pounds (4.5 to 13.6 kilograms) each. Seeding for re-vegetation shall conform to Item No. 604S, "Seeding for Erosion Control".

Use only open-graded rock of the size indicated on Standard Detail No. 639S-1, with most of the fines removed.

639S.5 - Construction Methods

All trees, brush, stumps and objectionable material shall be removed and disposed in a manner that will not interfere with the construction of the berm.

A trench shall be excavated to a minimum depth of 4 inches (100 mm) below existing grade for placement of the rock as indicated on Standard Detail No. 639S-1 and the Drawings. The rocks shall be placed in interlocking layers with close joints starting at the base. Open joints shall be filled with rock-spalled materials as required to stabilize the berm.

The area upstream from the rock berm shall be maintained in a condition, which will allow sediment to be removed following the runoff from a rainfall event. After each rainfall event with an accumulation of 1 inch (25 mm) or more, an inspection of the rock berm will be made by the Contractor and the stone shall be replaced, when the structure ceases to function as intended because of sediment accumulation among the rocks, washout, construction traffic damage, etc.

If the sediment reaches a depth equal to 1/3 the height of the berm or 6 inches (150 mm), whichever is less, the Contractor will remove the accumulated sediment and dispose of it at an approved disposal site in a manner that will not contribute to additional sedimentation. The berm will be reshaped as needed during construction.

When the site is completely stabilized, the berm will be removed and disposed of in a manner approved by the Engineer or designated representative.

The area will be re-vegetated as required by Item No. 604S, "Seeding for Erosion Control".

639S.6 - Measurement

Acceptable work performed and prescribed in this item will be measured by the linear foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) along the centerline of top of berm.

639S.7 - Payment

The work performed and material furnished and measured as provided under "Measurement" to construct this item will be paid for at the unit bid price per linear foot of rock berm barrier as indicated on the Drawings. The Unit Bid Price shall include full compensation for: (a) furnishing, hauling and placing all materials including all labor, tools, equipment and incidentals needed to complete the work, (b) maintaining the berm, (c) removing sediment accumulations, (d) rock replacement, (e) removing and disposing of all materials when the berm is no longer required and (f) re-vegetating the site upon removal of the berm.

Payment will be made under:

Pay Item No. 639S:	Rock Berm	Per Lineal Foot.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 639S, "Rock Berm"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.2.E	Rock Berm
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 639S-1	Rock Berm
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 604S	Seeding for Erosion Control

<u>RELATED CROSS REFERENCE MATERIALS</u>

<u>Specification 639S, "Rock Berm"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Table 1-1.3	Recommended Design Values For Functional Controls
Table 1-2	Maximum Water Depth At The Barrier
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401S	Structural Excavation and Backfill
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric

<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

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ITEM NO. 641S - STABILIZED CONSTRUCTION ENTRANCE 6-21-07

641S.1 - Description

This item governs the construction of a stabilized pad of crushed stone located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk or parking area. The removal of the stabilized pad of crushed stone shall also be included in the item. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking or deposition of sediment onto public right of way (Environmental Criteria Manual Section 1.4.2.N.4).

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

641S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Source, type and gradation of rock
- B. Drainage technique (i.e. drainage swale or entrance grading) proposed to prevent runoff from exiting the construction site.

641S.3 - Materials

Aggregate for construction shall conform to the following gradation:

Table 1: Aggregate Gradation Chart (TEX 401-A, % Retained per sieve)		
US 8 inch (SI 200 mm)	US 5 inch (SI 125 mm)	US 2 inch (SI 50 mm)
0	90-100	100

641S.4 - Construction Methods

All trees, brush, stumps, obstructions and other objectionable material shall be removed and disposed of in a manner that will not interfere with the excavation and construction of the entrance as indicated on the Drawings or as presented in Standard Details No. 641S-1. The entrance shall not drain onto the public right of way or shall not allow surface water runoff to exit the construction site.

When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right of way. When vehicle washing is required, it shall be done on an area stabilized with crushed stone, which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence (Standard Specification Item No 642S) or other methods approved by the Engineer or designated representative.

The entrance shall be maintained in a condition, that will prevent tracking or disposition of sediment onto public right of way. This restriction may require periodic top dressing with additional stone as conditions

demand, as well as the repair and/or cleanout of any measures used to trap sediment. All sediment that is spilled, dropped, washed or tracked onto public right of way must be removed immediately.

641S.5 - Measurement

Acceptable work performed as prescribed in this item will be measured by unit of each stabilized construction entrance installed.

641S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Stabilized Construction Entrance". The price shall include full compensation for furnishing, hauling and placing all materials, labor, tools, equipment and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating existing fencing, removal of silt and removal and disposal of all materials at the completion of construction.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 641S:	Stabilized Construction Entrance	Per Each.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 641S, "Stabilized Construction Entrance (SCE)"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.2.N.4	Stabilized Construction Entrance "Design Criteria"
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Number 641S-1	Stabilized Construction Entrance

<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 642S	Silt Fence (SF)

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 641S, "Stabilized Construction Entrance (SCE)"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.2.J	Sandbag Berm
Figure 1-11	Sand Bag Berm
Section 1.4.2.G	Silt Fence
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation

Item No. 401S	Structural Excavation and Backfill
Item No. 610S	Preservation of Trees and Other Vegetation
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 168	Vegetative Watering

ITEM NO. 642S - SILT FENCE 9-1-11

642S.1 - Description

This item shall govern the provision and placement of a silt fence fabric fence (Environmental Criteria Manual Section 1.4.5.G) including maintenance of the fence, removal of accumulated silt, removal of the silt fence and re-vegetation of disturbed areas upon completion of the project.

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

642S.2 - Submittals

The submittal requirements for this specification item shall include:

- A. Source, manufacturer, characteristics and test data for the silt fence fabric,
- B. Manufacturer, characteristics and test data for the posts and wire fence.
- C. Re-vegetation program, including:
 - 1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
 - 2. Type of mulch.
 - 3. Type of tacking agent.
 - 4. Type and rate of application of fertilizer.

642S.3 - Materials

- A. Fabric
 - 1. General:

The silt fence fabric shall be of nonwoven polypropylene, polyethylene or polyamide thermoplastic fibers with non-raveling edges. The silt fence fabric shall be non-biodegradable, inert to most soil chemicals, ultraviolet resistant, unaffected by moisture or other weather conditions, and permeable to water while retaining sediment. The silt fence fabric shall be supplied in rolls a minimum of 36 inches (0.9 meter) wide.
 - 2. Physical Requirements:

The fabric shall meet the requirements presented in Table 1, when sampled and tested in accordance with the methods indicated herein, on Standard Detail No. 642S-1 and/or on the Drawings.
- B. Posts:

Posts shall be steel Tee or Y-posts, not less than 4 feet (1.22 meters) in length with a minimum weight of 1.25 pounds per foot (1.86 kilograms per meter) with a minimum Brinell Hardness of 143. Hangers shall be adequate to secure fence and fabric to posts. Posts and anchor plates shall conform to ASTM A-702. Caps are required (*not specifying discretionary criteria).
- C. Wire Fence:

Wire fence shall be welded wire fabric 2 in. x 4 in. 12.5 SWG, wire diameter 0.099 in (±0.005 in.), and shall conform to Standard Specification Item No. 406, "Reinforcing Steel".

TABLE 1. Silt Fence Fabric Requirements		
Physical Properties	Method	Requirements
Fabric Weight in ounces per square yard (grams/square meter)	TEX-616-J ¹	5.0 minimum (150 minimum)
Equivalent Sieve Opening Size: US Standard (SI Standard sieve size)	CW-02215 ²	40 to 100 (425 to 150 µm)
Mullen Burst Strength: lbs. per sq. inch (psi) megaPascal (mPa)	ASTM D-3786 ³	280 minimum (1.9 minimum)
Ultraviolet Resistance; % Strength Retention	ASTM D-1682 ⁴	70 minimum

¹ TxDOT Test Method Tex-616-J, "Testing of Construction Fabrics".

² US Army Corps of Engineers Civil Works Construction Guide Specification CW-02215, "Plastic Filter Fabric".

³ ASTM D-3786, " Test Method for Hydraulic Bursting Strength of Knitting Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method".

⁴ ASTM D-1682, " Test Methods for Breaking Load and Elongation of Textile Fabrics ".

642S.4 - Construction Methods

The silt fence fabric shall be securely attached to the posts and the wire support fence with the bottom 12 inches (300 mm) of the material buried in a trench a minimum of 6 inches (150 mm) deep and 6 inches (150 mm) wide to prevent sediment from passing under the fence. When the silt fence is constructed on impervious material, a 12-inch (300-mm) flap of fabric shall be extended upstream from the bottom of the silt fence and weighted to limit particulate loss. No horizontal joints will be allowed in the silt fence fabric. Vertical joints shall be overlapped a minimum of 12 inches (300 mm) with the ends sewn or otherwise securely tied.

The silt fence shall be a minimum of 24 inches (0.6 meter) high. Posts shall be embedded a minimum of 12 inches (300 mm) in the ground, placed a maximum of 8 feet (2.4 meters) apart and set on a slight angle toward the anticipated runoff source. When directed by the Engineer or designated representative, posts shall be set at specified intervals to support concentrated loads.

* Per OSHA §1926.701, "all protruding reinforcing steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement". Caps must be large enough to dissipate the forces of impact to prevent impalement from a reasonably foreseeable fall distance. It should be noted that the use

of impalement protection caps is but one method of protection; covers or wooden troughs can be another means of meeting the guarding requirement. For City of Austin purposes, this also applies to t-posts and wooden stakes.

The silt fence shall be repaired, replaced, and/or relocated when necessary or as directed by the Engineer or designated representative. Accumulated silt shall be removed when it reaches a depth of 6 inches (150 mm).

642S.5 - Measurement

The work performed and the materials furnished under this item will be measured by the lineal foot of "Silt Fence", complete in place.

642S.6 - Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Silt Fence". The price shall include full compensation for furnishing, hauling and placing all materials, labor, tools, equipment and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating the fence, removal of silt and removal and disposal of all materials at the completion of construction in and re-vegetation of disturbed areas.

Payment will be made under:

Pay Item No. 642S:	Silt Fence for Erosion Control	Per Lineal Foot.
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END

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 642S, "Silt Fence"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.4.5.G	Silt Fence
<u>City of Austin Standard Details</u>	

<u>Designation</u>	<u>Description</u>
Number 642S-1	Silt Fence
<u>City of Austin Technical Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 406	Reinforcing Steel
<u>American Society For Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
A-702	Specification for Steel Fence Posts and Assemblies, Hot Wrought
D-1682	Test Methods for Breaking Load and Elongation of Textile Fabrics
D-3786	Test Method for Hydraulic Bursting Strength of Knitting Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method
<u>Texas Department of Transportation Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-616-J	Testing of Construction Fabrics
<u>U.S. Army Corps of Engineers</u>	
<u>Designation</u>	<u>Description</u>

CW-02215	Civil Works Construction Guide Specification "Plastic Filter Fabric"
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<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 642S, "Silt Fence"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Table 1-1.3	Recommended Design Values For Functional Controls
Table 1-2	Maximum Water Depth At The Barrier
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401S	Structural Excavation and Backfill
Item No. 610S	Preservation of Trees and Other Vegetation

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ITEM NO. 648S - MULCH SOCK 8-18-10

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. The sock material mesh opening shall be equal to or less than 3/8 inch (10 mm) and the material tensile strength shall be equal to or greater than 202 psi (14.2 kg/cm²).

Source: [Rule No. R161-14.29, 12-30-2014](#).

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 100 ft 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 100 ft 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.
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END

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 648S, "Mulch Sock"</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
1.4.5.F	Mulch Sock
1.4.5.G	Silt Fence
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
648S-1	Mulch Sock

ITEM NO. 658S - VOID AND WATER FLOW MITIGATION 4-4-12

658S.1 - Description

This item governs notification requirements, as well as the furnishing and installing mitigation measures, specified by the Engineer or the designated Representative, for voids and water flow features discovered in bedrock during excavation activities of a project. This item does not apply to excavations that occur below the water table or in unconsolidated earth material. It is intended to address features observed upon initial excavation or discrete discharge points that are discovered when trench backfill material is removed. The purpose of the mitigation is to preserve voids and water flow features while maintaining utility integrity and preventing pollution.

LDC Section 25-8-281(D) requires notification of a void that: (a) is at least one square foot in total area; or (b) blows air from within the substrate; (c) consistently receives water during any rain event; and/or (d) potentially transmits groundwater. Construction must stop until mitigation measures are reviewed and approved by the Watershed Protection Department.

The necessary investigation, definitions, selection methods for determining mitigation measures, and site plan correction submittal requirements are presented in Environmental Criteria Manual Section 1.12.

Standard Details 658S-1 through S-7 shall be used in site plan correction submittals related to the implementation of this item.

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.

Source: [Rule No. R161-14.29, 12-30-2014](#).

658S.2 - Submittals

A. Submittals requirements of this specification include:

1. 3×5 hard rock: Source, type and gradation of rock.
2. Controlled Low Strength Material (CLSM): Mix design for CLSM and other submittals shall be as required by SSM Item No. 402S.
3. Low Slump Concrete: The mix design for Class I, Curb & Gutter, Hand-vibrated Concrete (3500 psi) and other submittals shall be as required by City of Austin Standard Specification Item No. 403S.7, Table 5. The concrete shall have a maximum 3 inch (75 mm) slump. 2500 psi concrete mixtures allowed or required by the Texas Commission on Environmental Quality (TCEQ) that meet Class D, Table 5 of the same specification will be accepted as an alternate on a case-by-case basis.
4. Filter Fabric: Submittals as required by SSM Item No. 620S. The material to be used for this application shall be noted.
5. Permanent Turf Reinforcement Mat (PTRM): Non-degradable turf reinforcement mat that meets the specification requirements of the U.S. Department of Transportation, Federal Highway Administration (FHWA) FP-03, Section 713.18. The mat shall be made of nylon or other inert plastic and not be coated with chemical, substance or film. Maximum mesh opening shall be no greater than 2.5 mm (0.1 inch).

Source: [Rule No. R161-14.29, 12-30-2014](#).

658S.3 - Materials

- A. 3×5 hard rock: Rocks shall be sound with a minimum of 3 inches (75 mm) in smallest dimension and 5 inches (125 mm) in largest dimension. Open-graded rock of the size indicated on Details and fines removed, shall be used.
- B. Controlled Low Strength Material (CLSM): This material shall meet the requirements for CLSM as specified in SSM Item No. 402S.
- C. Filter Fabric: This material shall meet the requirements for filter fabric as specified in SSM Item No. 620S.
- D. Low Slump Concrete: This concrete shall meet the requirements for Class I, Curb & Gutter, Hand-vibrated Concrete as specified in SSM Item No. 403S.7, Table 5. The concrete shall have a maximum 3-inch (75 mm) slump. 2500 psi concrete mixtures allowed or required by the TCEQ that meet Class D, Table 5 of the same specification will be accepted as an alternate on a case-by-case basis.
- E. Polypropylene Bags filled with pea gravel. Pea gravel shall meet requirements of SSM Item No. 510.2 (5).
- F. Gravel Backfill: Gravel backfill shall meet requirements of SSM Item No. 510.2 (2) (a) for pipe bedding stone.
- G. Permanent Turf Reinforcement Mat (PTRM): Non-degradable turf reinforcement mat shall meet the specification requirements of the U.S. Department of Transportation, Federal Highway Administration (FHWA) FP-03, Section 713.18. The mat shall be made of nylon or other inert plastic and not be coated with chemical, substance or film. Maximum mesh opening shall be no greater than 2.5 mm (0.1 inch).

Source: [Rule No. R161-14.29, 12-30-2014](#).

658S.4 - Procedures

- A. The Owner or designated representative shall select a Geologist or designate a Geologist representative to observe trench walls greater than 5 feet (1.5 meters) deep of projects located within the Edwards Aquifer Recharge Zone (as defined in City Code 25-8-2), accessible tunnel shafts, wet wells or tunnel excavations or within 500 feet (152.5 meters) of a spring or seep identified during the permit review. Inspections must occur at least once daily during excavation operations and prior to backfilling the trench. Contractor shall be responsible to provide 24-hour prior notice of excavation activity to the designated Geologist or Geologist representative. The Contractor shall be responsible for ensuring that the Geologist or Geologist representative has the opportunity to observe the vertical face of all excavation activities (including pre-trenching operations) prior to any initial temporary back fill operations and following back fill removal for bedding, final back fill, pipe or manhole installation.
- B. Each underground void or water flow feature shall be mitigated in accordance with one or more of the following procedures and methods:
 - 1. The Geologist or designated Geologist representative will observe the trench wall for any voids larger than 1 cubic foot (0.023 cubic meters) or any flowing water anomalies. The Geologist or the Owner shall call the City of Austin Environmental Inspector, the Construction Inspector or Site/Subdivision Inspector, the City of Austin geologist, and/or cave biologist, as necessary, for additional observation of the anomaly. For General Permit projects, the General Permit office shall be notified. For City of Austin-constructed projects, the location of the anomaly shall be recorded in the Construction Inspector's daily progress report. The owner must also notify the Texas Commission on Environmental Quality (TCEQ) for projects located within the jurisdictional boundaries of the Edwards Aquifer Recharge Zone or Contributing Zone, as defined in Chapter 213 of Title 30 of the Texas Administrative Code.

