

RULE NO.: R161-22.01

NOTICE OF PROPOSED RULE

POSTING DATE: January 12, 2022

The Director of the Department of Public Works proposes to adopt the following rule on or after February 14, 2022.

Comments on the proposed rule are requested from the public. A summary of the written comments received will be included in the notice of rule adoption that must be posted for the rule to become effective.

An affordability impact statement regarding the proposed rule has been obtained and is available for inspection or copying by contacting Kristie Sandoval at Kristie.Sandoval@austintexas.gov.

EFFECTIVE DATE OF PROPOSED RULE

A rule proposed in this notice may not become effective before the effective date established by a separate notice of rule adoption. A notice of rule adoption may not be posted before February 14, 2022 (the 32nd day after the date of this notice) or not after March 23, 2022 (the 70th day after the date of this notice).

If a proposed rule is not adopted on or before March 23, 2022 it is automatically withdrawn and cannot be adopted without first posting a new notice of a proposed rule.

REQUEST FOR COMMENTS ON PROPOSED RULES

The City requests comments from the public with respect to the proposed rules included in this Notice. Comments must be submitted in writing to the contact person below no later than February 14, 2022 (the 32nd day after the date of this notice).

Contact Person:

Kristie Sandoval, Public Works Rules Posting Manager

Public Works, Quality Management Division
6800 Burleson Rd, BLDG 312 STE 250
Austin, TX 78744
kristie.sandoval@austintexas.gov
512-974-7992

TEXT OF PROPOSED RULE

The text of the proposed rule, indicating changes from the current text, is attached to this notice.

BRIEF EXPLANATION OF PROPOSED RULE

R161-22.01: Proposed revisions to the Standard Specification Manual 658, 501S, and 403S:

- ITEM NO. 658 - VOID AND WATER FLOW MITIGATION: The unit of measurement shown in 658S.7 Payment, paragraph 3, states Cubic Yard for "Controlled Low Strength Material," "Low Slump Concrete," and "3 To 5 Inch Rock for Void Mitigation", however, for pay items 658S-4 3 To 5 Inch Rock for Void Mitigation, and 658S-8 Low Slump Concrete, are shown paid per cubic foot. **Revise pay item units from CF to CY to match 658S.7 paragraph 3.**
- ITEM NO. 501S – JACKING OR BORING PIPE: Jacking and Boring falls under OSHA requirements (OSHA) Standards (29 FR 1926/1920) as published in U.S. Department of Labor publication OSHA 2207, latest revision, with particular attention to Subpart S. Spec includes requirement to submittal of Trench Safety Plan which is included in 509S Trench Safety which falls under OSHA rules Subpart P Excavation. The spec contains numerous inconsistencies and duplicates of references included in other Standard Specification. **Clean up inconsistencies, remove S designation. Update references to the most current version. Delete requirements for requiring compliance to 509S and submittal of Trench Safety Plan.**
- ITEM NO. 403S- CONCRETE FOR STRUCTURES: Improve specification requirements for acceptance of concrete in Paragraph 403.7. **Improve testing requirement to state acceptance is based upon 28-day compression test results.**
- 648S Mulch Sock: There is no Measurement Section in the specification. In addition, a conflict has occurred related to payment for the overlap. Is the overlap included in the linear footage? Solution is to include Measurement Section in Specification and clarify how the overlap is accounted for in the measurement section.

AUTHORITY FOR ADOPTION OF PROPOSED RULE

The authority and procedure for adoption of a rule to assist in the implementation, administration, or enforcement of a provision of the City Code is provided in Chapter 1-2 of the City Code. The authority to regulate construction requirements is established in Sections 25-6-267 and 25-6-268 of the City Code.

CERTIFICATION BY CITY ATTORNEY

By signing this Notice of Proposed Rule (R161-22.01), the City Attorney certifies the City Attorney has reviewed the rule and finds that adoption of the rule is a valid exercise of the Director's administrative authority.

REVIEWED AND APPROVED



Eric Bailey, Assistant Director, on behalf of
Richard Mendoza, Director
Public Works

Date: 12/9/21

Deborah Thomas for
Anne L. Morgan, City Attorney

Date: 12/15/2021

ITEM NO. 658S VOID AND WATER FLOW MITIGATION 4-4-12 XXXX (adoption date TBD)

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.

