CITY OF SAN MARCOS
CONSTRUCTION CHANGE ORDER
($50,000 and higher)

PROJECT: Sessom Creek Bank Stabilization & Wastewater Replacement - Phase 2
CONTRACT NO.: #224-002

Date Prepared: 7/29/2025
Change Order #: 3

CONTRACTOR: Jerdon Enterprise
ADDRESS: 825 W. Bitters, Suite 203
CITY/STATE/ZIP: San Antonio, TX 78216

We are submitting this Change Order to the referenced contract. In consideration of the Change Order agreed to herein as complete equitable adjustments and full and final payment for the Contractor's additional work, the Contractor hereby releases the Owner from any and all liability under this contract for further equitable adjustments, including additional time for performance, attributable to such facts or circumstances giving rise to the proposal for adjustment.

This authorization provides for the following modifications or additions: Rio Vista Outfall Maintenance. Purpose of this Change Order #3 is to fill in a scour hole with rock rip-rap and repair gabion basket chute.. Mobilization for CO #3 to be independent of work associated with Sessom Creek Bank Stabilization & Wastwater Replacement-Phase 2 Project. We anticipate 5 weeks to complete the project following the procurement of Gabion Basket and Mattress materials. Our proposal is contingent upon an agreement established with the home owner of 220 Riverside Drive for the job site access.

I. New Construction Bid Items

Item Number NUMBER	ITEM SPEC REF.	DESCRIPTION	PREVIOUS QUANTITY	REVISED QUANTITY	CHANGE IN QUANTITY	UNIT	UNIT PRICE	TOTAL
301	700S	CO3 Mobilization		1	1	LS	$23,687.45	$23,687.45
302	610S	Removal of Existing Trees		12	12	EA	$143.60	$1,723.20
303	639S	Rock Berm		10	10	LF	$169.62	$1,696.20
304	641S	Stabilized Construction Entrance		1	1	EA	$3,125.00	$3,125.00
305	628S	Filter Curb Inlet Protection		1	1	EA	$328.50	$328.50
306	SS902	Coir Fiber Matting		250	250	SF	$3.07	$767.50
307	591S	Rip Rap Embankment		1,122	1,122	SF	$17.22	$19,320.84
308	594S	Gabion Basket		96	96	CY	$628.41	$60,327.36
309	132S	Embankment - Scour Repair		47	47	CY	$49.64	$2,333.08
310	702S	Remove/Reinstall Chain Link Fence		60	60	LF	$44.00	$2,640.00
TOTAL FOR BID CATEGORY						**SUB TOTAL I:**		**$115,949.13**

II. Explanation of Items

ITEM NUMBER	ITEM SPEC REF.	DESCRIPTION	PREVIOUS QUANTITY	REVISED QUANTITY	CHANGE IN QUANTITY	UNIT	UNIT PRICE	TOTAL
ITEM #	ITEM #	ITEM DESCRIPTION			0			$0.00
ITEM #	ITEM #	ITEM DESCRIPTION			0			$0.00
ITEM #	ITEM #	ITEM DESCRIPTION			0			$0.00
ITEM #	ITEM #	ITEM DESCRIPTION			0			$0.00
TOTAL FOR BID CATEGORY						**SUB TOTAL II:**		**$0.00**

TOTAL CHANGE ORDER **TOTAL I+II:** **$115,949.13**

CHANGE IN DAYS REQUESTED FOR CHANGE ORDER **0**

Date	Contract Document	Amount	Days	Running Sum	% Change $
	ORIGINAL CONTRACT AMOUNT:	$2,534,640.30	280	$2,534,640.30	0.0%
	CHANGE ORDER 1:	$38,240.96	-30	$2,572,881.26	1.5%
	CHANGE ORDER 2:	$49,686.58	5	$2,622,567.84	3.5%
	CHANGE ORDER 3:	$115,949.13	0	$2,738,516.97	8.0%
	CHANGE ORDER XX:	$0.00	0	$2,738,516.97	8.0%
	REVISED CONTRACT AMOUNT/DAYS:	$2,738,516.97	255		