2. Initial observation of the anomaly shall be made from the top of the trench. The Contractor shall submit an Excavation Safety System Plan (City of Austin Standard Technical Specification Item No. 509S) for approval and shall install all necessary safety equipment to allow direct observation of the anomaly.
3. The Contractor must stop all excavation or trenching activities within 50 feet (15.24 meters) of the outer edge of the void's interior extent.
4. In certain cases, the Geologist or designated Geologist representative may determine that the void requires protection prior to any further backfill operations. Protection preventing the backfill from entering the void may consist of plywood planking or other barricade necessary to block the backfill. Areas of flowing water may require temporary mitigation measures, as well. The Contractor shall implement all appropriate mitigation measures established by the Geologist or designated Geologist representative.
5. If a void is located at the bottom of a trench, temporary void protection per Class I, Standard Detail 658S-1, shall be provided at all times that trench excavation is halted and until Owner's geologic and biologic inspection has occurred and Contractor has been given instructions on how to proceed.
6. A second void or water flow feature inspection may be required following final excavation operations. The Contractor shall stabilize the trench to allow for observation of the anomaly from within the trench. The Contractor shall provide an Excavation Safety System Plan (SSM Item No. 509S) and shall install all necessary safety equipment to allow direct observation of the void or water flow feature. The Contractor shall assist in the investigation by providing access to the anomaly (e.g., ladders, harness and rigging, scaffolding, etc.) and confined space safety equipment. Contractor shall install all necessary shoring and trench protection.
7. The Contractor shall provide the safety plan for allowing trench entry for anomaly inspection. The Contractor's designated safety supervisor shall ensure that all OSHA requirements are met during anomaly observation. The Contractor shall not place pipe, pipe bedding, and backfill within 50 feet (15.24 meters) of the anomaly prior to final inspection.
8. The Engineer or designated representative shall submit a site plan correction to the City of Austin for all voids and/or anomalies that require mitigation measures; except for voids that are less than 18 cubic feet (.504 cubic meters), are dry, have no airflow and are located above the top of a utility pipe. The site plan correction shall show the surveyed location of the void(s) and/or anomaly(ies) and shall reference mitigation measures from this specification. The corresponding detail(s) are to be included in the correction. The Contractor shall not proceed with construction of the mitigation measures, excavating, pipe placement or installing pipe bedding or backfill within 50 feet (15.24 meters) of the anomaly(ies) until an approved site plan correction is acquired.
9. Voids that are less than 18 cubic feet (.504 cubic meters), are dry, have no airflow and are located at least 1 foot (305 mm) above the top of a utility pipe do not require a City of Austin site plan correction approval prior to mitigation. Mitigation may occur after the City of Austin geologist concurs with the Geologist's description and the Engineer's proposed mitigation. The mitigation must be documented in a site plan correction prior to the completion of the project. TCEQ approval requirements must still be followed, if the site is located within the TCEQ-defined Edwards Aquifer Recharge Zone.
10. The Contractor shall construct the void and/or water flow mitigation measure(s) in accordance with the approved site plan correction. Anticipated measures shall be documented within the Contract Documents and pay items. The Contractor and Construction Inspector shall record material quantities of all completed mitigation measures in accordance with the pay items in the Construction Inspector's daily progress report for each day that a specific mitigation event is undertaken. The Contractor shall notify the Watershed Protection Department Geologist 48 hours in advance of mitigation installation.

11. Upon completion of each void and/or water flow mitigation measure, a Geologist or designated Geologist representative shall inspect the work before the Contractor resumes construction activities within 50 feet (15.24 meters) of the anomaly. The owner's Geologist or Geologist representative must observe and photograph the phases of the installation of the mitigation measures and submit an electronic report to the Watershed Protection Department.

Source: [Rule No. R161-14.29, 12-30-2014](#).

658S.5 - Execution

A. GENERAL

The Engineer or designated representative shall establish the appropriate permanent void and water flow mitigation measures. Void and/or water flow mitigation measures shall be constructed as herein depicted and specified for most anomalies encountered. If the Geologist or designated Geologist representative observes unusually large voids or unforeseen circumstances, other measures may be prescribed by the Engineer or designated representative once the anomaly is observed.

B. VOID AND WATER FLOW MITIGATION MEASURES

1. Class I temporary void mitigation measures for a void at the bottom of a trench or along a sidewall of a trench, as indicated in Standard Detail 658S-1, generally consist of:
 - a. Temporary protection of the void shall be provided by covering the void opening with filter fabric with minimum of 3 foot (915 mm) distance from edge of void to edge of filter fabric. This action will be taken prior to covering the trench or temporary backfilling operations.
 - b. The void opening shall be covered with plywood planking with a minimum of 1 foot (305 mm) distance from edge of the void to the edge of the planking. Planking is to be placed to prevent backfill from entering void. Rock (minimum weight of 5 pounds (2.3 kg)) or concrete block shall be placed over planking.
2. Class II permanent void mitigation measures, as indicated in Standard Detail 658S-2, generally consist of:
 - a. Permanent protection of the void by hand packing with 3 to 5-inch (75 to 125 mm) rock to provide stable bearing support and covering the rock at the opening with filter fabric. Low slump concrete (3500 psi) shall be placed to cover the opening area and to seal the void at the limits of excavation. Concrete shall be a minimum of 18 inches (457 mm) thick within the void opening and shall extend a minimum of 6 inches (152 mm) beyond the edge of the void. Void openings that are less than 30 inches deep shall be sealed entirely with concrete. A form shall be used to ensure proper placement of a low slump concrete-seal over the void opening. After the void is covered, the controlled low-strength bedding and backfill material shall be placed. The controlled low-strength fill material shall extend a minimum of 5 feet (1.5 meters) beyond the edge of all voids in all directions.
 - b. For Grade 2 voids, additional measures may be specified by the Engineer or designated representative (e.g., increase thickness of concrete and placement of rebar reinforcement in the concrete, placement of a steel plate over void opening, etc.).
3. Class III void mitigation measures, as indicated in Standard Detail 658S-3, generally consist of:
 - a. Permanent protection of the void by hand packing large areas with pea gravel-filled polypropylene bags to provide stable bearing support in order to protect a void from infiltration of backfill material. If a void is greater than 100 cubic feet (2.8 cubic meters) or is located within a rock strata that is structurally unstable, then 3 to 5-inch (75 to 125 mm) rock may be utilized behind the gravel-filled polypropylene bags to prevent ground collapse. A connector pipe may be required to maintain air or water flow within a void bisected by the trench. After a void is filled, low slump concrete (Class I, 3500 psi) shall be

placed to seal the void opening. If needed, place a form to ensure a minimum thickness of concrete that extends at least 18 inches (457 mm) into the void.

- b. Secondary containment of wastewater and stormsewer lines by outer carrier pipe or low slump concrete (Class I, 3500 psi) or CLSM encasement is required. If CLSM encasement is proposed, then the engineer must submit pipe deflection and wall crushing calculations. Low slump concrete or CLSM encasement shall be a minimum of 6 inches (152 mm) thickness on all sides of the pipe and shall extend a minimum of 5 feet (1.5 m) beyond the edge of any voids. Design of carrier pipe must be reviewed by the City for all City wastewater and stormsewer lines prior to submittal of the site plan correction. Stabilizing collars and other supports, as needed, must be provided. The engineer must modify Standard Detail 658S-3 or provide a specific detail showing the proposed carrier pipe installation and void mitigation.
4. Class IV void mitigation measures, as indicated in Standard Detail 658S-4, are RESERVED FOR FUTURE RULE REVISION.
5. Class V void mitigation measures, as indicated in Standard Detail 658S-5, generally consist of:
 - a. Placement of CLSM bedding material along the length of pipe as directed by the Engineer or designated representative.
 - b. Placement of gravel backfill material wrapped in PTRM one foot (.305 meters) beyond limits of void in all directions. PTRM shall be placed along areas between the gravel material and trench walls/earth backfill and shall overlap at top.
 - c. A minimum of 3 feet (.915 meters) of CLSM backfill shall be placed along the length of pipe on either side of the gravel backfill material and shall extend a minimum of 1 foot (.305 meters) above the gravel backfill material. Forms shall be used to control the placement of CLSM material.
6. For very large voids, the Engineer shall conduct a cave stability analysis per Attachment B of ECM 1.12.0 and define specific mitigation measures. The Contractor will implement specific mitigation measures per the direction of the Engineer or designated representative after the site plan correction is approved by the City of Austin. The mitigation measures must be agreed to by the Watershed Protection Department and affected departments or utilities such as the Austin Water Utility and the Public Works Department, Street and Bridge Operations.

C. REPORTING

1. The Contractor shall provide written documentation to the Engineer, the Owner, and the City of Austin or designated representative describing the void and water flow mitigation measures taken on the Project. The information shall be included in the Construction Inspector's daily progress report. The report shall include, as a minimum, the following information:
 - a. Location (line stationing, distance from permanent structure, depth in trench from adjacent surface grade, geologic strata, etc.).
 - b. Physical dimensions of void and/or description of water flow recorded on the Contractor Void Description and Documentation Log Sheet (provided as Attachment A).
 - c. Photographs, field notes, maps, sketches, and measurements.
 - d. Mitigation action taken and status. Include a copy of the plan sheet showing the location of the void and details for mitigation measures.

For City of Austin-constructed projects, also include the following:
 - e. Actual agreed-upon quantities of materials used by Contractor in execution of mitigation shall be included in the Construction Inspector's daily progress report.

- f. Signature from the Contractor and Construction Inspector indicating agreement with the documented quantities and any delays associated with downtime for observation of the void.

D. ENFORCEMENT

Failure to comply with this rule is a violation of LDC § 25-8-281 (D), Critical Environmental Features. Enforcement may be pursued.

Source: [Rule No. R161-14.29, 12-30-2014](#) ; [Rule No. R161-15.14, 1-4-2016](#) .

658S.6 - Measurement

A. Measurement for void and water flow mitigation measures shall be made as follows:

1. Measurement of temporary void protection (filter fabric, plywood planking, etc.) shall be per each occurrence.
2. Measurement of controlled low strength material shall be by the cubic yard of material in place.
3. Measurement of pea gravel-filled polypropylene bags shall be by each. Minimum size is 1 cubic foot (0.028 cubic meters).
4. Measurement of 3 to 5-inch (75 to 125 mm) rock shall be by the cubic yard (cubic meter) of rock placed.
5. Measurement of filter fabric shall be by the square yard of filter fabric as needed to maintain specified clearance from edge of void.
6. Measurement of permanent turf reinforcement mat shall be by the cubic foot (cubic meter) of material in place.
7. Measurement of low slump concrete material shall be by the cubic foot (cubic meter) of material in place.
8. Measurement for provision of Special Trench Safety shall be per Linear Foot.
9. Measurement for Downtime Associated with Observation of Voids and/or Flowing Water shall be per Day. This pay item shall only apply in circumstances where the Contractor's operations have been halted and Contractor cannot continue work in another area of the project. Delay time will not be allocated for time that work on a void mitigation measure is in progress, only for time associated with observation and determination of mitigation measures to be taken. Contractor must notify the City's Inspector within one hour of the beginning of the delay and document the time and cause of delay. Documentation shall also include explanation of why work could not continue. Work stoppage for one hour or less shall not be cause for delay and will not be measured, but shall be included in the unit price bid in the pipe pay items. Partial day delays shall be measured as fractions of a day calculated by half days. Delays over one hour and up to 4 hours will be counted at 0.5 DAY.

658S.7 - Payment

This section does not obligate the City to pay for void and water flow mitigation measures on private projects.

The work performed for "Temporary Void Protection (Plywood Planking)" and "Pea Gravel-Filled Polypropylene Bags for Void Mitigation" will be paid for at the unit price bid per each occurrence. The unit price bid items shall include full compensation for all materials and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

The work performed for "Controlled Low Strength Material," "Low Slump Concrete," and "3 To 5 Inch Rock for Void Mitigation" will be paid for at the unit price bid per cubic yard. These unit bid price items shall include full compensation for all concrete, rock, curing, finishing, and for all labor, tools, materials, equipment and incidentals necessary to complete the work.

The work performed for "Filter Fabric for Void Mitigation" and for "Permanent Turf Reinforcement Mat" will be paid for at the unit price bid per square yard. These unit bid price items shall include full compensation for all materials and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

The work performed for "Special Trench Safety Associated with Observation of Voids and/or Flowing Water" will be paid for at the unit price bid per linear foot. These unit bid price items shall include full compensation for all materials, supervision, mobilization, de-mobilization, and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

The work performed for "Downtime Associated with Observation of Voids and/or Flowing Water" will be paid for at the unit price bid per day. This unit bid price item shall include full compensation for all materials, supervision, mobilization, de-mobilization, and all manipulations, labor, tools, equipment and incidentals necessary to complete the work.

Source: [Rule No. R161-14.29, 12-30-2014](#).

Payment for will be made using the following bid items:

Pay Item 658S-1:	Temporary Void Protection (Plywood Planking)	Per Each
Pay Item 658S-2:	Controlled Low Strength Material for Mitigation	Per Cubic Yard
Pay Item 658S-3:	Pea Gravel-Filled Polypropylene Bags for Void Mitigation	Per Each
Pay Item 658S-4:	3 To 5 Inch Rock for Void Mitigation	Per Cubic Foot
Pay Item 658S-5:	Filter Fabric for Void Mitigation	Per Square Yard
Pay Item 658S-6:	Permanent Turf Reinforcement Mat for Void Mitigation	Per Square Yard
Pay Item 658S-7:	Low Slump Concrete	Per Cubic Foot
Pay Item 658S-	Special Trench Safety Associated with Observation of Voids and/or	Per Linear

8:	Flowing Water	Foot
Pay Item 658S-9:	Downtime Associated with Observation of Voids and/or Flowing Water	Per Day

END

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 658S, "Void and Water Flow Mitigation"</u>	
<u>City of Austin Criteria Manuals</u>	
<u>Designation</u>	<u>Description</u>
ECM 1.12.0	Void and Water Flow Mitigation
<u>City of Austin Standards</u>	
<u>Designation</u>	<u>Description</u>
658S-1	Class I - Temporary Protection of Void at Bottom of Trench
658S-2	Class II - Permanent Void Mitigation Measures
658S-3	Class III - Void Mitigation Measures
658S-4	Class IV - Water Flow Mitigation Measures Groundwater Within Bedding Material Depth
658S-5	Class V - Water Flow Mitigation Measures Groundwater Above Bedding Material Depth

658S-6	Class V - Combination Void and Potential Water Flow Mitigation Measures
658S-7	Modified Concrete Retard
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>
Item 402S	Controlled Low Strength Material
Item 403S	Concrete for Structures
Item 509S	Excavation Safety Systems
Item 510.2 (2)(a)	Pipe Materials, Pipe Bedding Stone
Item 510.2 (5)	Pipe Materials, Pea Gravel
Item 620S	Filter Fabric
<u>U.S. Dept. of Transportation, Federal Highway Administration</u>	
<u>Designation</u>	<u>Description</u>
FP-03, Section 713.18	Permanent Turf Reinforcement Mat specifications
<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 658S, "Void and Water Flow Mitigation"</u>	
<u>Designation</u>	<u>Description</u>
ECM, Appendix P-1, Note 8	Erosion and sedimentation control note requiring notification and work stoppage for voids discovered on a project.

LDC 25-8-281	Work stoppage required for voids intercepted during construction. Construction may only proceed after mitigation measures are reviewed and approved by the Watershed Protection Department.
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ATTACHMENT A

CONTRACTOR VOID DESCRIPTION AND DOCUMENTATION LOG SHEET

City of Austin Site Plan No.: _____ Project Name: _____
 TCEQ EAPP ID No: _____ Feature ID: _____
 Inspection Date: _____ Time: _____
 Latitude: _____ OR Easting: _____
 Longitude: _____ Northing: _____
 Datum: _____ Datum: _____
 Coordinate System & Units: _____ Coordinate System & Units: _____
 Trench Station ID: _____ Depth Below Surface: _____

Intercepted by: _____ Backhoe _____ Trencher _____ Dozer _____ Drill _____ Other _____
 Shape (Circle One): Spherical Keyhole Dome Irregular Other
 Vertical Fracture Trend Horizontal Fracture
 Size: _____ ft Length _____ ft. Width _____ ft. Height _____ ft³ Volume
 Extends into Rock: _____ ft

Water Flow (Y/N): ☐ Rate: _____ Note: _____
 Air Flow (Y/N): ☐ Rate: _____ Note: _____

Closest CEF or Recharge Feature: _____ Type: _____ Distance: _____

Size Category: Grade 1 ☐ (1 ft³ < V < 18 ft³)
 Grade 2 ☐ (18 ft³ ≤ V < 160 ft³)
 Grade 3 ☐ (≥ 160 ft³)
 Water Flow Category: Type A ☐ (Dry)
 Type B ☐ (<1 gpm or evidence of previous flow)
 Type C ☐ (≥1 gpm from discrete discharge point or bedrock horizon)
 Biological Category: Level 1 ☐ (No evidence of macrofauna)
 Level 2 ☐ (Evidence of macrofauna)
 Suggested Mitigation: Class I ☐ (**Temporary** measure only; Grade 1 and 2 voids)
 Class II ☐ (Grade 1 and 2 voids; floor of trench)
 Class III ☐ (Grade 1/Type A and Grade 2/Type A voids on trench sidewalls)
 Class V ☐ (Grade 1 or Grade 2 with water flow features/voids on sidewalls above bedding)
 Custom ☐ (Site Specific Measure)

Geologist/Inspector: _____ Phone No.: _____
 Construction Supervisor: _____ Phone No.: _____
 Project Engineer: _____ Phone No.: _____

ADDITIONAL NOTES AND SKETCHES

ITEM NO. 660S - BIOFILTRATION MEDIUM 1-4-16

660S.1 - Description

This item shall govern mixing and placing medium for a biofiltration basin intended to treat storm runoff. 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.

(1) Submittals

The submittal requirements of this specification item include:

A. A signed statement provided by the Contractor that:

1. A laboratory analysis has been conducted by of the actual mixture being proposed, and has been verified as meeting the specifications below. The date of the laboratory analysis must be no more than six months prior to the date of installation of the biofiltration medium. A copy of the laboratory results must be provided.
2. No "sandy loam" fill material (aka "red death") is included in the mixture.
3. Report the source of organic matter.