658S.2 Submittals

A. Submittals requirements of this specification include:

1. 3x5 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 Standard Specification 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 Standard Specification 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).

658 S.3 Materials

- A. 3x5 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 Standard Specification Item No. 402S.
- C. Filter Fabric: This material shall meet the requirements for filter fabric as specified in SSM Standard Specification 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 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 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 Standard Specification Item No. 510.2 (5).
- F. Gravel Backfill: Gravel backfill shall meet requirements of SSM Standard Specification 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).

658 S.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.

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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~~ **Standard Specification** 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.

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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.

658-5.5 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:

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- 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.

658-§.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 ~~square yard cubic foot (cubic meter)~~ of material in place.
7. Measurement of low slump concrete material shall be by the cubic ~~yard 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.

658-§.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.

Payment for will be made using the following bid items:

Pay Item 658-S-1:	Temporary Void Protection (Plywood Planking)	Per Each
Pay Item 658-S-2:	Controlled Low Strength Material for Mitigation	Per Cubic Yard
Pay Item 658-S-3:	Pea Gravel-Filled Polypropylene Bags for Void Mitigation	Per Each
Pay Item 658-S-4:	3 To 5 Inch Rock for Void Mitigation	Per Cubic Foot Yard
Pay Item 658-S-5:	Filter Fabric for Void Mitigation	Per Square Yard
Pay Item 658-S-6:	Permanent Turf Reinforcement Mat for Void Mitigation	Per Square Yard
Pay Item 658-S-7:	Low Slump Concrete	Per Cubic Foot Yard
Pay Item 658-S-8:	Special Trench Safety Associated with Observation of Voids and/or Flowing Water	Per Linear Foot
Pay Item 658-S-9:	Downtime Associated with Observation of Voids and/or Flowing Water	Per Day

END

<u>SPECIFIC CROSS REFERENCE MATERIALS</u>	
<u>Specification 658-S, "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

City of Austin Standard Specification Items

<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.S. Dept. of Transportation, Federal Highway Administration

<u>Designation</u>	<u>Description</u>
FP-03, Section 713.18	Permanent Turf Reinforcement Mat specifications

RELATED CROSS REFERENCE MATERIALS

Specification 658-S, "Void and Water Flow Mitigation"

<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.

ITEM NO. 501S JACKING OR BORING PIPE 9-26-12 XXXX (adoption date TBD)

501S.1 Description

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

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

501S.2 Submittals

The submittal requirements for this specification item shall include:

- A. Shop drawings identifying proposed jacking or boring method complete in assembled position
- ~~B. Trench Safety Plan including pits, trenches and sheeting or bracing if necessary,~~
- ~~C.~~ B. Design for jacking or boring head,
- ~~D.~~ C. Installation of jacking or boring supports or back stop,
- ~~E.~~ D. Arrangement and position of jacks and pipe guides, and
- ~~F.~~ E. Grouting plan,

501S.3 Materials

- A. Pipe
Carrier pipe and encasement pipe shall conform to Standard Specification Item Nos. 505S, "Concrete Encasement and Encasement Pipe" and 510, "Pipe" and shall be size, type materials, thickness and class indicated on the Drawings, unless otherwise specified.
- B. Grout
Grout for void areas shall consist of 1 part Portland cement and 4 parts fine, clean sand mixed with water.

501S.4 Construction Methods

- A. General
The Contractor is responsible for:
 - 1. Adequacy of jacking and boring operations,
 - 2. Installation of support systems as indicated on the Drawings,
 - 3. Provision of encasement and carrier pipe, and
 - 4. Execution of work involving the jacking operation, the wet or dry method of boring and the installation of encasement pipe simultaneously, and

5. Complying with OSHA 29CFR Part 1926 Subpart P for excavations and Subpart S for underground construction

The Contractor shall have sole responsibility for the safety of the jacking and boring operations and for persons engaged in the work. The Contractor's attention is directed to the Construction Industry Occupational Safety and Health Administration (OSHA) Standards (29 FR 1926/1920) as published in U.S. Department of Labor publication OSHA 2207, latest revision, with particular attention to Subpart S. The Contractor shall conform to the requirements in accordance with Standard Specification Item 509S, "Trench Safety System" and shall provide an appropriate Trench Safety Plan.