Your signature below will constitute your acceptance of this Change Order:

1. Prepared By Project Manager: Digitally signed by Rey Garcia DN: cn=Rey Garcia, c=US, o=City of San Marcos, ou=Engineering, email=rgarcia@sanmarcostx.gov Date: 2025.08.04 10:27:00 -05'00'
{Signature} Date

2. Contractor: PRESIDENT 8/4/25
{Contractor Signature, Title} Date

3. Recommended by Design Consultant: Digitally signed by Rey Garcia DN: cn=Rey Garcia, c=US, o=City of San Marcos, ou=Engineering, email=rgarcia@sanmarcostx.gov Date: 2025.08.04 11:31:33 -05'00'
{Consultant Signature, Title} Date

4. Recommended by Department Director: Shaun Condor Digitally signed by Shaun Condor DN: cn=Shaun Condor, c=US, o=City of San Marcos, ou=Engineering and Capital Improvements, email=scondor@sanmarcostx.gov Date: 2025.08.04 12:30:08 -05'00'
{Director Signature} Date

5. Reviewed by Finance:
Contractor Administrator Date

Purchasing Manager Date

6. Approved By:
City Manager Date

Distribution List: Project Manager
Finance Department - Contract Administration
Contractor
Inspector

JERDON
SAFETY · QUALITY · MAINTENANCE
Enterprise, L.P.

July 29, 2025

City of San Marcos
Attn: Rey Garcia
630 E. Hopkins St.
San Marcos, TX 78666

Re: Sessom Creek Bank Stabilization & Wastewater Replacement – PCO 1rev. Rio Vista Outfall Maintenance

Dear Rey,

In response to your request, Jerdon Enterprise proposes to install 21'-0" of Gabion Dissipators, one 12' x 6' x 3' Pie Shaped Gabion, extend 52'-0" of Gabion, Stack 88'-0" of Gabion, install 360 sqft of Gabion Mattress per Rio Vista Terrace plan sheet CH-1 and Item 594S. The work will also include the Repair Scour Damages, Install 6" – 12" Rock Armor for Embankment, Stabilized Construction Entrance, and coordinate Site Access at 220 Riverside Drive for the lump sum price of $115,949.13.

Our proposal is contingent upon final agreement with Dr. Sand for access from 220 Riverside Dr.

We respectfully exclude City Permitting, Testing Lab, Professional Survey, SWPPP Permit/Inspections Engineered Drawings, Damages caused by flash flooding, or events beyond our control.

We anticipate 5 weeks to complete the project.

Our detailed price breakdown is attached.