B. Laboratory reports of analyses results documenting that the mixture meets the following specifications:

1. Particle size distribution performed per ASTM D-422:

- Coarse fragments + sand content of 70 - 90% by weight

- Clay content of 3 - 10% by weight

- Silt + clay content \leq 27% by weight

2. Percent organic matter of 0.5 - 5% by weight per ASTM D2974 Method C

C. Contractor's statement that the biofiltration medium has been tested by a laboratory using approved procedures (copy of lab results provided below) and meets the criteria as noted in Table 1 below:

Table 1 - Biofiltration Medium Characteristics

Parameter	Results*	Criteria	Criteria Met?*
Percent Sand + Coarse Fragments (ASTMD-422)		70 - 90%	
Percent Clay (< 0.002 mm)		3 - 10%	
Percent Silt + Clay (< 0.05 mm)		\leq 27%	

Percent Organic Matter (ASTM D-2974)		0.5 - 5%	
Is any "Red Death" included in medium?		None allowed	
Is the mixture free of trash, stones, weeds, or other undesirable material?		None allowed	
Is the medium well-mixed and homogenous?		Must be homogenous	

* Laboratory Must Fill In These Cells

Table 2 - Biofiltration Medium Testing and Installation Dates

Date of Laboratory Analysis (earliest)*	
Date of Medium Installation*	
Time between Dates (months)*	
Criteria for Time Between Dates (months)	6
Is Criteria Met?*	

* Contractor Must Fill In These Cells

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.2 - Materials

(1) Acceptable Materials

The following mixture (% by volume) should create an appropriate biofiltration medium, subject to specific characteristics of the topsoil, which may exhibit considerable variability:

- 70-80% concrete sand per ASTM C33 and/or screened decomposed granite sand
- 20-30% screened bulk topsoil (chocolate loam is also acceptable)

- The source materials must be free of stones, roots, or other similar objects larger than two inches. Additionally, it should be free of trash, other undesirable material, and should not contain weeds or weed seeds.
- The ingredients shall be well-mixed to create a homogenous medium.

(2) Unacceptable Materials

A commercially available fill material that should not be used is typically marketed as "sandy loam." This product is often referred to by landscapers as "red death", which refers to the color of the material, and is an infertile fill material that has poor drainage characteristics. All materials shall be free of Bermuda grass, Quackgrass, Johnson grass, or other noxious weeds, their roots or seeds.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.3 - Construction Methods

(1) Erosion Control

Prior to commencing this work, all required erosion control and environmental measures shall be in place as indicated on the approved site plan and/or modified.

(2) Scheduling, Delivery, Storage and Signage

The biofiltration medium must be delivered to, or mixed at, the site prior to the mid-construction conference. The medium must be certified as meeting the required specifications by the project Engineer, and approved by the City Inspector. The medium must be stored on-site separate from other materials, and covered to prevent erosion of the mixture by rainfall and runoff. The medium must have a prominent tag affixed that reads "BIOFILTRATION MEDIUM FOR WATER QUALITY POND."

(3) Placement

Complete construction and stabilize all areas draining to the biofiltration basin. Permanent controls will be cleaned out and filter medium will be installed after stabilization of the site. Install geotextile fabric per the Biofiltration Bed detail provided in Standard Detail 661-3. Biofiltration medium shall be placed in lifts of 12 to 18 inches without using heavy operating equipment or compaction. Lifts should be lightly watered to encourage soil settling. The final surface must be raked flat. The project Engineer must be notified 24 hours prior to installation of the biofiltration medium and approve and certify the installation.

(4) Shrinkage

Some shrinkage of the medium is to be expected after installation, in the range of 5-15%. As a general recommendation about 20 inches of medium should be installed to achieve a depth of 18 inches.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.4 - Measurement

Biofiltration medium will be measured by the cubic yard (cubic meters: 1 cubic meter is equal to 1.196 cubic yards) in its final position based upon the average end areas, calculated from pre-construction

cross sections and plan grades. The plan quantities for biofiltration medium will be used as the measurement for payment of this item.

Source: [Rule No. R161-15.14, 1-4-2016](#).

660S.5 - Payment

All work performed as required herein and measured as provided under "Measurement" will be paid for at the unit bid price. The bid prices shall include full compensation for furnishing all labor; all materials; all royalty and freight involved; all hauling and delivering on the road; and all tools, equipment and incidentals necessary to complete the work. Payment will not be made for unauthorized work.

Payment will be made under the following:

Pay Item No. 660S:	Biofiltration Medium.	Per Cubic Yard.
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END OF SECTION

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Biofiltration Medium</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 1.6.7.C	Biofiltration

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Biofiltration Medium</u>	
<u>City of Austin Environmental Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>

Section 1.6.5.A.4	Sand Filtration Basin Details
City of Austin Standards Details	
Designation	Description
Item No. 661-3	Biofiltration Bed Configurations Using Geomembrane/Clay Liner
City of Austin Standard Specifications	
Designation	Description
Item No. 620S	Filter Fabric

ITEM NO. 661S - SOIL DECOMPACTION 11-14-16

661S.1 - Description

This work shall consist of performing all required activities for soil decompaction in areas shown on the Drawings or as directed by the Engineer, Landscape Architect, or authorized City of Austin representative. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with Soil Decompaction, complete as shown on the drawings and as specified herein.

A. The scope of work in this section includes, but is not limited to, the following:

1. Modify existing site soil.
 - a. Modify existing in-situ site soil in place for use as Planting Soil.
 - b. Install existing or modified existing stockpiled soil for use as Planting Soil.
2. Install compost and/or other amendments into existing site soil as part of decompaction.
3. Clean up and disposal of all excess and surplus material.

B. Definitions

1. Air tillage, fertilizer, mulch (AFM), as coined by Fite, Smiley, McIntyre & Wells (2011 ⁱ[14](#)), is a soil decompaction and amendment process for trees involving decompaction with a pneumatic air tool while simultaneously incorporating organic matter and fertilizer into the soil.
2. **A horizon:** Mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material.
3. **Bulk Density Method:** A method for measuring soil compaction where bulk density is an indicator of compaction, calculated as the dry weight of soil divided by its volume. Bulk density reflects a soil's ability to function for structural support, water and solute movement, and soil aeration. Threshold results that determine critical bulk density are different for each soil texture. Typical measurement is done with bulk density cores, and the units are in lb./cf or g/cc ³ dry weight.
4. **Compacted soil:** High density soil lacking structure and porosity and characterized by restricted water infiltration and percolation (drainage), and limited root penetration.
5. **Critical Root Zone (CRZ):** The amount of ground around a tree protected from impacts by the City ordinance. This is defined as a radius around the tree trunk equal to one (1) foot of ground for every one (1) inch of tree trunk diameter when measured four-and-a-half (4.5) feet above the ground (DBH). This area is depicted in the plan as a circle centered on the location of the tree's base.
6. **Diameter Breast Height (DBH):** Tree diameter measured at breast height, defined as 4.5 feet above average ground level. **Field Capacity:** The amount of water held in the soil after drainage due to the force of gravity. The volumetric soil moisture content remaining at field capacity is about 15 - 20% for sandy soils, 35 - 45% for loam soils, and 45 - 55% for clay soils.
7. **Graded soil:** Soil where the A horizon has been stripped and relocated or re-spread; cuts and fills deeper than twelve (12) inches.
8. **Penetration Resistance Method:** A method for measuring soil compaction based on penetrometry, or soil strength, measuring the resistance of soil surface to vertical force by inserting a rod or penetrometer into the soil. Threshold results that determine critical bulk density are somewhat the same for each soil texture. The typical measurement tool is a penetrometer, and the units are PSI (pounds of pressure per square inch).

9. Permanent Wilting Point: Water content of a soil when most plants growing in that soil wilt and fail to recover their turgor upon rewetting.

Table 661S.1 Wilting Point and Field Capacity by Soil Type

Soil type	Permanent wilt point v/v	Field capacity v/v
Sand, Loamy sand, Sandy loam	5 - 8%	12 - 18%
Loam, Sandy clay, Sandy clay loam	14 - 25%	27 - 36%
Clay loam, Silt loam	11 - 22%	31 - 36%
Silty clay, Silty clay loam	22 - 27%	38 - 41%

Volumetric soil moisture shall be measured with a digital, electric conductivity meter. The meter shall be the Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent meter.

Source: 015639 Tree and Plant Protection Specification (www.isa-arbor.com)

10. Planting Soil: Approved topsoil and topsoil mix as defined in Standard Specification 601S.
11. Scarify: Loosening and roughening the surface of soil and sub soil prior to adding additional soil on top.
12. Soil Ripping: Loosening the soil by dragging a ripping shank or chisel through the soil to the depths and spacing specified.
13. Soil Tilling: Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, roto tiller, or spade tiller.
14. Solvita compost maturity test: A patented environmental measurement system for carbon dioxide and ammonia, the results of which can be used to assess soil health (biology), compost maturity, ammonia volatilization in manure, or grain spoilage due to fungal respiration.
15. Standard Proctor Method ASTM D 698: A method for measuring soil compaction, determining the optimal moisture content at which a given soil type will become most dense, achieving its maximum dry density. Threshold results that determine critical bulk density are the same for each soil texture. A proctor test will typically also provide results as bulk density lb/cf dry weight. Typical measurement tool is a densitometer, and the units are percentage maximum dry bulk density as tested by the standard proctor method.
16. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
17. Subsoiling: A soil decompaction method that fractures compacted soil without adversely disturbing plants or topsoil.
18. Surface Soil Compaction: A maximum of six (6) inches deep and the result of traffic, light grading, or other impacts. The original A horizon may have been previously removed or graded

but the lower profile is intact with acceptable compaction levels and limited grading. The soil organic matter, pH and chemistry in the A horizon may not be suitable for the proposed plant and may need to be modified.

19. Subsoil or Deep Soil Compaction: Deeper than six (6) inches, and may be the result of previous grading, filling and dynamic or static compaction forces.
20. Topsoil: Naturally produced and harvested soil from the A horizon or upper layers or the soil.
21. Vertical Mulching: A soil decompaction method for tree root zones involving drilling or air spading a series of shallow holes in the root zone and filling them with compost or other materials.
22. Undisturbed, ungraded soil: Soils with the original A horizon intact that have not been graded or compacted. Examples of undisturbed soils are those that have been farmed by no-till methods; those subjected to fire or logged but not graded; and natural forested land.

Source: [Rule No. R161-16.21, 11-14-16](#).

Footnotes:

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Fite, K., E. Thomas Smiley, J. McIntyre, & C.E. Wells. 2011. Evaluation of a Soil Decompaction and Amendment Process for Urban Trees. *Arboriculture & Urban Forestry* 37(6).

661S.2 - Submittals

The submittal requirements of this specification item shall include the test results, information about proposed equipment, and samples necessary for approval of decompaction techniques and methods.

- A. Soil compaction testing shall be performed both before and after modification of soil, unless otherwise specified by the Engineer or Landscape Architect.
 1. Soil compaction testing shall include written results and mapped locations of tests provided to the Owner. A minimum of two tests per 1,000 square feet are required. Test results shall be reported in PSI or bulk density (g/cm³) unless otherwise specified by the Engineer or Landscape Architect. For surface decompaction, measure at both the surface and at six (6) inches depth. For subsurface decompaction, measure at both six (6) inches depth and three-quarters of the maximum depth of decompaction. For example, if maximum depth of desired decompaction is 15 inches, measure at both 6 inches and 11 inches below finished grade.
- B. Provide written information on type and size of equipment proposed to produce the desired decompaction.
- C. For any required compost and mulch, provide a one gallon sample of the material with a lab analysis supplied by the producer to the inspector showing that the product(s) meets the requirements. Lab analyses for compost shall be no older than ninety (90) calendar days at the time of submittal.
 1. Submit samples a minimum of two (2) weeks before the anticipated date of the start of the compost installation.
 2. Samples shall be submitted at the same time as the lab analysis of the material.
 3. Producer shall provide a letter stating the length of the composting period for compost, and listing the source materials by volume for compost and mulch.
- D. For decompaction work under trees, provide qualified arborist credentials, including proof of certification from the International Society of Arboriculture, licenses, resume and/or references.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.3 - Materials

The Contractor shall be responsible for supplying all supplies and equipment in sufficient quantities so as to perform soil decompaction as necessary without delaying construction progress.

A. Compost: Blended and ground leaf, wood and other plant based material, composted for a minimum of nine (9) months and at temperatures sufficient to break down all woody fibers, seeds and leaf structures, free of toxic material at levels that are harmful to plants or humans. Source material shall be yard waste trimmings blended with other plants or other materials designed to produce compost high in fungal material. Non-vegetal source materials may be acceptable upon approval by the Owner. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.

1. Compost shall be commercially prepared compost and meet US Compost Council STATMECC criteria or as modified in this section for "Compost as a Landscape Backfill Mix Component".

http://compostingcouncil.org/admin/wp-content/plugins/wp-pdfupload/pdf/191/LandscapeArch_Specs.pdf

2. Compost shall comply with the following parameters:

PARAMETERS ¹	REPORTED AS (UNITS OF MEASURE)	GENERAL RANGE
pH	pH units	6.0 - 8.5
Soil Salt (electric conductivity)	dS/m (mmhos/cm)	Maximum 10
Moisture Content	%, net weight basis	30 - 60%
Organic Matter Content	%, dry weight basis	30 - 65%
Particle Size	% passing a selected mesh size, dry weight basis	98% pass through ¾ inch screen
Stability Carbon Dioxide Evolution Rate	mg CO ₂ -C per g OM per day	<8
Solvita Compost Maturity Test	Solvita units	>6
Physical Contaminants (inerts)	%, dry weight basis	<1%

Chemical Contaminants ²	mg/kg (ppm)	Meet or exceed US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels
Biological Contaminants Select pathogens Fecal coliform bacteria or Salmonella ³	MPN per gram per dry weight MPN per 4 grams per dry weight	Meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) levels

¹ Recommended test methodologies are provided in Test Methods for the Examination of Composting and Compost (TMECC, The US Composting Council).

² US EPA Class A standard, 40 CFR § 503.13, Tables 1 and 3 levels = Arsenic 41 ppm, Cadmium 39 ppm, Copper 1,500 ppm, Lead 300 ppm, Mercury 17 ppm, Molybdenum 75 ppm, Nickel 420 ppm, Selenium 100 ppm, Zinc 2,800 ppm.

³ US EPA Class A standard, 40 CFR § 503.32(a) levels = Salmonella <3 MPN/4grams of total solids or Fecal Coliform <1000 MPN/gram of total solids.

- B. Mulch (hardwood): Mulch shall be coarse-ground and derived from hardwood (e.g., oak, elm) trees and woody brush sources. No more than 25% of the total volume shall be fine particles and no more than 20% of total volume shall be large pieces, where fine particles are defined as less than 3/8 inch in size and large pieces are defined as either larger than 1½ inch in diameter or longer than eight (8) inches. The mulch shall be free from foreign materials.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.4 - Construction Methods

- A. General. Before initiation of decompaction activities, all required erosion control and environmental measures shall be in place as indicated on the drawings, and the depth(s) and location(s) of underground utilities shall be verified. The surface of the subgrade shall be shaped in general conformity with the typical sections, lines, and grades indicated on the drawings by the removal of existing material or by the addition of approved material as established by the Engineer or Landscape Architect.

This specification covers decompaction of (1) surface soils (0 - 6 inches) and/or (2) subsoil (below 7 inches) as show on the drawings. Requirements for decompaction of soils within the critical root zones of existing trees are also described.

- B. The following are general threshold levels of compaction as determined by three compaction testing methods, including the bulk density method, standard proctor method, and penetration resistance method. The penetration resistance values were derived from the measurement of reference and degraded riparian sites across Austin, Texas studied in the Watershed Protection Department's Riparian Functional Assessment project.

Compaction levels that are detrimental to root growth are dependent on soil type, which typically varies from site to site and must be determined by an Engineer or Landscape Architect before testing occurs.

Excellent to Good Compaction: Good rooting anticipated, but increasing settlement expected as compaction is reduced and/or in soil with a high organic matter content.

Fair Compaction: Root growth is limited with fewer, shorter and slower growing roots.

Poor Compaction: Roots not likely to grow but may penetrate soil when soil is above field capacity.

Table 661S.4.1 Comparison of Compaction limits by various methods.

COMPACTION RATING	BULK DENSITY ¹ (g/cm ³)	STANDARD PROCTOR (%)	PENETRATION RESISTANCE (PSI) ²
Excellent	<1.10 to	75 - 85%	75 - 125 ³
Good	<1.60		126 - 175
Fair	1.39 to 1.69	>85%	176 - 225
Poor	>1.47 to >1.80		>225

¹ Root limiting bulk density varies by soil type. See Table SS-661.4.2 for specifics.

² Acceptable test methods include ASTM D3441 Standard Test Method for Mechanical Cone Penetration or methods described in references such as Methods for Soil Analysis, Part 1, Physical and Mineralogical Methods, 2nd ed., EA Klute, ed. (Soil Science Society of America: Madison, WI 1986).

³ Penetration resistance method: Below 75 psi soil becomes increasingly unstable and will settle excessively.

Table 661S.4.2 Comparison of Root Limiting Bulk Density for Different Soil Types. Source: NRCS 1998 in Dallas and Lewandowski (2003).