When the grade of the pipe at the jacking or boring end is below the ground surface, suitable pits or trenches excavations shall be made excavated to provide sufficient room to conduct the jacking or boring operations and for placement of end joints of the pipe. The Contractor shall install all necessary sheeting and bracing required in order to provide a safe and stable work area, the excavated area shall be securely sheeted and braced to prevent earth caving in accordance with the Trench Safety Plan.

The location of the work pit and associated traffic control measures required for the jacking or boring operations shall conform to the requirements of the City of Austin Transportation Criteria Manual and TxDOT Manual on Uniform Traffic Control Devices.

Where installation of pipe is required under railroad embankments, highways, streets, or other facilities by jacking or boring methods, construction shall be undertaken in such a manner that it will not interfere with operation of any railroad, street, highway, utility or other facility and shall not weaken or damage any embankment or structure. All appropriate permits shall be acquired prior to the initiation of the work.

During construction operations, and until the work pits are backfilled and fill material compacted, traffic barricades and warning lights to safeguard traffic and pedestrians shall be furnished and maintained by the Contractor. The Contractor shall submit the proposed pit location and traffic control plan for review by the Engineer or designated representative. The Review by the Engineer or designated representative, however, will not relieve the Contractor of the responsibility to obtain specified results in a safe, professional manner.

~~When grade of pipe at jacking or boring end is below ground surface, suitable pits or trenches shall be excavated for the purpose of conducting the jacking or boring operations and for joining pipe. Work shall be securely sheeted and braced as indicated on the Trench Safety Plan to prevent earth caving and to provide a safe and stable work area.~~

The pipe shall be jacked or bored from the low or downstream end, if possible. Minor lateral or vertical variation in the final position of pipe from line and grade established by Engineer or designated representative will be permitted at the discretion of Engineer or designated representative provided that such variation is regular and occurs only in one direction and that the final grade of the flow line conforms to the specified direction.

When conforming to details indicated on the drawings, but the bottom of the work pit is unstable or excessively wet or the installation of water and wastewater pipe will result in less than 30 inches (750 mm) of cover, the Contractor shall notify the Engineer or designated representative. The Engineer or designated representative may require the Contractor to install a concrete seal, cradle, cap or encasement or other appropriate action.

Immediately after jacking or boring is complete and the encasement pipe is accurately positioned and approved for line and grade, the clear space between the pipe and the surrounding excavated material shall be completely filled by pressure grouting for entire length of installation if the encasement pipe is 36 inches or larger in diameter.

After placement of the carrier pipe is complete, the ends of the encasement pipe shall be sealed with end seals meeting SPL WW-575A.

As soon as possible after the carrier pipe(s) and end seals are completed, the excavations made work pits or trenches, which are excavated to facilitate these operations, shall be backfilled. The backfill in the street ROW shall be compacted to not less than 95 percent of the maximum density conforming to TxDOT Test Method Tex-114-E, "Laboratory Compaction Characteristics & Moisture-Density Relationship of Subgrade & Embankment Soils and Backfill Material". Field density measurements will be made in accordance with TxDOT Test Method Tex-115-E, "Field Method for Determination of In-Place Density of Soils and Base Materials".

Where the characteristics of soil, size or size of proposed pipe dictate that tunneling is more satisfactory than jacking or boring, a tunneling method may be submitted for acceptance by Engineer or designated representative.

B. Jacking

Heavy duty jacks suitable for forcing the pipe through the ground embankment shall be provided. In operating the jacks, an even pressure shall be applied to all jacks used so that the pressure will be applied to the pipe uniformly around the ring of the pipe. A suitable jacking frame or back stop shall be provided. The pipe to be jacked shall be set on guides properly braced together, to support the section of the pipe and to direct it in the proper line and grade. The complete jacking assembly shall be placed in order to line up with the direction and grade of the pipe. In general, the embankment material shall be excavated just ahead of the pipe, the material removed through the pipe and the pipe forced through embankment by jacking, into the space thus provided.