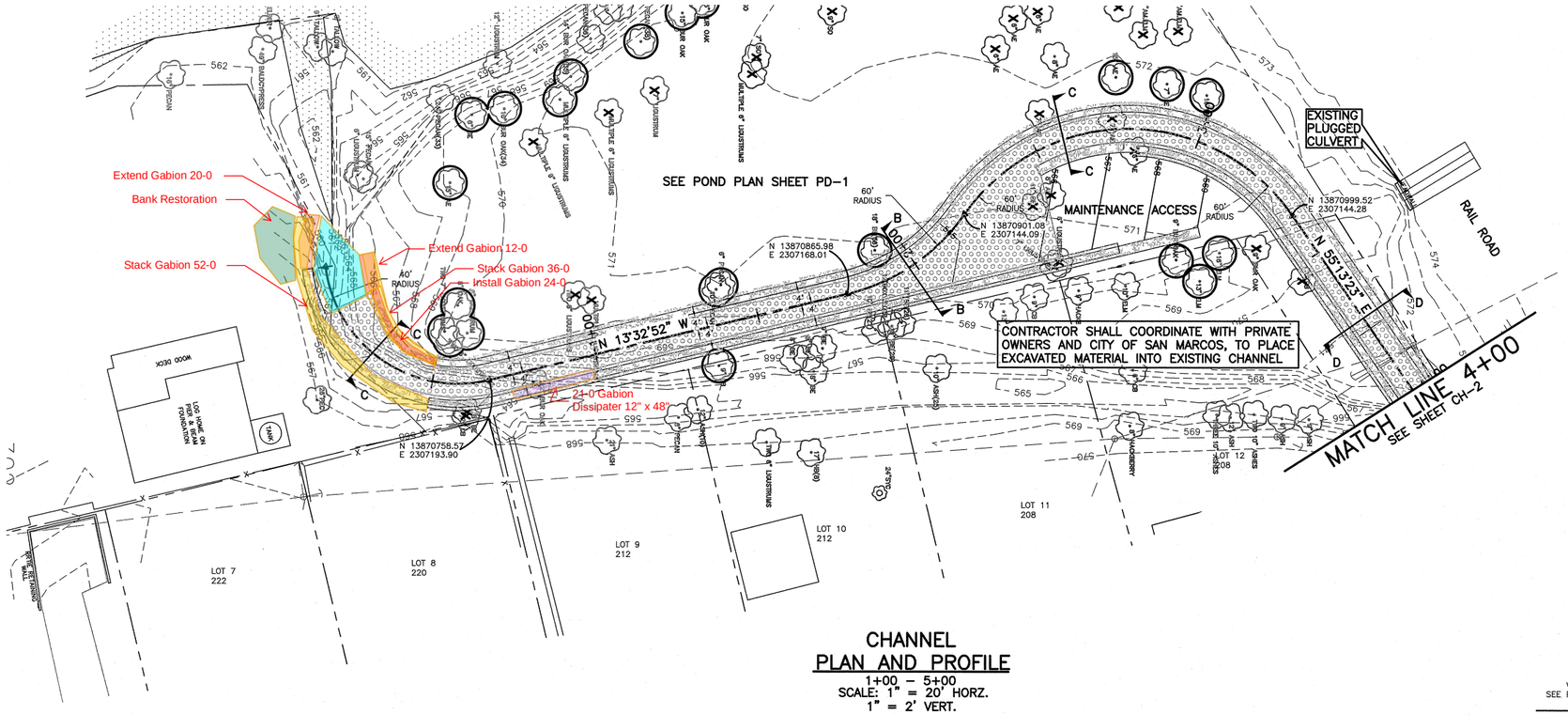
If there are any additional questions or comments, please call me at (210) 544-7289