Soil texture	Ideal bulk densities (g/cm ³)	Bulk densities that may affect root growth (g/cm ³)	Bulk densities that restrict root growth (g/cm ³)
Sands, loamy sands	<1.60	1.69	>1.80
Sandy loams, loams	<1.40	1.63	>1.80
Sandy clay loams, loams, clay loams	<1.40		>1.75

Silts, silt loams	<1.30	1.60	>1.75
Silt loams, silty clay loams	<1.10	1.55	>1.65
Sandy clays, silty clays, some clay loams (35 - 45% clay)	<1.10	1.49	>1.58
Clays (>45% clay)	<1.10	1.39	>1.47

- C. All soil management activities including amendment and/or decompaction must occur at a soil moisture content between 5 - 20% measured at the depth of the work.
- D. Compacted Surface Soil (**0 - 6 inches**) : Tilling. Surface tilling shall not be considered adequate to reduce compaction at depths seven (7) inches or greater below finished grade.
1. After rough grading and removing all plants and debris from the surface, till top six (6) inches with a roto tiller, spade tiller, or other equipment approved by the Engineer or Landscape Architect. Spread three (3) inches of compost on the surface of the tilled soil.
 2. Till the compost into the loosened soil. Smooth out grades with a drag rake or drag slip. An even bed, with limited irregularities, lumps or soil clods shall be prepared. Clods or rocks larger than two (2) inches shall be removed.
- E. Compacted Subsoil (**7 - 24 inches**) : Soil Ripping
1. After rough grading and removing all plants and debris from the surface, loosen the soil by dragging a ripping shank or chisel through the soil to depths of twenty-four (24) inches maximum. The Engineer or Landscape Architect shall specify the appropriate depth of ripping based on site conditions. Shank spacing varies with soil moisture, soil type, and degree and depth of compaction. Shank spacing shall be as specified by the Engineer or Landscape Architect.
 2. At least three (3) separate series or patterns of movement are required.
 - (1) The first series or pattern of passes is applied lengthwise, parallel with the longest spread of the site; gradually progressing across the site's width, with each successive pass.
 - (2) The second series runs obliquely, crossing the first series at an angle of about 45 degrees.
 - (3) The third series runs at right angle or 90 degrees to the first series.
 3. Spread three (3) inches of compost or other specified amendment over the ripped area and till the material into the top six (6) inches of the soil surface using a roto-tiller or other approved method. An even bed, with limited irregularities, lumps or soil clods shall be prepared. Clods or rocks larger than 2" shall be removed.
- F. Compacted Subsoil (**7 - 24 inches**) : Subsoiling.
1. Drag a ripping shank or chisel thru the soil to depths of twenty-four (24) inches maximum. The Engineer or Landscape Architect shall specify the appropriate depth of ripping based on site conditions. Shank spacing varies with soil moisture, soil type, and degree and depth of compaction. Shank spacing shall be as specified by the Engineer or Landscape Architect. Do not disturb soil or plants in the areas between subsoiled trenches.

2. Fill subsoiled trenches with compost to create a uniform surface grade.

G. Compacted Soil within the critical root zone of existing established trees: Full AFM or Vertical Mulching.

Two techniques are described based on tree location relative to the floodplain and potential for adverse erosion. An International Society of Arboriculture (ISA) certified arborist should oversee work under trees at all times.

Under no circumstances should decompaction work be done in the one-quarter ($\frac{1}{4}$) critical root zone.

1. Remove the tops of all plants to be removed from the root zone. Remove sod with a walk behind sod cutter. Do not grub out the roots of plants to be removed.
2. Prior to beginning work, the proposed area shall be sufficiently wetted twenty-four (24) hours in advance to minimize dust to the greatest extent possible.
3. Use a pneumatic air tool such as an air knife or air spade.
4. Method 1 - Full AFM: In a location outside the floodplain and on slopes of 3:1 or less, use a pneumatic air tool to loosen the top nine (9) to twelve (12) inches of the soil in the entire dripline. In cases where nine (9) to twelve (12) inches is not attainable (i.e., shallow soil), apply aeration to the depth of soil present. Surface roots may move and separate from soil during this process but the bark on roots should not be broken. Make chemical adjustment as recommended by the soil test and as recommended by an ISA arborist or Landscape Architect. Any fertilizer treatment should be per a certified arborist. Add three (3) inches of compost over the soil immediately after aeration. Use a pneumatic air tool to mix the compost into the top six (6) to eight (8) inches of the loosened soil. Apply a minimum of three (3) inches of shredded hardwood mulch across the entire treatment area, but kept back one (1) foot from the trunk.
5. Method 2 - Vertical Mulching: This technique is suitable for a floodplain or other location subject to adverse erosion. Use a pneumatic air tool to make one (1) inch minimum diameter holes to a depth of ten (10) to twelve (12) inches with holes three (3) feet on center from the half critical root zone (CRZ) to the dripline. Funnel compost into the holes. Apply three (3) inches of shredded hardwood mulch across the entire treatment area, but kept back one (1) foot from the trunk.
6. Work in sections such that the entire process - including any proposed irrigation - can be completed in one day for each section. Apply ten (10) gallons of water per inch in diameter of DBH over the loosened soil at the completion of each day's work except during precipitation events of half inch or greater. During drought or other prolonged dry periods, continue to provide supplemental water for one (1) to three (3) weeks minimum after treatment.
7. Decompacted tree root zones should be access-restricted for one year using aluminum posts and chain barriers, at minimum, or approved equal. The barriers shall be erected at the edge of the decompacted zones around an entire tree or tree cluster, per the plans, without driving posts into major roots (3-inches diameter or greater).

H. Protection of Decompacted Soils: After any decompaction activities have taken place do not pass motorized equipment or stockpile construction materials or equipment on previously decompacted soil.

The Contractor shall protect decompacted soil from damage including contamination and re-compaction due to other soil installation, planting operations, and operations by other Contractors. Maintain protection of decompacted areas until project acceptance. Utilize fencing and matting as required or directed to protect the finished soil work. Treat, repair or replace damaged decompacted soil immediately.

I. Repair of Re-compacted Soils: After decompaction has taken place, any soil that becomes re-compacted to a density greater than 225 psi shall be decompacted again.

1. Loosen compacted soil and replace soil that has become contaminated as determined by the Engineer or Landscape Architect. Re-compacted and/or contaminated soil shall be loosened or replaced at no expense to the Owner.
2. Where modified existing soil has become compacted or contaminated and needs to be replaced, provide imported soil that is of similar composition, depth and density as the soil that was removed.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.5 - Measurement

All acceptable surface and subsurface decompaction will be measured by the square yard.

Existing soil that is modified by tilling, or ripping shall have a density to the depth of the modification, after completion of the loosening, such that the compaction readings at each tested location are in the Excellent to Fair ranges as defined above, at soil moisture approximately the mid-point between wilting point and field capacity. Soil that is modified by subsoiling shall have trenches of uniform depth and spacing throughout the subsoiled area.

Source: [Rule No. R161-16.21, 11-14-16](#).

661S.6 - Payment

Payment for Soil Decompaction shall be made according to the unit price for completion of all components necessary to decompact work areas, and shall include all labor, tools, equipment, water, measuring devices, testing, materials, supplies, and incidentals to complete the work:

Item No. 661S-A	Compacted Surface Soil: Tilling	Per Square Yard
Item No. 661S-B	Compacted Subsoil: Ripping to a depth of (x) inches	Per Square Yard
Item No. 661S-C	Compacted Subsoil: Subsoiling to a depth of (x) inches	Per Square Yard
Item No. 661S-D	Compacted Surface Soil: Root Zone - AFM	Per Square Yard
Item No. 661S-E	Compacted Surface Soil: Root Zone - Vertical Mulching	Per Square Yard
Item No. 661S-F	Aluminum post and chain barriers for trees	Per Linear Foot

Source: [Rule No. R161-16.21, 11-14-16](#).

End

ITEM NO. 700S - MOBILIZATION 9-26-12

700S.1 - Description

This item shall govern the mobilization of personnel, equipment and materials at the work site for other contract items that will be performed by the Contractor. Mobilization shall include, but not be limited to the movement of equipment, personnel, material, supplies, etc. to the Work site; the installation of temporary facilities (when not paid for separately) and the establishment of office and other necessary facilities prior to the initiation of the Work. The cost of the Payment Bond and Performance Bond on the Work that is delayed due to circumstances beyond Contractor's control, a closed construction season or for the convenience of the City of Austin will be considered part of the mobilization item under this Contract.

700S.2 - Measurement.

Measurement of the Specification Item, "Mobilization", as specified herein as "Total Mobilization Payment", will be by the "Lump Sum", as the Work progresses.

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
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End

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 700S, "MOBILIZATION"</u>	
<u>City of Austin Standard Contract Documents</u>	
<u>Designation</u>	<u>Description</u>
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. 701S - FENCING 9-26-12

701S.1 - Description

This item shall govern furnishing and installing fencing and gates at locations shown on the Drawings or directed by the Engineer or designated representative, including all posts, bracing and accessories as specified in this Item and as indicated on the Drawings.

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

701S.2 - Submittals

Prior to installation of the fencing the Contractor shall furnish the Engineer or designated representative with certification from the manufacturer that all fencing materials comply with the requirements specified in this Item.

701S.3 - Materials

A. Chain Link Fabric

1. Wire fabric for fencing shall be 9 gauge (3.76 mm) steel with a minimum breaking strength of 1,290 pounds per foot (1 750 Newtons per square meter). The overall height of the fence when erected shall be the height above grade as indicated on the Drawings. The fabric shall be woven into an approximately 2-inch \pm 1/8 -inch (50 mm \pm 3 mm) mesh such that in a vertical dimension of 23 inches (585 mm) along the diagonals of the openings there shall be at least 7 meshes. Unless indicated otherwise on the Drawings the fabric shall have a knuckled (K) and twisted (T) finish for the top and bottom selvages respectively. The wire in the fabric shall withstand a minimum tensile strength test of 75,000 psi (517 kPa) after galvanizing. Except as provided herein, the chain link fence fabric shall conform to ASTM A392, Class I or ASTM A491.
2. The fabric shall be hot dip galvanized after weaving and shall have a minimum coating of 1.2 ounces per square foot (0.4 kilograms per square meter) of uncoated surface conforming to ASTM A392, Class I.
3. Between posts the fabric shall be fastened at 12-inch (300-mm) intervals to a top and bottom tension wire. When a top rail is shown on the Drawings, the fabric shall also be fashioned in the same manner. On gate frames, the fabric shall be fastened to top and bottom of the gate frame at all 12-inch (300-mm) intervals. Steel or aluminum wire fabric ties with a minimum 9 gauge (3.76 mm) diameter shall be used.

B. Woven Wire Fencing

Woven wire fencing shall be either galvanized steel wire fencing or aluminum-coated steel wire fencing conforming to the following requirements:

1. Galvanized steel wire fencing shall conform to ASTM A116, Class 1.
2. Aluminum-coated steel wire fencing shall consist of aluminum-coated steel wire conforming to the requirement for galvanized steel wire fencing, except the wire shall be aluminum coated. The wire shall not have less than 0.40 ounce (11 grams) coating of aluminum alloy per square foot of uncoated surface in accordance with ASTM A491

C. Wire Fencing

Wire shall be either galvanized or aluminum alloy coated 9 gage (3.76 mm) steel wire conforming to the specifications for galvanized steel or aluminum alloy coated woven wire fencing above.

D. Wood Fencing

Wood for wood fencing shall be Wolmanized pine, cedar or as indicated on the Drawings. The timber shall be sound and free from all decay, shakes, splits or any other defects, which would make it structurally unsuitable for the intended purpose.

E. Metal Posts, Top Rails, Braces and Gates

Steel pipe used for posts, top rails, braces and gate frames shall conform to the specifications of ASTM A 53. Steel sections used for posts, top rails, frames and braces shall be a good commercial quality weldable steel. All material shall be new and no used, re-rolled or open seam material will be acceptable. All posts shall meet the weight and length requirements indicated. The fabric bands and steel wire ties shall conform to the gauge and spacing indicated and shall be of suitable design to fasten fabric to the posts. Wire ties of the gauge shown may be used in lieu of fabric bands. All fittings required for posts shall be pressed or rolled steel, forge steel, malleable iron or wrought iron of good commercial quality and spaced as indicated on the Drawings.

1. Line Posts

Line posts may be either C-section or tubular. Tubular line posts shall be fitted with watertight malleable iron caps. Line posts shall be furnished in sufficient quantity to provide a maximum spacing of 10 feet (3 meters)

2. Terminal Posts

All end, corner and pull posts shall be known as terminal posts and shall be of either round or square sections. All terminal posts shall be furnished with watertight malleable iron caps. Fabric shall be fastened to terminal posts by steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing indicated on the Drawings.

3. Gate Posts

Gateposts shall be either round or square. All gateposts shall be furnished with watertight malleable iron caps. The fabric shall be attached to the gateposts by means of steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing indicated on the Drawings.

4. Post Caps

Post caps for pipe sections shall be designed to exclude all moisture. Where a top rail is shown on the Drawings, post caps shall have an opening for the top rail. All post caps shall have a 2-inch (50-mm) skirt for rigidity. When barbed wire is allowed for topping a six-foot (1.82 meter) or higher fence (LDC Section 10-1-9) the barbed wire support arms shall be integral with post caps.

5. Gates

a. Single Swing Gate

The gate frames shall be fabricated from sections either round or square of the size and weight indicated on the Drawings and shall be filled out with the same type fabric specified for the chain link fence. All gates shall be equipped with approved malleable iron or steel latches, stops and center rest. A satisfactory locking device suitable for padlocking shall be provided. The gates shall be hung by at least 2 steel or malleable iron hinges securely fastened to the posts. Hinges shall not twist or turn under the action of the gate, shall be capable of allowing a full 180 degree opening turn, shall be so arranged that a closed gate cannot be lifted off the hinges to obtain entry and shall be easily operated by one person.

b. Double Swing Gate

Double swing gates shall be furnished and installed as indicated on the drawings. Gates shall be of the same height as the fence and shall have a single vertical mat of barbed

wire. The gates shall be hinged to swing 180 degrees from closed to open. The gates shall be complete with frames, latches, stops, keepers, hinges, fabric, braces, padlocks and three strands of barbed wire. Gates shall have intermediate members and diagonal truss rods as required for rigid construction and shall be free from sag and twist. Gates shall be fitted with vertical extension arms or shall have frame end members intended to carry barbed wire.

Hinges shall be pinned type, heavy pattern with large bearing surface and shall not twist or turn under the action of gate. Latches for double swing gates shall be plunger bar type, full gate height, and arranged to engage the gate stop. Stops shall consist of a roadway plate with anchor set in Portland Cement concrete and arranged to engage the plunger. Keepers shall consist of mechanical devices for securing and supporting the free end when in the full open position. Latches shall be arranged for padlocking with padlock accessible from sides of the gate. Gates shall be installed so that they cannot be removed without disassembly of the hardware. Hardware attachment bolt shall be pinned to prevent easy removal.

6. Top Rail

The top rail shall be of size and weight indicated on the Drawings and shall be furnished in random lengths, not less than 18 feet (5.5 meters) per section with outside sleeve type couplings at least 6 inches (150 mm) long and having a wall thickness of not less than 0.70-inch (18-mm). One coupling in five shall have a heavy spring to take up expansion and contraction of the rail. The top rail shall be installed before installing chain link fabric and shall pass through post tops.

7. Braces

All braces shall be of the size, weight and length indicated on the Drawings. All braces shall be trussed with rods and turnbuckles of the dimensions indicated on the Drawings. Braces shall be installed on all terminal posts and shall extend to the adjacent line posts. All corner and pull posts shall have braces on each side of terminal.

8. Fittings, Bolts and Other Miscellaneous Hardware

All fittings, bolts and miscellaneous hardware shall be hot dip galvanized in conformance with TxDoT Standard Specification Item No. 445, "Galvanizing."

9. Tension Wire

Between posts, the fabric shall be fastened to a top and bottom tension wire or to the top rail and bottom tension wire by steel wire ties of the gauge and spacing indicated on the Drawings. The tension wire shall be at least 7 gauge (4.5 mm) galvanized coil spring steel of good commercial quality.

Tension wire shall have a minimum coating of 0.8 ounce per square foot (0.2 kilogram per square meter) of uncoated surface when tested in conformance with ASTM A116.

10. Security Fence

The security fence shall be 8 feet (2.44 meters) high with brackets and 3 strands barbed wire.

Barbed wire, when specified on the Drawings, shall be 12-½ gauge wire (2.51 mm), twisted with two-point 14 gauge (2.03 mm) barbs spaced approximately 5 inches (125 mm) apart and shall conform to ASTM A121 or ASTM A585. Three strands of barbed wire will be required when a barbed wire top is specified on the Drawings.

Barbed wire support arms shall be at an angle of 45° from vertical and shall have clips for attaching three (3) strands of barbed wire to each support arm. Each support arm shall be of

sufficient strength to support a 200-pound (90 kilograms) weight (mass) applied at the outer strand of barbed wire.

11. Galvanizing

Thin-wall, high-strength pipe posts shall be externally hot-dip galvanized with a minimum weight of coating of 0.9 ounce per square foot (0.3 kilogram per square meter). After galvanizing, thin-wall, high-strength pipe posts shall be externally chromated by total immersion followed by application of clear polyurethane finish.

Interior surfaces shall have a hot-dip galvanized coating, a zinc base coating with thickness 0.5 mil \pm 0.2 mil (13 micrometer \pm 5 micrometer). The coating shall be 94 percent zinc powder by weight (mass).

All tubular posts, rails and braces shall comply with the following salt spray performance requirements when tested in accordance with ASTM B117.

Exterior - 1250 hours to maximum 5 % red rust

Interior - 650 hours to maximum 5 % red rust

The uniformity of the zinc coating shall be determined by visual inspection. If, in the opinion of the Engineer or designated representative, visual examination is not conclusive, he may use the Preece Test as described in ASTM A239. When so tested, all items shall withstand a minimum of 6 one-minute dips except for those items designated in ASTM A153 as Class B-2, B-3, C and D, which shall withstand a minimum of 4 one-minute dips.