The excavation for the underside of the pipe, for at least 1/3 of the circumference of the pipe, shall conform to the contour and grade of the pipe. A clearance of no more than 2 inches (50 mm) may be provided for the upper half of the pipe. This clearance shall be tapered to zero at the point where excavation conforms to contour of pipe.

The distance that excavation shall extend beyond the end of the pipe depends on the character of material encountered, but it shall not exceed 2 feet (0.6 meter) in any case. This distance shall be decreased, when directed by the Engineer or designated representative, if the character of the material being excavated makes it desirable to keep the advance closer to the end of the pipe.

The Contractor may use a cutting edge of steel plate around head end of the pipe extending a short distance beyond the end of pipe with inside angles or lugs to keep cutting edge from slipping back onto the pipe.

When jacking of the pipe is begun, all operations shall be carried on without interruption, insofar as practical, to prevent the pipe from becoming firmly set in the embankment.

Any pipe damaged in jacking operations shall be removed and replaced by the Contractor at its entire expense.

C. Boring

The boring shall proceed from a work pit provided for the boring equipment and workers. Excavation for the work pits and the installation of shoring shall be as outlined in the Trench Safety Plan. The location of the pit shall be approved by the Engineer or designated representative. The boring shall be done mechanically using either a pilot hole or the augur method.

In the pilot hole method, an approximate 2-inch (50 mm) pilot hole shall be bored the entire length of the crossing and shall be checked for line and grade on the opposite end of the bore from the work pit. This pilot hole shall serve as the centerline of the larger diameter hole to be bored.

When the augur method is used, a steel encasement pipe of the appropriate diameter equipped with a cutter head to mechanically perform the excavation shall be used. Augurs shall be of sufficient diameter to convey the excavated material to the work pit.

Excavated material will be removed from the working pit and disposed of properly. The use of water or other fluids in connection with the boring operation will be permitted only to the extent to lubricate cuttings. Water jetting will not be permitted.

In unstable soil formations, a gel-forming colloidal drilling fluid, that consists of at least 10 percent of high grade carefully processed bentonite, may be used to consolidate the drill cuttings, seal the walls of the hole and furnish lubrication to facilitate removal of the cuttings from the bore.

D. Tunneling

Where the characteristics of the soil, the size of the proposed pipe, or the use of monolithic sewer would make the use of tunneling more satisfactory than jacking or boring; or when indicated on the drawings, a tunneling method may be used, with the approval of the Engineer or designated representative.

E. Joints

If reinforced concrete pipe is used, the joints shall be in accordance with TxDOT Specification Item 464, "Reinforced Concrete Pipe".

501S.5 Measurement

Jacking or boring pipe will be measured by the linear foot (meter: 1 meter equals 3.281 feet) of pipe complete in place. Such measurement will be made between the ends of the pipe along the central axis as installed.

501S.6 Payment

The work performed and materials furnished as prescribed by this item and measured as provided under "Measurement" will be paid for at the unit bid price per linear foot for "Jacking or Boring Pipe" as the case may be, of type, size and class of encasement pipe indicated on the Drawings. The price shall include full compensation for furnishing, preparing, hauling and installing required materials, encasement pipe, end seals, for grouting and for labor, tools, equipment and incidentals necessary to complete work, including excavation, backfilling and disposal of surplus material.

The Carrier pipe shall be paid at the unit price bid for Standard Specification Item 510, "Pipe".

Payment when included as a contract pay item, will be made under one of the following:

Pay Item No. 501S:	Jacking or Boring _____ In. Pipe, Class _____	Per Linear Foot.
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End

SPECIFIC CROSS REFERENCE MATERIALS	
Specification Item 501S, "Jacking or Boring Pipe"	
City of Austin Standard Specification Items	
Designation	Description
Item No. 505S	Concrete Encasement and Encasement Pipe
Item No. 509S	Trench Safety Systems
Item No. 510	Pipe
TxDOT Standard Specifications For Construction And Maintenance Of Highways, Streets, And Bridges	
Designation	Description
Item 464	Reinforced Concrete Pipe