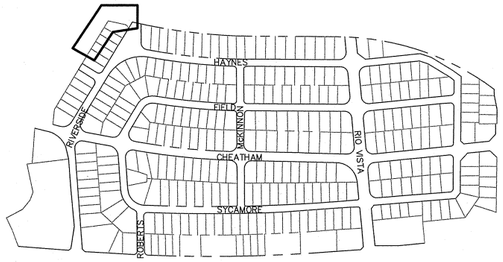
Sincerely,

Mark Kollock
Project Manager

By: Jerdon Enterprise

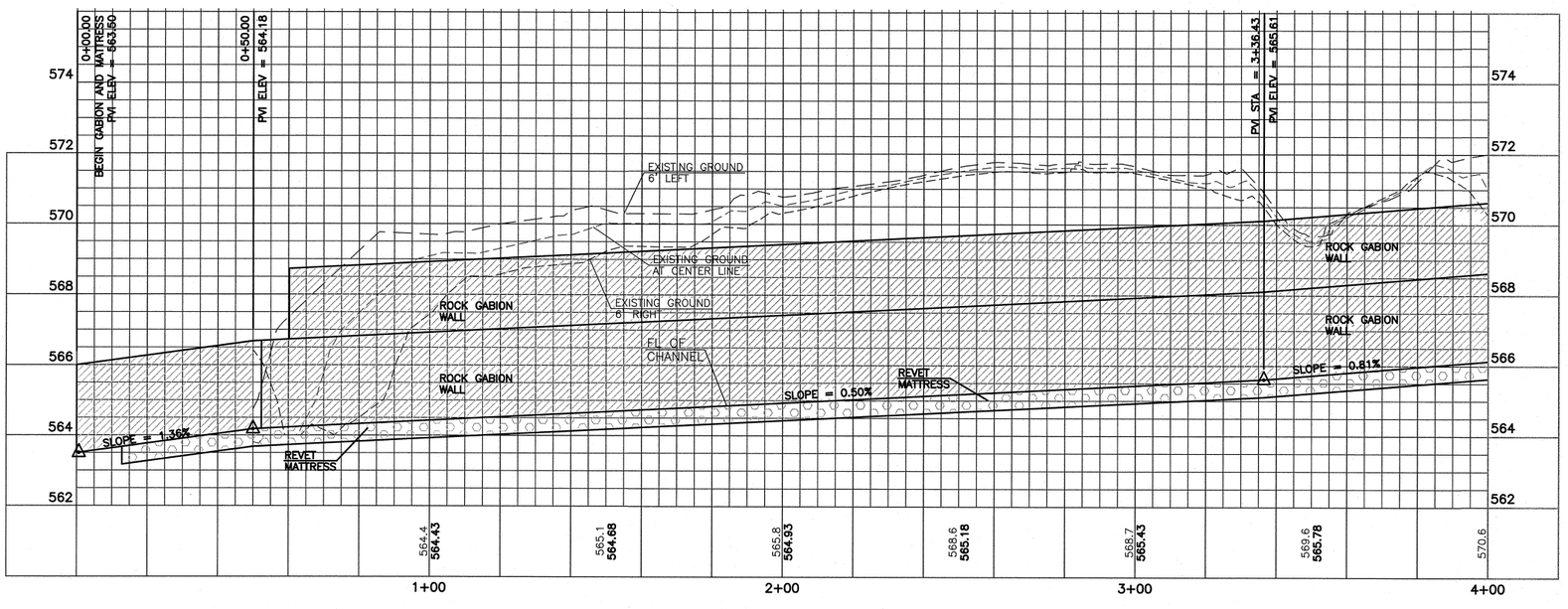
825 W. Bitters Road, Suite 203 • San Antonio, TX 78216
Phone (210) 590-1110 Fax (210) 590-7515

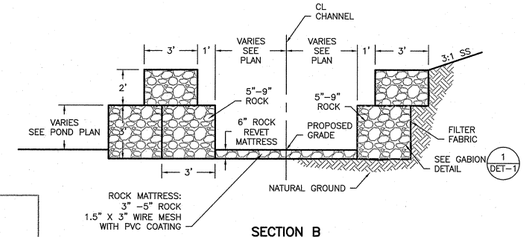




KEY MAP
SCALE: 1" = 500'

CHANNEL
PLAN AND PROFILE
1+00 – 5+00
SCALE: 1" = 20' HORZ.
1" = 2' VERT.





SECTION B
NOT TO SCALE

SECTION C
SCALE: 1" = 4'

SECTION D
SCALE: 1" = 4'

1 CH–1 CHANNEL CROSS SECTIONS

REVISIONS			
NO.	SHEET / DESCRIPTION	DATE	APPROVED
1			
2			
3			
4			
5			
6			
7			

FB 624 626 | PG 1 1

DESIGNED BY: JIM WATSON
DRAWN BY: JIM WATSON
CHECKED BY: JOHN J. DIPOLLINO
APPROVED BY: JOHN J. DIPOLLINO

PROJECT FILE 08\25588\4 ENG
DRAWING 5B CH-1CHAN

BYRN & ASSOCIATES, INC.
ENGINEERS SURVEYORS
1115 HWY 80 EAST, SAN MARCOS, TEXAS 78666-1433
PHONE 512-396-2270 FAX 512-392-2945