Careful visual inspection shall be made to determine the quality of the zinc coating. Excessive roughness, blisters, salammoniac spots, bruises and flaking if present to any considerable extent, shall provide a basis for rejection. Where practicable, all inspection and tests shall be made at the place of manufacturer prior to shipment and shall be so conducted as not to interfere unnecessarily with the progress of the work.

Damaged spelter coating shall be repaired by thoroughly wire brushing the damaged area and removing all loose, cracked or weld-burner spelter coating. The cleaned area shall be painted with 2 coats of zinc oxide-zinc dust paint conforming to the requirements of Federal Specification TT-P-641B. The paint shall be furnished at the Contractor's expense.

F. Concrete Post Anchorages

Concrete for post footings, catch blocks, anchors and other such items related to the fence construction, shall be Class B Concrete conforming to Item No. 403S, "Concrete for Structures" or as indicated on the Drawings. Maximum size of aggregate shall be $\frac{3}{4}$ inch (19 mm). Hand mixing of concrete will be permitted on batches under $\frac{1}{2}$ cubic yard (0.38 cubic meter). All batches exceeding this volume will be machine mixed.

Concrete shall be placed promptly and without segregation after mixing. The Contractor shall consolidate the concrete satisfactorily by tamping or vibrating. Excess excavation from footings shall be satisfactorily disposed of.

The tops of post footings shall extend slightly above ground and shall be steel troweled to a smooth finish sloped to drain away from posts. Posts, braces and other units shall be centered in footings.

G. Mowing Strip

When called out in the drawings, a mowing strip shall be Class A concrete. It shall be 24 inches (610 mm) wide and a minimum of 4 inches (100 mm) thick. Three (3) number 3 (#3) bars shall be evenly

spaced and supported along the full length of the mow strip, and a number 3 (#3) bar shall be cross-tied every 4 feet (1.2 m). Fence posts shall be installed in center of mow strip.

701S.4 - Inspection and Sampling

The Contractor shall furnish, upon request of the Engineer or designated representative, samples of each component part of the fence including fittings. These samples shall be subjected to the galvanizing, weight and where required, strength tests. A sample may be taken for each project or for each shipment to a project, when requested by the Engineer or designated representative. All samples shall be furnished to the City free of charge.

If any specimen tested fails to meet the requirements of this specification, two (2) additional specimens shall be cut from the remainder of the sample and tested, both of which shall meet the requirements in every respect or the lot represented by the sample may be rejected.

701S.5 - Construction Methods

The Chain Link Fence shall be erected to lines and grades established by the Engineer or designated representative in accordance with the details indicated on the Drawings. The fence shall be true to line, taut and shall comply with the best practice for fence construction of this type.

A. Clearing and Grading

The Contractor shall perform all clearing of brush, rocks and debris necessary for the installation of this fencing.

B. Erection of Posts

Posts shall be set plumb and permanently positioned and anchorages firmly set before fabric is placed. Posts shall be set in concrete, unless otherwise indicated on the Drawings.

Concrete footings shall be carried to the depth and dimensions indicated on the Drawings. Where rock is encountered within the required depth to which the post is to be erected, a hole of a diameter slightly larger than the largest dimension of the post may be drilled into the rock and the post grouted in. The regular dimensioned concrete footing as indicated on the Drawings shall then be placed between the top of the rock and required grade indicated on the Drawings. Posts shall be approximately centered in their footings. All concrete shall be placed promptly and compacted by tamping or other approved methods. Concrete shall be finished in a dome and shall be cured a minimum of 48 hours before further work is done on the posts.

Pull posts shall be placed not over 500 feet (15.25 meters) apart in straight runs and at each vertical angle point, all as directed by the Engineer or designated representative. Corner posts shall be placed at each horizontal angle point greater than 15 degrees. Corner and pull posts shall have horizontal braces and tie rods as specified above and as indicated or designated representative.

C. Erection of Top Rail and Tension Wire

The top rail and bottom tension wire and/or top and bottom tension wires shall be installed before installing the chain link fabric. The top rail shall be firmly attached in final position. Tension wires shall be within 4 inches (100 mm) of the top and bottom of the fabric and shall be pulled taut.

D. Erection of Fabric

After all posts have been permanently positioned and anchorages firmly set with the cables drawn taut with the turnbuckles, the fabric shall be placed by securing one end and applying sufficient tension to the other end to remove all slack before making attachments. Unless otherwise indicated on the Drawings, the fabric shall be cut and each span shall be attached independently at all corner posts and pull posts.

Fabric shall be fastened as indicated on the Drawings and the bottom of the fabric shall be placed a normal distance of 2 inches (50 mm) above the ground line; however, over irregular ground this distance may vary between 1 inch (25 mm) and 6 inches (150 mm) for a distance not to exceed 8 feet (2.44 meters). Any necessary backfilling required, in order to comply with these provisions, will be considered as incidental work.

E. Fence Grounding

This fence shall be grounded where a power line passes over the fence. In any case, a ground shall be provided at locations not to exceed 1,000 feet (30 meters) apart in straight runs of fence. Each individual section of fence shall have at least 1 ground. The ground shall consist of a copper-weld rod 8 feet (2.44 meters) long and a minimum of 5/8 inch (16 mm) in diameter driven or drilled in vertically until the top of the rod is approximately 6 inches (150 mm) below the top of the ground. A No. 6 solid copper conductor shall be brazed to the rod and to the fence in such a manner that each element of the fence is grounded.

F. Erection of Wood Fencing Material

After all posts have been permanently positioned and anchorages firmly set, stringers shall be placed and boards secured to the stringers. Other techniques utilizing modular precut panels may be used, when indicated on the Drawings.

701S.6 - Measurement

Chain Link Fence, of each height specified, will be measured by the lineal foot of fence measured at the bottom of the fabric along the centerline of fence from center to center of terminal posts, excluding gates. Gates will be measured as each gate, complete in place.

701S.7 - Payment

The work performed and material furnished as prescribed by this item, measured as provided under "Measurement" will be paid for at the unit bid price for "Chain Link Fence" of the height specified. The unit bid price shall include full compensation for furnishing and installing all fencing materials (except gates) including all miscellaneous fittings, braces, post caps, line wires, connection clips or wires; digging post holes and grouting in rock where required; furnishing and placing concrete for setting posts; furnishing and installing all electrical grounds; all hauling and handling charges; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work, including excavation, backfilling and disposal of surplus material.

Gates measured as provided under "Measurement" will be paid for at the unit bid price for "Pedestrian Gate" or "Vehicular Gate", of the type, height and opening specified. The unit bid price shall include full compensation for furnishing all materials; fabricating, preparation, hauling, handling charges and erecting, including all miscellaneous fittings, braces, latches, gate hinges, stops and center anchorage; and for all manipulations, labor, tools, equipment and incidentals necessary for complete installation.

Payment will be made under one of the following:

Pay Item No. 701S-A:	Chain Link Fence,	Per Lineal Foot.
Pay Item No. 701S-BS:	Chain Link Pedestrian Single Swing Gate, ____ Foot. × ____ Foot.	Per Each.
Pay Item No. 701S-BD:	Chain Link Pedestrian Double Swing Gate, ____ Foot. × ____	Per Each

	Foot.	
Pay Item No. 701S-CS:	Chain Link Vehicular Single Swing Gate, ___ Foot. × ___ Foot.	Per Each.
Pay Item No. 701S-CD:	Chain Link Vehicular Double Swing Gate, ___ Foot. × ___ Foot.	Per Each
Pay Item No. 701S-D:	Wire Fence	Per Lineal Foot.
Pay Item No. 701S-E:	Wood Fence	Per Lineal Foot.
Pay Item No. 701S-F:	Wood Fence Pedestrian Gate, ___ Foot. × ___ Foot.	Per Each.
Pay Item No. 701S-G:	Wood Fence Vehicular Gate, ___ Foot. × ___ Foot.	Per Each.
Pay Item No. 701S-H:	Security Fence, ___ Foot High, Type ___	Per Lineal Foot.
Pay Item No. 701S-T:	Temporary Fence, ___ Foot High, ___ Type	Per Lineal Foot.
Pay Item No. 701S-MS:	Mowing Strip	Per Lineal Foot

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 701S, "Fencing"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>

Item No. 403	Concrete for Structures
<u>City of Austin Code of Ordinances, Volume I</u>	
<u>Designation</u>	<u>Description</u>
Section 10-1-9	Barbed Wire Fences
<u>Texas Department of Transportation: Standard Specifications For Construction of Highways, Streets and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 445	Galvanizing
<u>American Society For Testing And Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
A 53/A 53M	Specification For Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A 116	Specification For Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
A 121	Specification For Zinc-Coated (Galvanized) Steel Barbed Wire
A 153/A 153M	Specification For Zinc-Coated (Hot-Dip) on Iron and Steel Hardware
A 239	Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron and Steel Articles
A 392	Specification For Zinc-Coated Steel Chain-Link Fence Fabric

A 491	Specification For Aluminum-Coated Steel Chain-Link Fence Fabric
A 585	Specification For Aluminum-Coated Steel Barbed Wire
B 117	Practice for Operating Salt Spray (Fog) Apparatus Federal Specification TT-P-641B

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 701S, "Fencing"</u>	
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 550	Chain Link Fence
Item No. 552	Wire Fence

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ITEM NO. 702S - REMOVAL AND RELOCATION OF EXISTING FENCES 5-20-02**702S.1 - Description**

This item shall govern the removal and relocation of existing fence, gates and hardware to a new alignment at the location in conformance to the typical details indicated on the Drawings or as directed by the Engineer or designated representative.

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

702S.2 - Removal of Existing Materials

The existing boards, fabric, posts, wire, rails, braces, hardware, gates and miscellaneous items shall be carefully removed, bundled, rolled and stockpiled as indicated on the Drawings for installation at the new fence assignment. The removal and handling shall be such that the fence materials may be reused in the relocated fence.

A. Removal of Fabric and Wire

Fabric and wire of all types shall be carefully untied or disassembled from the posts and other appurtenances and shall be rolled in bundles of a size that will allow handling with ordinary equipment.

B. Removal of Posts

Posts shall be carefully removed from the ground and the concrete footing removed. The concrete shall be disposed of off site. Post holes shall be filled with suitable embankment material and thoroughly compacted.

C. Removal of Boards

Boards of all types shall be carefully disassembled from the rails and other appurtenances to facilitate removal in panels. Excess material removed shall be disposed of as indicated below.

D. Storage of Materials

Storage of all salvageable materials, that will be reinstalled at a new location, shall be stored on-site or at such other locations as the Contractor may elect, subject to approval by the Engineer or designated representative. Security and maintenance of the salvageable materials shall be the responsibility of the Contractor.

E. Excess Materials

Materials, that are damaged, unsuitable for reinstallation or unnecessary for completion of the scope of the fence work in the new alignment shall be considered as excess but shall be offered to the Owner before removal from the site by the Contractor.

702S.3 - New Materials

New materials that are required to complete the fence at the location indicated on the Drawings shall be of equal quality to the existing materials. Used materials from other projects or from the Contractor's own used material stocks will not be allowed. The new materials to be furnished will be those necessary to replace items from the existing fence which were damaged during removal operations or which for other reasons cannot be reused.

702S.4 - Construction Methods

The removed fence shall be installed at the new assignment in accordance with the typical details indicated on the Drawings and shall comply with Standard Specification Item No. 701S, "Fencing" and the best practice for fence construction of the specified type.

702S.5 - Measurement

Fences of the height and type to be relocated will be measured by the lineal foot (lineal meter: 1lineal foot equals 0.31 meters) of fence in its new location measured at the bottom of the fence along the centerline of the fence from center to center of terminal posts, excluding gates.

702S.6 - Payment

The work performed and material furnished as prescribed by this item measured under "Measurement" will be paid for at the unit bid price for "Removing and Relocating Fences" of the size and type specified to be relocated. The unit bid price shall include full compensation for removing, salvaging, storing and handling all existing fence materials; furnishing new posts, boards, rails, braces, tie wires, connection clips, fabric, rails, brace rods and any other fence component items that were damaged during removal and necessitating new material being furnished to complete the project; digging post holes and grouting in rock where required; furnishing concrete for post footings; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work including excavation, backfilling and disposal of surplus materials.

Gates as provided under "Measurement" will be paid for at the unit bid price for Removal and Relocation of Existing Pedestrian or Vehicular Gates of the type and size specified to be relocated. The unit bid price shall include full compensation for removing the gate from the existing locations, handling, storing and hauling all gate materials, furnishing any new materials necessary for installing at new locations; providing new center anchorage blocks, latches and catch blocks and for manipulations, labor, tools, equipment and incidentals necessary to complete the gate relocation.

Payment will be made under one of the following:

Pay Item No. 702S-A:	Removing and Relocating Existing ____ Ft. Chain Link Fence	Per Lineal Foot.
Pay Item No. 702S-B:	Removing and Relocating Existing ____ Ft. × ____ Ft. Chain Link Pedestrian Gate	Per Each.
Pay Item No. 702S-C:	Removing and Relocating Existing ____ Ft. × ____ Ft. Chain Link Vehicular Gate	Per Each.
Pay Item No. 702S-D:	Removing and Relocating Existing ____ Ft. Wooden Fence	Per Lineal Foot.
Pay Item No. 702S-E:	Removing and Relocating Existing ____ Ft. × ____ Ft. Wooden Pedestrian Gate	Per Each.
Pay Item No. 702S-F:	Removing and Relocating Existing ____ Ft. × ____ Ft. Wooden Vehicular Gate	Per Each.

REMOVAL AND RELOCATION OF EXISTING FENCES

Item No. 702S

Pay Item No. 702S-G:	Removing and Relocating Existing ____ Ft. Wire Fence	Per Lineal Foot.
Pay Item No. 702S-H:	Removing & Relocating Existing ____ Ft. × ____ Ft. Metal Gate	Per Each.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 702S, "Removal and Relocation of Existing Fences"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 701S	Fencing

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification 702S, "Removal and Relocation of Existing Fences"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures
<u>Texas Department of Transportation: Standard Specifications For Construction of Highways, Streets and</u>	

<u>Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item No. 445	Galvanizing
<u>American Society For Testing And Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
A 53/A 53M	Specification For Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A 116	Specification For Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
A 121	Specification For Zinc-Coated (Galvanized) Steel Barbed Wire
A 153/A 153M	Specification For Zinc-Coated (Hot-Dip) on Iron and Steel Hardware
A 239	Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron and Steel Articles
A 392	Specification For Zinc-Coated Steel Chain-Link Fence Fabric
A 491	Specification For Aluminum-Coated Steel Chain-Link Fence Fabric
A 585	Specification For Aluminum-Coated Steel Barbed Wire
B 117	Practice for Operating Salt Spray (Fog) Apparatus

ITEM NO. 704 - METAL BEAM GUARD RAILING 9-26-12**704.1 - Description**

This item shall consist of furnishing metal beam guard railing consisting of 1 line of metal beam rail element supported on timber or steel posts. Metal beam guard railing shall be constructed with materials and work quality indicated or approved by the Engineer.

704.2 - Materials**(1) Rail Elements**

The rail elements, end shoes or terminal anchors shall be of the deep beam type fabricated to develop continuous beam strength and shall consist of a metal plate or sheet formed into a beam not less than 12 inches wide and 3 inches deep as indicated. The beam shall be free from warp. When tested with a straight edge or string along either edge of a 12½ foot sectional length of beam, the maximum deviation of the beam edges from the straight edge shall not exceed ½ inch at any point. The steel for the rail elements shall conform to AASHTO M-180. The rail shall be 12 gauge (0.1046 ? 0.008 inch) or as indicated.

The rail element may be galvanized before or after fabrication in accordance with the requirements of ASTM A 123 or A 525, whichever is applicable, except that the galvanized coating shall not be less than 1.8 ounces per square foot of double exposed surface (single spot test).

Rail elements shall contain not more than 0.04 percent phosphorous nor more than 0.05 percent sulfur.

(2) Posts

The posts shall be either timber or steel as indicated and shall meet one of the following requirements:

Timber posts and spacers, where required, shall be Southern Yellow Pine. All posts shall be round. Posts shall not be less than 7 inches in diameter. The diameter shall be determined by means of a circumference-diameter tape. The average diameter at the base of the dome shall not exceed the specified diameter by more than 1 inch. The diameter at the butt of any post shall not exceed the diameter at the base of the dome of that post by more than 2 inches. The supplier shall stencil on the butt of each post the nominal diameter of the top 7 inches. The stenciled numeral shall be 1 inch high. The length of the posts shall not vary more than 1 inch from the specified length. They shall be of the length indicated; the bottom and the top shall be fabricated as indicated.

All posts shall be domed at the top. The dome shall be approximately hemispherical in shape and the radius of the dome of each post shall be ½ the diameter of the posts at the base of the domed portion. The dome shall be smooth and the distance from the top of the dome to the base of the dome shall not vary more than 1 inch at any location. The posts shall be machine peeled and trimmed of all knots and knobs and shall be free from defects such as injurious ring shakes, unsound or loose knots or other defects which might impair their strength and durability. Sound knots will be permitted provided they are not in clusters and they do not exceed 1/3 of the small diameter or least dimension. Any defect or combination of defects which would be more injurious than the maximum allowable knot will not be permitted. A line drawn from the center of each end of the post shall not fall outside the center of the post at any point more than 1¼ required, shall be bored and cut to dimensions indicated before being treated. They shall be treated with 0.4 pounds/cubic foot, dry pentachlorophenol treatment or ACA by assay. Posts and spacers, where required, shall be painted with two coats of good quality aluminum paint after the guard rail is erected unless otherwise indicated.

Steel posts and spacers, where required, shall be of the rolled sections as indicated. The posts and spacers, where required, shall be structural steel conforming to ASTM A 36. The top of all posts shall be beveled or square as required by detail and drilled or punched for bolts for rail attachments.