<u>TxDOT Testing Procedures</u>	
<u>Designation</u>	<u>Description</u>
Tex-114-E	Laboratory Compaction Characteristics & Moisture Density Relationship of Subgrade & Embankment Soils, and Backfill Material
Tex-115-E	Field Method for Determination of In-Place Density of Soils and Base Materials
<u>TxDOT Manual on Uniform Traffic Control Devices (MUTCD)</u>	
<u>Designation</u>	<u>Description</u>
MUTCD Part VI	Traffic Controls for Street and Highway Construction, Maintenance, Utility and Incident Management Operations
MUTCD Section 6C	Channelizing Devices
MUTCD Section 6C-8	Barricade Design
MUTCD Section 6C-9	Barricade Application
MUTCD Section 6E	Lighting Devices
MUTCD Section 6F	Control of Traffic Through Work Areas
<u>City of Austin Transportation Criteria Manual</u>	
<u>Designation</u>	<u>Description</u>
Section 8	Traffic Control
Section 8.5.5.E	Typical Applications/Bore Pits

<u>RELATED CROSS REFERENCE MATERIALS</u>	
Specification Item 501S, "Jacking or Boring Pipe"	
<u>City of Austin Standard Details</u>	
<u>Designation</u>	<u>Description</u>
Detail 501S-1	Encasement Detail w/ Casing Spacers
501-AW-01	Encasement Pipe Detail with Casing Spacers
<u>TxDOT Standard Specifications</u>	
<u>Designation</u>	<u>Description</u>
Item 476	Jacking, Boring or Tunneling Pipe
Item 502	Barricades, Signs and Traffic Handling

403S.7 Consistency and Quality of Concrete

Concrete shall be workable, cohesive, possess satisfactory finishing qualities and of stiffest consistency that can be placed and vibrated into a homogeneous mass within slump requirements specified in Table 4 without the development of segregation or honeycombing. No concrete will be permitted with a slump in excess of the maximums shown unless water-reducing admixtures have been previously approved. Concrete that exceeds the maximum acceptable placement slump at time of delivery will be rejected. Slump values shall be conducted in accordance with TXDOT Test Method TEX-415-A.

Consistency and quality of concrete should allow efficient placement and completion of finishing operations before initial set. Re-tempering (i.e. addition of water and reworking concrete after initial set) shall not be allowed. When field conditions are such that additional moisture is needed for final concrete surface finishing operation, the required water shall be applied to surface by fog spray only and shall be held to a minimum. Excessive bleeding shall be avoided and in no case will it be permissible to expedite finishing and drying by sprinkling the surface with cement powder.

Table 4: Slump Requirements		
	Slump¹, inches (mm)	
Type of Construction	Maximum	Minimum
Cased Drilled Shafts	4 (100)	3 (75)
Reinforced Foundation Caissons and Footings	3 (75)	1 (25)
Reinforced Footings and Substructure Walls	3 (75)	1 (25)
Uncased Drilled Shafts	6 (150)	5 (125)
Thin-walled Sections; 9 inches (225 mm) or less	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 will **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 will determine 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 e-Concrete quality is by 28-day compressive tests, job control testing will be by 7-day compressive strength tests. **Should the concrete fail to meet the 28-day required strength, the tolerance for acceptance shall follow ACI 301 and be acceptable to the Engineer of Record.** 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 **the Engineer shall be notified within 3 days to determine how to proceed.** **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.**

Class	Cement Skes 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
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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.

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).

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

Nominal Maximum Aggregate Size In (mm)	% Air Entrainment	
	Moderate Exposure	Severe Exposure

$\frac{3}{8}$ (9.5)- Grades 7 & 8	6	$7\frac{1}{2}$
$\frac{1}{2}$ (12.5)- Grades 6	$5\frac{1}{2}$	7
$\frac{3}{4}$ (19)- Grades 5	5	6
1 (25)- Grades 4	$4\frac{1}{2}$	6
$1\frac{1}{2}$ (37.5)- Grades 2 & 3	$4\frac{1}{2}$	$5\frac{1}{2}$
2 (50)- Grades 2	4	5

1. For specified concrete strengths above 5,000 psi (34.42 MPa) a reduction of 1 percentage point is allowed.

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 Measurement

Installed mulch sock shall be measured along the center line of the installed mulch sock ignoring any overlaps.

648S.6 Payment

648S.7 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

City of Austin Standard Details	
<u>Designation</u>	<u>Description</u>
648S-1	Mulch Sock