Steel posts and spacers, where required, shall be galvanized and shall conform to ASTM A 123.

Fittings shall consist of bolts, nuts and washers and shall conform to the details indicated and shall comply with the requirements as specified herein.

All bolts and nuts used with galvanized steel rail shall be made by either the open hearth or electric furnace process and shall conform to ASTM A 307. They shall be hot-dip galvanized to conform to ASTM A 153, Class C or D.

Unless otherwise indicated, the concrete for terminal anchor posts or for embedment or other posts in concrete, where required, shall meet the requirements for Class A Concrete, as specified in Item No. 403, "Concrete for Structures" and subsequent Special Provisions thereto. The rail element for the terminal anchor section shall be of the same materials as the rail element used throughout the project.

704.3 - Sampling and Testing

A sample of the rail and terminal section may be taken for each project or for each shipment to a project. Samples of bolts and nuts may also be required. All samples shall be furnished to the City free of charge. The plate or sheet shall be sampled and tested in accordance with the requirements of ASTM E-8. For galvanized articles, the weight of the zinc coating shall be determined by stripping in accordance with ASTM A 90.

The uniformity of the zinc coating shall be determined by visual inspection. If, in the opinion of the Engineer, visual examination is not conclusive, the uniformity of the coating may be determined by magnetic thickness gauge measurement in accordance with ASTM Designation: E 376 or by the Preece Test as described in ASTM Designation: A 239. When the Preece Test is used, all items designated in ASTM A 153 as Class B-2, B-3, C and D shall withstand a minimum of 4 one minute dips; all other items shall withstand a minimum of 6 one minute dips.

The cleaned area shall be coated with 2 coats of zinc dust compound meeting Federal Specification 0-G-98 (stick only), applied in accordance with the manufacturer's recommendations.

704.4 - Construction Methods

The posts shall be set plumb and firm to the line and grade indicated. Unless the plans call for setting in concrete, the posts shall be backfilled by thoroughly tamping the material in 4 inch layers. The rail elements shall be erected to produce a smooth, continuous rail paralleling the line and grade of the roadway surface or as indicated. The rail elements shall be joined end to end by bolts and lapped in the direction of traffic in the lane adjoining the guard fence. When indicated, the rail elements shall be curved before erection. Holes for special details may be field drilled or punched, when approved by the Engineer.

After erection, all parts of galvanized steel posts, spacers where required, bolts and rail elements on which the galvanizing has become scratched, chipped or otherwise damaged shall be thoroughly cleaned by wire brushing the damaged area to remove all loose, cracked or bruised spelter coating. The cleaned area shall be painted with 2 coats of zinc dust-zinc oxide compound conforming to the requirements of Federal Specification TT-P-641b in accordance with the manufacturer's recommendations.

When fabrication is done after galvanizing and where indicated, the cut edges and bolt holes shall be cleaned by brushing and the cleaned area shall be painted with 2 coats of zinc dust-zinc oxide compound conforming to the requirements of the Federal Specification TT-P-641b or shall be repaired by application of galvanizing repair compounds in accordance with the manufacturer's recommendations.

No painting of galvanized steel rail members will be required.

704.5 - Measurement

This item will be measured by the linear foot of rail, complete in place, measurement being made upon the face of the rail in place, from center to center of end posts, from terminal anchor sections or, in the case of structure railing connection, from the points indicated except as follows: Where bids are requested for "Terminal Anchor Sections", measurement will be made as each section, complete in place, each section consisting of a terminal anchor post and one 25 foot rail element, as indicated.

704.6 - 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 "Metal Beam Guard Railing" or "Metal Beam Guard Railing, Terminal Anchor Sections", which price shall be full compensation for furnishing all materials, including necessary boring for preparation, hauling and erection and galvanizing of same; for setting posts in concrete when specified and spacers where required and for all labor, tools, equipment and incidentals necessary to complete the work, including driving posts, excavating, backfilling and disposing of surplus materials.

Payment will be made under one of the following:

Pay Item No. 704:	Metal Beam Guard Railing	Per Linear Foot.
Pay Item No. 704-T:	Metal Beam Guard Railing, Terminal Anchor Sections	Per Each.

End

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ITEM NO. 706S - BRIDGE AND CULVERT RAILING 9-29-99**706S.1 - Description**

This item shall govern the construction of concrete, steel, or pipe railing or a combination of these materials on bridges, walls or incidental structures as indicated on the Drawings.

In general, the railing shall include that portion of the structure erected on and above the roadway curb or along the edges of walks, curbs and/or slabs for the protection of traffic and pedestrians and the tie in anchorage to the approach railing erected on the embankment.

The railing, including the necessary anchorage, shall be constructed in accordance with the details indicated on the Drawings.

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

706S.2 - Submittals

The submittal requirements of this specification item include:

- A. Shop fabrication details/drawings for metal railings.
- B. Splice locations and details.
- C. Radiographic results for castings.
- D. Mill test reports for each casting lot (chemical composition, tensile strength, elongation, etc.).

706S.3 - Materials

All materials shall conform to Class H, Item No. 403S, "Concrete for Structures", Item No. 406, "Reinforcing Steel" and Item No. 720, "Metal for Structures" as appropriate.

706S.4 - Construction Methods

The railing shall meet the classification and type specified, conform with the requirements herein and be constructed in accordance with details indicated on the Drawings. It shall be constructed to the alignment, grade and camber indicated on the Drawings. Shop fabricated railing shall be uniform in configuration to insure good joints and continuous lines after erection on the structure.

Any appreciable amount of cutting, bending or filling required during erection to produce a reasonable fit would be cause for rejection of the rail. Unless otherwise provided, the railing shall not be placed until falsework, if any, for the span has been released. During construction, care shall be exercised to insure proper functioning of expansion joints.

Unless otherwise indicated on the Drawings, the rail posts shall be vertical. Fabrication and erection of metal for railing shall conform to Item No. 721, "Steel Structures" and to the requirements of this specification.

Splicing of members will be permitted only as provided by the contract Drawings. In general, splices shall be at rail posts. All splice locations and details shall be as indicated on the Drawings.

For metal railings, shop drawings shall be prepared and forwarded for review in accordance with Item No. 720, "Metal for Structures".

Welding shall conform to Item No. 723, "Structural Welding" and with applicable American Welding Society requirements.

Railing materials shall be stored above the ground on platforms, skids or other supports and kept free from grease, dirt and contact with dissimilar metals. Care shall be taken at all times to avoid scratching, marring, denting, discoloring or otherwise damaging the railing. Unpacking and storing of rail members at the job site shall be in accordance with manufacturer's recommendations.

A. Concrete Railing

For Portland cement concrete portions of railings, the construction and removal of forms and the placement, curing and surface finishing shall conform to Standard Specification Item No. 410, "Concrete Structures" and to the requirements specified herein. Provisions shall be made in the construction of forms to provide for checking and correction of railing lines and grades after concrete has been placed, but before initial set. The finish floating of the railing tops shall not disturb the form alignment after the final check. Particular care shall be exercised in other construction operations to avoid disturbing or vibrating the span with the newly placed railing.

Construction joints at the bottom of rail posts or rail parapet shall conform to Standard Specification Item No. 410, "Concrete Structures".

Precast members shall conform to TxDOT Specification Item 424, "Precast Concrete Structures (Fabrication)". Care shall be taken to preserve true and even edges and corners of precast members. Any member, which becomes marred or cracked, will be rejected and shall be removed from the work.

Material requirements and storage, splicing, bending and placement of reinforcing steel for railing shall conform to the pertinent provisions of Standard Specification Item No. 406, "Reinforcing Steel".

B. Pipe Railing

Pipe shall be fabricated from the material and to the shape and dimensions indicated on the Drawings.

Pipe rail and posts shop fabricated into panels shall be mounted in a jig clamped in their true relative positions, accurately spaced with respect to each other and while assembled shall be completely welded or bolted, as the case may be. When indicated on the Drawings, as each rail section is completely assembled and connected, the adjacent section shall be set in its proper relative positions, with the ends engaged and remain in this position until completely connected. Each pair of sections shall be matchmarked so they may be erected in the same order in which they were fabricated.

C. Metal Rail

The fabricated elements shall conform to the dimensions and cross-section indicated on the Drawings. The rail shall be straight and free from warp.

Maximum deviation from straightness of either edge of a full-length section shall be ¼ inch per ten feet (6 millimeters per three meters).

Rail elements shall be jointed and connected to the rail posts as indicated on the Drawings. Lapped elements shall have the lap in the direction of traffic in the adjacent lane.

Unless indicated otherwise on the Drawings, bolts and nuts for the metal railing shall conform to ASTM A307 and shall be galvanized in accordance with TxDOT Specification Item 445, "Galvanizing".

D. Cast Rail Posts

Castings shall be true to pattern in form and dimensions and shall be of the materials indicated on the Drawings.

Castings shall be permanent mold castings of uniform quality and condition, free from cracks and shall be free of defects such as blow holes, porosity, hard spots or shrinkage effects which are extensive enough to materially affect their suitability for the intended use. The castings shall be free of all burrs, fins, discoloration and mold marks and shall, when finished, have a smooth and uniform appearance and texture.

Castings shall be produced under radiographic control to establish and verify a product free from harmful internal defects. Radiographic examination of production castings shall be made, as necessary, to insure satisfactory quality.

When required, the castings shall be heat treated to produce material with the utmost uniformity conforming to the properties specified. The entire lot of castings shall be heat-treated to the specified temper.

All castings shall be permanently marked on the web or top of base with the lot number or the heat treat lot identification. Mill test reports shall be furnished showing the heat or lot number, chemical composition, tensile strength, elongation and number of pieces for each casting heat or lot. Such markings shall be sufficient to correlate the castings with the mill test reports.

To provide more uniform materials and to reduce the number of samples required to establish material compliance, the entire number of acceptable posts cast from each lot shall be furnished to the project, except where less than the complete lot is required or where a portion of a lot is required to complete the shipment. The mill test report shall indicate the number of posts represented by each lot and furnished to the project.

706S.5 - Tests

For Metal Beam Rail, a sample of the rail and terminal may be taken from each project or from each shipment to a project. Samples of bolts and nuts may also be required. Physical tests shall be performed in accordance with TxDOT's Manual of Testing Procedures (ASTM E-8/E-8M) and tests for galvanized coatings shall be in accordance with ASTM A-90. Field testing of galvanized coating thickness shall be in accordance with TxDOT Test Method Tex-728-I.

706S.6 - Protective Coating

Unless otherwise indicated on the Drawings, all portions of steel railing shall be galvanized. When painting is specified on the Drawings, the type and coating thickness shall be in accordance with the paint system shown on the Drawings and shall conform with Standard Specification Item No. 722, "Paint and Painting".

Galvanized railing shall be hot dip galvanized after fabrication. Any damaged galvanizing shall be repaired after erection. Galvanizing and repairs shall be done in accordance with TxDOT Specification Item 445, "Galvanizing". Galvanized steel railing shall not require field painting. Prior to acceptance, extrusion marks, grease, dirt and grime shall be cleaned from the railing.

After erection, galvanizing on all parts of steel posts and rail elements which has become scratched, chipped or otherwise damaged shall be thoroughly cleaned, dry and free of oil, grease, welding slag or flux and corrosion products. The surface preparation shall be to near-white metal and shall extend into the undamaged galvanized coating to provide a smooth repair. Spray or brush apply the zinc-rich paint to the prepared area in accordance with the manufacturer's instructions to attain the required dry-film thickness.

After completion of the repair process, the coating thickness shall be measured in accordance with TxDOT Test Method Tex-728-I. The minimum coating thickness for repairs shall be the same, as that required for the specified galvanizing.

Where fabrication is done after galvanizing and when indicated, the cut edges and bolt holes shall be cleaned by brushing and the cleaned area shall be painted with zinc-rich paint to the prepared area in accordance with the manufacturer's instructions to attain the required dry-film thickness.

706S.7 - Designation of Railing

Railing shall be designated by the general classification and type indicated on the Drawings.

706S.8 - Measurement

Railing of the classification and type designated will be measured by the lineal foot (lineal meter), complete in place, in accordance with the dimensions and details indicated on the Drawings.

706S.9 - Payment

The Work performed and materials furnished in accordance with this Specification Item and measured under Section 706S.7, 'Measurement', will be paid for at the unit bid price for "Railing" of the classification and type indicated on the Drawings. The unit bid price shall include full compensation for: furnishing all materials including concrete, expansion joint material, reinforcing steel, structural steel, cast steel, pipe, anchor bolts and all others required in the finished railing; all labor, tools, hardware, equipment, paint and painting, galvanizing; and all incidentals necessary to complete the work in the manner specified in this Specification Item and in accordance with the details specified in the contract Drawings.

For metal railing, the price paid shall be for the length of metal rail installed and shall not include concrete parapet walls or concrete wing terminal walls unless specifically designated on the Drawings.

Payment will be made under:

Pay Item No. 706S:	Bridge and Culvert Railing, Type ____	Per Lineal Foot.
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End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 706S "Bridge and Culvert Railing"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403S	Concrete for Structures
Item No. 406	Reinforcing Steel

Item No. 410	Concrete Structures
Item No. 720	Metal for Structures
Item No. 721	Steel Structures
Item No. 722	Paint and Painting
Item No. 723	Structural Welding
<u>Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges</u>	
<u>Designation</u>	<u>Description</u>
Item 445	Galvanizing
Item 424,	Precast Concrete Structures (Fabrication)
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-728-I	Measurements of Dry Film Coating Thickness on Steel
<u>American Society for Testing and Materials</u>	
<u>Designation</u>	<u>Description</u>
A-90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
A-307	Specification for Carbon Steel Externally Threaded Standard Fasteners

E-8/E-8M	Methods of Tension Testing of Metallic Materials
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RELATED CROSS REFERENCE MATERIALSSpecification Item 706S "Bridge and Culvert Railing"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 405	Concrete Admixtures
Item No. 409	Membrane Curing
Item No. 411	Surface Finishes for Concrete
Item No. 558	Structural Plate Structures
Item No. 559	Concrete Box Culverts
Item No. 704	Metal Beam Guard Railing
Item No. 705	Remove and Relocate Existing Metal Beam Guard Railing

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
Item No. 406S-1	Reinforced Steel Tolerances

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

<u>Designation</u>	<u>Description</u>
Item 420	Concrete Structures
Item 421	Portland Cement Concrete
Item 427	Surface Finishes for Concrete
Item 437	Concrete Admixtures
Item 440	Reinforcing Steel
Item 450	Railing

American Society for Testing and Materials

<u>Designation</u>	<u>Description</u>
A-123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A-153	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware
A-525	Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process

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ITEM NO. 722S - PROTECTIVE COATINGS 9-26-12**722S.1 - Description**

- A. This item shall govern protective coatings and their application for the following conditions:
1. Exterior surfaces.
 2. Interior surfaces.
 3. Anti-graffiti surfaces.
- B. "Protective coatings" shall be defined as any paint or paint system applied to a base material to provide protection from the elements, wear, or other harmful mechanisms of deterioration. The specified protective coating systems shall include primers or other layers as required to provide complete protection as intended.
- C. Also included are failure modes identification, cause, and repair.

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

722S.2 - Submittals

- A. Protective Coatings Schedule
1. Submit eight (8) copies of a protective coatings schedule which indicates the manufacturer and paint number, keyed to the drawings, prior to, or at the time of, submittal of samples required herein.
 2. The schedule shall indicate all shop and field coatings of items to receive protection, including all surfaces to be coated and the type and color to be applied to each. Identify each material by the manufacturer's catalog number and general classification. Where a color selection is required by the Owner, clearly mark on the submittal.
- B. Product Data
1. Product data must verify compatibility with substrates and conditions to be encountered. Provide manufacturer's technical information, including label analysis and instructions for handling, storing and application of each material proposed for use. List each material and cross-reference the specific coating, finish system and application. Identify each material by the manufacturer's catalog number and general classification.
 2. Submit a full range of color choices, sheen, and textures for final selection.
 3. Submit complete documentation for all protective coatings and systems proposed for use that are not in accordance with those specified herein. The Owner reserves the right to reject alternates proposed in lieu of those specified.
- C. Prepare and submit two (2) protective coatings samples of each finish, including all coats thereof, to the Engineer or designated representative for approval. The samples shall be clearly marked with the manufacturer's name and product identification, and shall be submitted in sufficient time to allow for review, and, if necessary, resubmittal without delay to the project.
- D. Provide certification that the manufacturers' supplied products comply with state and federal regulations on controlling the use of Volatile Organic Compounds (VOC). "Low" (less than or equal to 50 g/l) or zero VOC products, where applicable, are recommended.
- E. The protective coatings applicator shall submit written documentation that they have a minimum of three (3) years' application experience with each product type and the equipment required to provide application.

722S.3 - Cleaning and Preparation of Surfaces

- A. Surfaces to be coated, whether in the shop or field, shall be completely free of oil, grease, moisture, dirt, sand, overspray, welding contamination, loose or flaking mill scale, rust, or paint and free of any other conditions that will prevent the protective coating from forming a continuous, uniform tightly adhering film.
- B. Cleaning and surface preparation shall be in accordance with the Society for Protective Coatings (SSPC) requirements and as specified herein.
 - 1. SSPC-SP1, Solvent Cleaning. Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants. Solvent cleaning does not remove rust or mill scale. Change rags and cleaning solution frequently so that deposits of oil and grease are not spread over additional areas in the cleaning process. Be sure to allow adequate ventilation. For complete instructions, refer to SSPC-SP1.
 - 2. SSPC-SP3, Power Tool Cleaning. Power tool cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife. Before power tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP1. For complete instructions, refer to SSPC-SP3.
 - 3. SSPC-SP6, Commercial Blast Cleaning. A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 33 percent of each square-inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods. For complete instructions, refer to SSPC-SP6.
 - 4. SSPC-SP7, Brush-Off Blast Cleaning. A brush-off blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Mill scale, rust, and coating are considered adherent if they cannot be removed by lifting with a dull putty knife. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods. For complete instructions, refer to SSPC-SP7.
 - 5. SSPC-SP10, Near-White Blast Cleaning. A near-white blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square-inch of surface area and may consist of light shadows, slight streaks, or minor discoloration caused by stains of rust, stains of mill scale, or stains of previously applied paint. Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP1 or other agreed upon methods. For complete instructions, refer to SSPC-SP10.
 - 6. SSPC-SP13, Concrete. SSPC-SP13 gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a dry, sound, uniform substrate suitable for the application of protective coating or lining systems. Depending upon the desired finish and system, a block filler may be required. For complete instructions, refer to SSPC-SP13.

722S.4 - Protective Coating

- A. Protective coatings and systems are specified herein. Submit complete documentation for all protective coatings and systems proposed for use that are not in accordance with those specified.
- B. Exterior Surfaces to be Coated
 1. Exterior protective coatings are specified herein. For additional products refer to TxDOT "DMS-8000, Maintenance Paints", "DMS-8101, Structural Steel Paints - Performance", and "DMS-8110, Coatings for Concrete".
 2. Exterior Condition 1 - Ferrous Metals other than Stainless Steel
 - a. EC-1a - Normal exterior exposure not exposed to chemical attack.
 - 1) Surface preparation: SSPC-SP6.
 - 2) Primer: alkyd, 2 mils (50 µm) minimum dry film thickness.
 - 3) 2nd and 3rd coats: polyurethane modified alkyd, 2 mils (50 µm) minimum dry film thickness each coat.
 - b. EC-1b - Submerged or intermittently submerged in water, sludge, sewage, chemical or similar corrosive liquid; supports in contact with or attached to concrete.
 - 1) Surface preparation: SSPC-SP10.
 - 2) Primer and 2nd coat: high solids, high-build cycloaliphatic amine epoxy, 10 mils (250 µm) minimum dry film thickness each coat.
 - c. EC-1c - Subject to corrosive atmosphere and condensation.
 - 1) Surface preparation: SSPC-SP6.
 - 2) Primer: inorganic zinc, 3 mils (75 µm) minimum dry film thickness.
 - 3) 2nd coat: high solids, high-build cycloaliphatic amine epoxy, 4 mils (100 µm) minimum dry film thickness.
 - 4) 3rd coat: high-build aliphatic acrylic-polyester polyurethane, 3 mils (75 µm) minimum dry film thickness.
 - d. EC-1d - Galvanized.
 - 1) Surface preparation: in accordance with the manufacturer's recommendations for galvanized ferrous metal under service conditions.
 - 2) Primer and 2nd coat: polyamide epoxy, 3 mils (75 µm) minimum dry film thickness each coat.
 3. Exterior Condition 2 - Non-ferrous Metals
 - a. EC-2a - Non-ferrous metals other than aluminum.
 - 1) Surface preparation: SSPC-SP1 followed by SSPC-SP3 or SSPC-SP7 as required to establish a uniform anchor profile.
 - 2) Primer: polyamide epoxy, 3 mils (75 µm) minimum dry film thickness.
 - 3) 2nd coat: aliphatic acrylic polyurethane, 2.5 mils (65 µm) minimum dry film thickness.
 - 4) 3rd coat (optional as required for color/gloss retention): high solids fluoropolymer, 2.5 mils (65 µm) minimum dry film thickness.
 - b. EC-2b - Aluminum.
 - 1) Surface preparation: SSPC-SP1 and sanding with approved pads as required to establish a uniform anchor profile of 1 mil (25 µm).

- 2) Primer: polyamide epoxy, 2 mils (50 µm) minimum dry film thickness.
 - 3) 2nd coat: aliphatic acrylic polyurethane, 2 mils (50 µm) minimum dry film thickness.
 - 4) 3rd coat (optional as required for color/gloss retention): high solids fluoropolymer, 2.5 mils (65 µm) minimum dry film thickness.
4. Exterior Condition 3 - Concrete
- a. EC-3a - Submerged or intermittently submerged in water, sludge, sewage, chemical or similar corrosive liquid.
 - 1) Surface preparation: Allow concrete to cure 28 days minimum and test for moisture in accordance with ASTM D4263. When concrete is ready, complete surface preparation in accordance with SSPC-SP13.
 - 2) Primer: epoxy polyamide, 5 mils (125 µm) minimum dry film thickness.
 - 3) 2nd and 3rd coats: coal tar epoxy, 8 mils (200 µm) minimum dry film thickness each coat.
 - b. EC-3b - Subject to corrosive atmosphere and condensation.
 - 1) Surface preparation: Allow concrete to cure 28 days minimum and test for moisture in accordance with ASTM D4263. When concrete is ready, complete surface preparation in accordance with SSPC-SP13.
 - 2) Primer and 2nd coat: cycloaliphatic amine epoxy, 4 mils (100 µm) minimum dry film thickness each coat.
 - 3) 3rd coat: high-build aliphatic acrylic-polyester polyurethane, 3 mils (75 µm) minimum dry film thickness.
 - c. EC-3c - Concrete surfaces to be painted and not requiring service conditions of EC-3a or EC-3b.
 - 1) Surface preparation: Allow concrete to cure 28 days minimum and test for moisture in accordance with ASTM D4263. When concrete is ready, complete surface preparation in accordance with SSPC-SP13.
 - 2) Primer and 2nd coat: waterborne acrylate (54% ± 2% solids volume), 8 mils (200 µm) minimum dry film thickness each coat.
 - d. EC-3d - Concrete surfaces to be stained and not requiring service conditions of EC-3a or EC-3b.
 - 1) Surface preparation: Allow concrete to cure 28 days minimum and test for moisture in accordance with ASTM D4263. When concrete is ready, complete surface preparation in accordance with SSPC-SP13.
 - 2) Final appearance of EC-3d will be clear, but slightly darkened.
 - 3) Primer: siloxane with diffused quartz carbide, 100 square feet per gallon (2.5 square meters per liter) application rate.
 - 4) 2nd coat: methylmethacrylate acrylic/hydrophobic fumed silica, 125 square feet per gallon (3.1 square meters per liter) application rate.
5. Exterior Condition 4 - Masonry
- a. EC-4a - Painted masonry surfaces.
 - 1) Surface preparation: SSPC-SP13.
 - 2) Primer and 2nd coat: waterborne acrylate (54% ± 2% solids volume), 8 mils (200 µm) minimum dry film thickness each coat.

- b. EC-4b - Stained masonry surfaces.
 - 1) Surface preparation: SSPC-SP13.
 - 2) Final appearance of EC-3d will be clear, but slightly darkened.
 - 3) Primer: siloxane with diffused quartz carbide, 75 square feet per gallon (1.8 square meters per liter) application rate.
 - 4) 2nd coat: methylmethacrylate acrylic/hydrophobic fumed silica, 100 square feet per gallon (2.5 square meters per liter) application rate.
- C. Interior Surfaces to be Coated
 1. Interior protective coatings are specified herein. For additional products refer to TxDOT "DMS-8000, Maintenance Paints", "DMS-8101, Structural Steel Paints - Performance", and "DMS-8110, Coatings for Concrete".
 2. Interior Condition 1 (IC-1) - Ferrous, Non-ferrous, and Galvanized Metals
 - a. Surface preparation: SSPC-SP1 followed by SSPC-SP3 or SSPC-SP7 as required to establish a uniform anchor profile.
 - b. Primer: polyamide epoxy, 3 mils (75 µm) minimum dry film thickness.
 - c. 2nd coat: waterborne aliphatic polyurethane: 2 mils (50 µm) minimum dry film thickness.
 3. Interior Condition 2 - Concrete
 - a. IC-2a - Vertical, non-traffic horizontal, and overhead surfaces.
 - 1) Surface preparation: Allow concrete to cure 28 days minimum and test for moisture in accordance with ASTM D4263. When concrete is ready, complete surface preparation in accordance with SSPC-SP13.
 - 2) Primer: acrylic epoxy, 4 mils (100 µm) minimum dry film thickness.
 - 3) 2nd coat: waterborne aliphatic polyurethane, 2.5 mils (65 µm) minimum dry film thickness.
 - b. IC-2b - Floors.
 - 1) Surface preparation: Allow concrete to cure 28 days minimum and test for moisture in accordance with ASTM D4263. When concrete is ready, complete surface preparation in accordance with SSPC-SP13.
 - 2) Primer and 2nd coat: waterborne epoxy-amine for horizontal surfaces, 3 mils (75 µm) minimum dry film thickness each coat.
 4. Interior Condition 3 (IC-3) - Masonry
 - a. Surface preparation: SSPC-SP13.
 - b. Primer: Waterborne cementitious acrylic, 100 square per gallon (2.5 square meters per liter) application rate.
 - c. 2nd coat: acrylic epoxy, 4 mils (100 µm) minimum dry film thickness.
 - d. 3rd coat: waterborne aliphatic polyurethane, 2.5 mils (65 µm) minimum dry film thickness.
 5. Interior Condition 4 (IC-4) - Wood and Drywall
 - a. Primer: latex enamel, 1.1 mils (28 µm) minimum dry film thickness.
 - b. 2nd and 3rd coats: acrylic enamel, 1.5 mils (38 µm) minimum dry film thickness each coat.
- D. Surfaces to be Anti-graffiti
 1. Anti-graffiti Condition 1 (AGC-1) - Sacrificial

- a. Acceptable for above-grade concrete, exposed aggregate concrete, CMU, brick, stone, painted steel, or aluminum.
 - b. Sacrificial anti-graffiti coatings require a pressurized water wash for graffiti removal. Wash shall not exceed 1,500 psi (10 MPa) and 180 F (82 C).
 - c. Biodegradable formulation in accordance with TxDOT DMS-8111, 3 mil (75 μ m) minimum dry film thickness.
2. Anti-graffiti Condition 2 (AGC-2) - Permanent
- a. Acceptable for above-grade concrete, exposed aggregate concrete, CMU, brick, stone, painted steel, or aluminum.
 - b. Permanent anti-graffiti coatings require the use of a solvent or chemical for graffiti removal. Damage or pigment loss shall not occur during removal.
 - c. Aliphatic polyurethane in accordance with TxDOT DMS-8111, 3 mil (75 μ m) minimum dry film thickness.

722S.5 - Source of Supply

All protective coatings shall be furnished with the manufacturer's labels on each can. Primers shall be produced by the same manufacturer as finish coats. Use only thinners approved by paint manufacturer and use only within recommended limits.

722S.6 - Application of Protective Coatings

- A. The protective coatings applicator shall submit written documentation that they have a minimum of three (3) years' application experience with each product type and the equipment required to provide application.
- B. All equipment used for paint application shall be in accordance with the protective coating manufacturer's recommendations for the coating being applied. Brushes shall not exceed 4 inches (100 mm) in width, shall be springy and not flabby, and shall be kept free of contaminants. Equipment used for spraying shall have adequate provision for separation of moisture from any air stream in contact with the coating, shall be adequate for the type of coating being used, and shall be equipped with spray heads adequate to provide a smooth, uniform coating.
- C. Application
 1. Apply protective coatings in strict conformance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
 2. Protective coatings shall not be applied closer than 12 inches (300 mm) to a surface which is to be cleaned.
 3. Provide finish coats which are compatible with primers used.
 4. Apply additional coats when undercoats or other conditions show through final coat, until all surfaces are of uniform finish, color, and appearance. Give special attention to insure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
 5. Coat surfaces behind movable equipment and furniture the same as similar exposed surfaces. Coat surfaces behind permanently fixed equipment or furniture with primer only before final installation of equipment.
 6. Coat interior surfaces of ducts, where visible through registers or grilles, with a flat black paint.
 7. Coat back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

9. Each coat shall be applied so that it will dry to form a smooth, continuous, tightly adhering film of uniform thickness and appearance, free of brush marks, sags, runs, holidays, and overspray. Measure dry film coating thickness using an apparatus that can be adjusted to measure directly and exactly the known thickness of a shim placed on uncoated material similar to that bearing the coating to be measured. The apparatus shall be readable to at least ± 0.1 mil ($3 \mu\text{m}$) over the range of the instrument. Standard thickness shims shall be used for adjusting the apparatus and shall be made of non-magnetic material with a known thickness uniform over its entire area and accurate within the manufacturer's established tolerances.
 10. Spray application of the first coat will be permitted only when the surfaces are cleaned by blasting. Any method of application approved by the Engineer or designated representative may be used to paint inaccessible areas.
 11. Protective coatings shall not be applied to any surface containing moisture discernible with the eye or by the following test: if the temperature and humidity conditions are such that moisture is likely to condense upon the surface, a small area thereon shall be moistened with a damp cloth to apply a clearly defined, thin film of water. If this thin film evaporates within 15 minutes, the surface shall be considered safe to apply coatings from the standpoint of continued condensation at that particular time.
 12. Protective coatings shall not be applied at an air temperature below 40 F (5 C) nor when there is likelihood of change in weather conditions within 2 hours after application which would result in air temperatures below 40 F (5 C) or deposition of moisture in the form of rain, snow, condensation, etc., upon the surface. The Engineer or designated representative reserves the right to require that no paint be applied when impending weather conditions might result in damage to fresh coatings.
 13. If, in the opinion of the Engineer or designated representative, construction traffic produces an objectionable amount of dust, the Contractor shall, at the Contractor's expense, take precautions necessary to prevent dust and dirt from coming in contact with freshly coated surfaces or with surfaces before the coating is applied.
 14. After all fabrication work is completed and has been tentatively accepted, all surfaces to be coated shall be cleaned and coated with the required primer. Materials shall not be loaded for shipment until coatings are thoroughly dry. No coating work shall be done after material is loaded for shipment. Erection marks for field identification of members shall be coated upon previously coated surfaces. Surfaces to be in contact after shop riveting or bolting shall be cleaned but not coated. Unless otherwise indicated, the top flanges of girders and I-beams shall be coated.
 15. Unless otherwise indicated or exempted, the surfaces to be shop coated shall include the rolling faces of rockers and base plates, all surfaces of bearing plates, and all surfaces of iron or steel castings, whether or not such surfaces are milled.
 16. If concreting operations have damaged the protective coatings, the surface shall be re-cleaned and re-coated in accordance with the manufacturer's recommendations. Primed surfaces shall be cleaned to remove dirt, grease, or other foreign material prior to the application of the final coat(s). Coatings that have become defective shall be removed, the base material properly cleaned, and the required primer reapplied. Excessive amounts of coatings that fail to properly dry or that improperly cure shall be removed and replaced in accordance with the manufacturer's recommendations. In no case shall a succeeding coat be applied until the previous coat and all touch up has dried throughout the full thickness of the coating. At the time of acceptance, the protective coatings shall present an even and uniform appearance throughout.
- D. Improperly Applied Protective Coatings
1. To uncover evidence of improperly applied protective coatings, the Engineer may, at any time during construction, explore underneath the surface of any coatings already applied.

2. All protective coatings which have been applied improperly, applied to improperly cleaned surfaces, fail to dry and harden properly, fail to adhere tightly to underlying material or other parts of the coating system, or do not evidence a normal workmanlike appearance in conformance with these specifications, shall be repaired or completely removed and replaced at.
3. When the final coat does not have a uniform color and appearance throughout, it shall be corrected.
4. Freshly applied coatings which have not yet set shall be removed with the use of suitable solvents.
5. All work required to correct improperly applied protective coatings shall be to the satisfaction of the Engineer or designated representative and at the expense of the Contractor.

722S.7 - Protective Coatings for Existing Structures

Unless otherwise indicated, existing materials shall receive the same protective coatings as those required for new materials.

722S.8 - Responsibility for Hazards

The Contractor is responsible for the safety of all protective coatings operations and personnel. The City of Austin is thus absolved from liability in the event of harm to persons or property due to the Contractor's work specified herein.

722S.9 - Failure Modes - Causes, Identification, and Repair

Refer to Table A for identification, cause, and repair of common protective coatings failure modes.

TABLE A			
Failure Mode	Identification	Cause	Repair
Alligatoring	Very large macro-checking, usually with a cross-hatched pattern	Internal stresses where surface shrinks more rapidly than body of coating, hard topcoat over soft undercoat	Apply thin coats in accordance with manufacturer and thoroughly dry before applying additional coats
Biological failure	Softening or slime reaction, blotchy brown or black spots on coating surface causing poor/dirty appearance	Biodegradation of the coating by bacteria or fungi, coating is used as a source of nourishment	Use coatings that contain permanent fungicides, bactericides, or non-biodegradable modifiers
Brush marks	Linear hills and valleys with considerable difference in thickness from hills to valleys, rusting in valleys	Application of a very heavy-bodied coating	Brush coating out well, finishing by light brushing in one direction

Chalking	Surface soft and powdery, easily removed by wiping surface	Surface disintegration by the sun, improper pigmentation	Use coatings formulated with radiation-resistant resins and non-catalytic, non-chalking pigments
Checking	Uneven, small, non-continuous fissures that do not penetrate to the substrate	Surface stresses caused by shrinkage due to weathering and continued surface polymerization and oxidation	Use coatings formulated with weather resistant resins and inert reinforcing pigments, as well as non-catalytic colored pigments
Cracking	Small breaks in coating to substrate, may be linear, cross-hatched, or curved, may be continuous or not	Stress set up in coating due to continued polymerization and oxidation, improper pigmentation	Use coatings formulated with weather-resistant resins and inert reinforcing pigments, as well as non-catalytic colored pigments
Cratering	Pinpoint rust forming in thin areas of bug eyes, fish eyes, or craters randomly dispersed, may be more prevalent in thicker sections	Improper solvent mixture, surface contamination, oil in atomizing air, particulate fallout during application, high surface tension	Sand or roughen crater area, apply second coat by brush, working coating into cratered area
Discoloration	Yellowing, graying, or darkening of coating	Resin or pigment color change due to weather or chemical reaction	Use coatings formulated with both color-stable resins and pigments
Erosion	Similar to chalking, surface removed on high spots and brush marks to base coating or primer	Chalking mechanism with coating surface removed by weathering	Use chalk-resistant coatings with good flow out to a smooth film
Holidays	General corrosion in bare or thin areas that were uncoated, most often in difficult locations to coat	Poor, inconsistent application, lack of care	Apply in careful, consistent manner, making certain that no areas remain uncoated, overlap each pass 50%
Improper thickness	Areas of pinpoint corrosion between areas of solid coating, areas where coating	Thin areas, spatter, holidays, runs, puddles, excessive number of spray	Careful application, even spray passes with each pass overlapped 50%, use cross-

	is too thick, possible checking and cracking	passes in areas where coating is difficult	spray technique
Mud cracking	Fine to fairly large segments, flaking or curling from surface	Rapid drying, application of coating too heavy, rapid drying conditions	Use coatings with strong adhesion, apply under proper drying conditions, prevent sags, puddles, or excessive thickness
Overspray	Very rough coating surface, may appear like sand in surface, pinpoint corrosion throughout rough areas	Improper spraying technique, uneven spray passes with gun too far from surface	Apply with even, wet spray passes overlapped 50%, remove overspray before applying additional coats
Pinholes	Small, visible holes - 1/32 inch (1 mm) - generally random and in concentrations, pinpoint corrosion in pinholes	Improper spray technique, spray gun too close to surface	Apply with spray gun at the optimum distance from the surface
Pinpoint rusting	Pinpoint spots of corrosion progressing from a small area to a larger area, early failure can ruin entire surface	Zinc pigment mask by other pigmentation or improper zinc-to-binder ratio, uneven coating thickness with thin areas failing first	Remove coating and reapply properly, apply maintenance coat at first sign of pinpoint failure
Runs, sags, and curtains	Heavy areas in coating that flow down vertical surface in streaks or curtains	Improper application	Remove runs and sags with a brush prior to initial set of coating, smooth area with light spray coat
Spatter coat	Pinpoint rusting in thin areas, small spots of coating that are non-continuous over substrate, in poor light may seem continuous	Inconsistent spray passes not overlapped 50%, spray gun flipped at end of spray passes	Use even, wet spray with each pass overlapped 50%, use cross-spray technique
Wrinkling	Furrows and ridges, may be linear or random, fine or quite large	Surface reaction where surface expands during drying more rapidly than	Use coatings with even, thorough drying characteristics, apply evenly, avoid excessive

		the body of the coating	thickness
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722S.10 - Measurement

Unless otherwise indicated on the Drawings or contract bid form, individual items including the furnishing of all materials, equipment, supervision, labor, scaffolding, protection of traffic, and incidentals necessary to complete the work required by this item will not be measured for payment.

722S.11 - Payment

The work performed as prescribed by this item will be paid for at the unit bid price per lump sum of "Protective Coating New Structures" and "Protective Coating Existing Structures". The bid price shall include full compensation for the cost of all individual items including the furnishing of all materials, equipment, supervision, labor, scaffolding, protection of traffic, and incidentals necessary to complete the work required by this item.

Payment will be made under:

Pay Item No. 722S-A:	Protective Coating New Structures	Lump Sum.
Pay Item No. 722S-B:	Protective Coating Existing Structures	Lump Sum.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 722S, "Paint and Painting"</u>	
<u>American Society for Testing and Materials (ASTM)</u>	
<u>Designation</u>	<u>Description</u>
D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
<u>The Society for Protective Coatings (SSPC)</u>	

<u>Designation</u>	<u>Description</u>
SP1	Solvent Cleaning
SP3	Power Tool Cleaning
SP6	Commercial Blast Cleaning
SP7	Brush-Off Blast Cleaning
SP10	Near-White Blast Cleaning
SP13	Concrete
<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS-8000	Maintenance Paints
DMS-8101	Structural Steel Paints - Performance
DMS-8110	Coatings for Concrete
DMS-8111	Anti-Graffiti Coatings

<u>RELATED CROSS REFERENCE MATERIALS</u>	
<u>Specification Item 722S, "Paint and Painting"</u>	
<u>City of Austin Standard Specification Items</u>	
<u>Designation</u>	<u>Description</u>

Item 720S	Metal for Structure
Item 721S	Steel Structures
<u>TxDOT Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS-8100	Structural Steel Paints - Formula

ITEM NO. 725S - SURVEY MARKERS 9-26-12**725S.1 - Description**

This item shall consist of the installation of type of survey markers furnished by the City at locations indicated on the Drawings or as directed by the Engineer or designated representative.

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

725S.2 - Submittals

The submittal requirements of this specification item include:

- A. Class A p.c. concrete mix design,
- B. Type of survey marker and associated construction details.

725S.3 - Materials

Survey marker types A, B, C and D shall be cast metal anchor plates that are provided by the City of Austin Department of Public Works or successor department. The completed survey markers are used for future survey reference markers.

Type A survey markers (Standard Detail No. 725S-1) shall be used on all City of Austin Capital Improvement Projects (CIPs), while types B (Standard Detail No. 725S-2) and C (Standard Detail No. 725S-3) shall be used on all subdivisions within the City of Austin Extra Territorial Jurisdiction (ETJ). A type D marker (Special Detail No. SD725S-4) shall be used to visually delineate locations of landfill area soil caps. A type C marker shall be used for all aerial mapping projects.

For CIP Roadway Construction Projects a type A survey monument shall be installed within an adjustable valve box (Standard Detail No. 725S-11) and anchored in Class A p.c. concrete (Standard Detail No. 725S-10). Survey markers B and C shall be anchored in a p.c. concrete mass (Standard Detail No. 725S-7) with minimum dimensions of 12 inches (300 mm) in width and 18 inches (450 mm) in depth, unless directed otherwise by the Engineer or designated representative.

Survey marker D shall be anchored in a p.c. concrete mass (Standard Detail No. 725S-4, sheet 2) with minimum dimensions of 6 inches (150 mm) in width and 12 inches (300 mm) in depth, unless directed otherwise by the Engineer or designated representative.

725S.4 - Construction Methods

Survey markers of the type specified shall be installed complete in place at locations indicated on the Drawings or as directed by the Engineer or designated representative. They shall be properly referenced by a Registered Professional Land Surveyor licensed in the State of Texas and set at locations that are clear of obstructions that would interfere with the setup of tripods and survey instruments over the marker.

725S.5 - Measurement

Survey markers shall be measured per each marker type, installed complete in place as described in the Construction Methods section above (725S.4).

725S.6 - Payment

This item shall be paid for at the unit bid price per each type of Survey Marker, installed complete in place. The unit bid prices shall include full compensation for all materials, p.c. concrete, labor, equipment and incidentals necessary to complete the work, including excavation for installation of the survey marker and p.c. concrete and restoration of the site to the condition necessary for construction of sidewalk or other structures around the survey marker.

Payment will be made under:

Pay Item No. 725S-A:	Type A Survey Identification Marker	Per Each.
Pay Item No. 725S-AR:	Type A Survey Identification Marker with Adjustable Valve Box	Per Each.
Pay Item No. 725S-B:	Type B Survey Identification Marker	Per Each.
Pay Item No. 725S-C:	Type C Survey Identification Marker	Per Each.
Pay Item No. 725S-D:	Type D Survey Identification Marker	Per Each.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 725S, "Survey Markers"</u>	
<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item No. 403s	Concrete for Structures
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Item No. 725S-1	Monument, Type A Survey Identification Marker

Item No. 725S-2	Monument, Type B Survey Identification Marker
Item No. 725S-3	Monument, Type C Survey Identification Marker
Item No. SD725S-4	Monument, Type D Survey Identification Marker
Item No. 725S-7	Survey Identification Marker, Non Traffic Construction Detail
Item No. 725S-10	Survey Identification Marker, Roadway Traffic Construction Detail
Item No. 725S-11	Adjustable Valve Box for Survey Monument

RELATED CROSS REFERENCE MATERIALS

Specification Item No.P725S, "Survey Markers"

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 401S	Structural Excavation and Backfill

ITEM NO. 802S - PROJECT SIGNS 9-26-12**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 $\frac{3}{4}$ 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 (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 foot x 8 foot (1.2 meter 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 foot x 3 foot (0.2 meter 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 two 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

In 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-AC.I.P.:	C.I.P.Project Signs	Lump Sum.
Pay Item No. 802S-BC.I.P.:	C.I.P. Project Sign	Per Each.
Pay Item No. 802S-ABOND:	Bond Project Signs	Lump Sum.
Pay Item No. 802S-BBOND:	Bond Project Sign	Per Each.

End

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification Item No. 802S, "Project Signs"</u>	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Item No. 802S-1	2.4 m x 1.2 m (8' x 4') C.I.P. Building Project Sign
Item No. 802S-1A	2.4 m x 1.2 m (8' x 4') Bond Program Building Project Sign

Item No. 802S-2	600 mm × 900 mm (24" × 36") C.I.P. Movable Sign Type II
Item No. 802S-2A	600 mm × 900 mm (24" × 36") Joint C.I.P. Movable Sign Type II
Item No. 802S-2B	900 mm . 1.2 m (36" × 48") Bond Program Project Movable Sign Type II
Item No. 804S-5	Typical CMTA/C.I.P. Sign Locations

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ITEM NO. 803S - BARRICADES, SIGNS AND TRAFFIC HANDLING 11-15-11**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 two 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 MATERIALSSpecification Item No. 803S, "Barricades, Signs and Traffic Handling"City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
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:

<u>Designation</u>	<u>Description</u>
(TMUTCD)	Texas Manual on Uniform Traffic Control Devices

RELATED CROSS REFERENCE MATERIALSSpecification Item No. 803S, "Barricades, Signs and Traffic Handling"

<u>City of Austin Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
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

<u>Designation</u>	<u>Description</u>
803S-1	Street-End Barricades

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

<u>Designation</u>	<u>Description</u>
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
<u>Texas Department of Transportation: Departmental Materials Specifications</u>	
<u>Designation</u>	<u>Description</u>
DMS 7110	Aluminum Sign Blanks
DMS 8310	Flexible Roll-up Reflective Signs
<u>Texas Department of Transportation: Manual of Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-839-B	Determining Color in Reflective Materials
Tex-842-B	Method for Measuring Retroreflectivity
<u>American Society for Testing and Materials (ASTM)</u>	

<u>Designation</u>	<u>Description</u>
A-307	Specification for Carbon Steel Externally Threaded Standard Fasteners
A-320	Specification for Alloys-Steel Bolting Materials for Low-Temperature Service
A-513	Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
B-108/B108M	Specification for Aluminum-Alloy Permanent Mold Castings
B-183	Practice for Preparation of Low-Carbon Steel for Electroplating
B-221/B-221M	Specification for Aluminum-Alloy Extended Bars, Rods, Wire, Shapes, and Tubes
D-523	Test Method for Specular Gloss
D-822	Recommended Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products
D-828	Test Method for Tensile Breaking Strength of Paper and Paperboard
G-23	Recommended Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials

SPECIAL PROVISION ITEM NO. 420S – DRILLED SHAFT FOUNDATIONS 09-26-12

For this project, **ITEM NO. 420S, DRILLED SHAFT FOUNDATIONS**, of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

420S.1 – Description

Contractor shall retain a Geotechnical Firm to complete two exploratory borings within the building footprint and submit the findings to the Engineer for review and approval prior to proceeding with shaft installations.

- A. The location of the borings shall be proposed by Contractor and approved by Engineer.
- B. The exploratory borings shall extend to a depth of 40 feet using rock coring methods.
- C. The borings shall be completed by a Texas licensed engineering firm and logged by an individual with training in geotechnical engineering.
- D. At a minimum logging shall include percent recoveries (REC) and rock quality designations (RQD) of the core-able rock material, as well as the thickness of overburden not core-able. The any voids encountered should be characterized to the extent practical.
- E. At a minimum, five rock core specimens per boring shall be tested in a laboratory for unconfined compressive strength.

420S.2 – Submittals

Results of the borings and testing shall be submitted to Engineer for confirmation or adjustment of shaft depths before proceeding with installation.

- A. Drilled shafts will be continuously inspected during installation by an Owner's representative. The representative will verify or otherwise document the following:
 - B. Characteristics of encountered material are similar to the materials encountered in the two exploratory borings.
 - C. Presence and frequency of voids and their dimensional characteristics.
 - D. Drilled shafts do not terminate in a void.
 - E. Drilled shafts are extended beyond the design length in amount equal to the sum of all encountered voids that are greater than 4 inches.

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SPECIAL PROVISION ITEM NO. 609S - NATIVE SEEDING AND PLANTING FOR RESTORATION 01-04-16

For this project, **ITEM NO. 609S, NATIVE SEEDING AND PLANTING FOR RESTORATION** of the City of Austin Standard Technical Specifications is hereby amended with respect to the clauses cited below. No other clauses or requirements of this Section of the City of Austin Standard Specifications are waived or changed.

609S.4 – Construction Methods

Add the following to the end of Section 609S.4 Item C (Watering):“Temporary irrigation shall be provided for final stabilization.”

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The Work of this Contract includes sustainability requirements as shown in the Division 1 Sections 01352 and/or 01505 and all other applicable specification sections. It is the intent of the Owner to work in partnership with the Contractor in implementing sustainable construction practices to the greatest extent possible.

PART 1 - GENERAL

1.1 Related Documents:

Drawings and general provisions of Contract, including General Conditions, Section 00700, and Supplemental General Conditions, Section 00810, and Division 1 requirements.

1.2 DESCRIPTION OF WORK

1.21 Scope of Work

A. This section describes the Project in general and provides an overview of the extent of the Work to be performed by the CONTRACTOR. Detailed requirements and extent of Work is stated in the applicable Specification Sections and shown on the Drawings. CONTRACTOR shall, except as otherwise specifically stated herein or in any applicable part of these Contract Documents, provide and pay for all labor, materials, equipment, tools, construction equipment, and other facilities and services necessary for proper execution, testing, and completion of the Work.

B. Any part or item of the Work which is reasonably implied or normally required to make the installation satisfactorily operable shall be performed by the CONTRACTOR and the expense thereof shall be included in the applicable unit prices or lump sum prices bid for the Work. It is the intent of these Specifications to provide the OWNER with the complete system. All miscellaneous appurtenances and other items of Work that are incidental to meeting the intent of the Specifications shall be considered as having been included in the applicable unit prices or lump sum prices bid for the Work even though these appurtenances and items may not be specifically called for in the Bid Documents.

C. The Work shall include furnishing all tools, labor, materials, equipment, and miscellaneous items necessary for the complete construction of a functional switch gear facility for the Ullrich Water Treatment Plant Low Service Pump Station, the connecting access road, duct bank utilities, restroom facility, and alterations at the Low Service Pump Station including the installation approximately 750 linear feet of ductbank to the LSPS, 685 linear feet of ductbank to the Powder Activated Carbon building, and a relocation of 91 linear feet of 16-inch water main and appurtenances.

1.22 Location of Project

A. The Project begins at [specify starting point - describing proximity to intersection if appropriate - and continue description of route]. The project location/route is shown on the Drawings.

1.23 Contractor's Responsibilities

A. Execute all Work, including excavation, installing pipe, backfill, miscellaneous concrete and testing. The Work of this Contract is specified in the City of Austin Standard Specifications, Special Provisions and Special Specifications listed in the Table of Contents.

B. Secure all construction-related permits, other than those provided by OWNER as described in paragraph 6.6 of Section 00810, Supplemental General Conditions, and pay for the same.

C. Arrange for the necessary temporary water and electric service and pay for these services and all water and electricity consumed during the construction Work.

D. Provide adequate temporary sanitary facilities.

1.24 Easements and Rights-Of-Way

CONTRACTOR shall confine his construction operations within the limits indicated on the Drawings, and shall use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies so as to cause the least possible damage to property and interference with traffic. If the CONTRACTOR requires additional easement for his operations, the CONTRACTOR is solely responsible for acquisition and maintenance of the easement. No additional compensation will be provided by the OWNER.

A. Easements - Easements across private property are indicated on the Drawings. CONTRACTOR shall set stakes to mark the boundaries of construction easement across private property. The stakes shall be protected and maintained until completion of construction and cleanup.

B. Rights-of-Way - Permits for Work in rights-of-way shall be obtained by the CONTRACTOR. All Work performed and all operations of CONTRACTOR, his employees, or subcontractors, within the limits of railroad and highway rights-of-way, shall be in conformity with the requirements and be under the control (through OWNER) of the railroad or highway authority owning, or having jurisdiction over and control of, the right-of-way in each case.

1.25 Operation of Existing Facilities

Existing water and wastewater facilities shall be kept in continuous operation throughout the construction period. No interruption will be permitted which adversely affects the degree of service provided. Provided permission is obtained from OWNER in advance, portions of the existing facilities may be taken out of service for short periods corresponding with periods of minimum service demands.

CONTRACTOR shall provide temporary facilities and make temporary modifications as necessary to keep the existing facilities in operation during the construction period.

1.26 Connections to Existing Facilities

Unless otherwise specified or indicated, CONTRACTOR shall make all necessary connections to existing facilities including structures, drain lines, and utilities. In each case, CONTRACTOR shall receive permission from OWNER or the owning utility prior to undertaking connections. CONTRACTOR shall protect facilities against deleterious substances and damage.

SUMMARY OF WORK

Section 01010

Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials and labor shall be on hand at the time of undertaking the connection. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

1.27 Unfavorable Construction Conditions

No portion of the Work shall be constructed under conditions which adversely affect the quality or efficiency thereof, unless special means or precautions are taken by CONTRACTOR to perform the Work in a proper and satisfactory manner.

END

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