STATE OF TEXAS
JOHN J. DIPOLLINO
85355
REGISTERED PROFESSIONAL ENGINEER
8/6/09

RIO VISTA TERRACE SUBDIVISION RECONSTRUCTION PHASE II
CITY OF SAN MARCOS

CHANNEL PLAN AND PROFILE
1+00 – 4+00

SHEET NUMBER CH–1
OF 140 SHEETS
JOB NUMBER 25588-08-4

25588–08–4

S:\08\25588\4 ENG\5B CH-1CHAN base.dwg, 8/6/2009 8:54:13 AM, Oce TDS320

Item No. 609S Native Grassland Seeding and Planting for Erosion Control

609S.4.A General (Table 1: Weed List)

Delete Table 1: Weed List and replace with the following:

Weed Type	Botanical Name	Common Name
Summer Annual Herb	*Ambrosia spp.*	Ragweed
Perennial Grass	*Bothriochloa ischaemum*	K.R. Bluestem
Annual Grass	*Cenchrus spp.*	Sandbur
Herb	*Cnidoscolus texanus*	Bull Nettle
Perennial Grass	*Sorghum halapense*	Johnson Grass
Perennial Grass	*Arundo donax*	Giant Cane
Perennial Grass	*Phllostachys aurea*	Golden Bamboo
Vine	*Toxicodendron radicans*	Poison Ivy
Herb	*Urtica spp.*	Stinging Nettle
Winter Annual Herb	*Rapistrum rugosum*	Bastard Cabbage
Winter Annual Grass	*Bromus arvensis*	Japanese Brome
Winter Annual Grass	*Lolium multiflorum*	Annual Ryegrass
Tree	*Triadica sebifera*	Chinese Tallow
Tree	*Ligustrum sp.*	Privet
Tree	*Melia azedarach*	Chinaberry
Tree	*Lonicera japonica*	Japanese Honeysuckle
Shrub	*Nandina domestica*	Heavenly Bamboo
Shrub	*Photinia sp.*	Photinia

Item No. 610S Preservations of Trees and Other Vegetation

610S.1 Description and Definitions

Add the following:

This Section includes the protection and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction.

All pruning shall be performed under the direct supervision of a certified arborist provided by the contractor as indicated below.

- The requirement for a certified arborist will be waived on private jobs that have been reviewed and approved permit through *MyPermitNow*.
- A certified arborist must be provided by the contractor on all projects that are not permitted through *MyPermitNow*. This will not be paid for separately, but will be considered subsidiary to the overall project cost.

The Contractor will not begin any utility or street excavation work where tree preservation and treatment measures have not been completed and approved.

Modify the definition of a City Arborist as indicated below:

Delete: 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.

Replace With: Person designated as such by the Director of Engineering and Capital Improvement or as designated by the City Urban Forester.

Modify the definition of a Qualified Arborist as indicated below:

Delete: 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).

Replace With: Certified arborist retained by a Contractor for the purpose of overseeing on-site activity involving the welfare of trees to be retained. The Qualified Arborist shall be responsible for all reports, appraisals, tree preservation plants, or inspections as required. The contractor shall provide an (ISA) International Society of Arboriculture Certified Arborist that has a minimum of five years' experience who will serve in the roles described in the specification as the responsibilities of the City Arborist.

Add the following Definitions:

Critical Root Zone (CRZ) – See definition below for *Root Protection Zone (RPZ).*

Excessive Pruning – removal of the trees foliage & branches that exceeds approximately 25% or more of the trees canopy. The City Arborist shall have the final decision on determining excessive pruning.

Protective Tree Fencing – A temporary enclosure erected around a tree to be protected at the boundary of the tree root protection zone. The fence serves three primary functions:

1) To keep the foliage crown, branch structure an trunk clear from direct contact and damage by equipment, materials or disturbances
2) To preserve roots and soil in an intact and non-compacted state
3) To identify the tree protective zone in which no soil disturbance is permitted and activities are restricted.

Root Protection Zone (RPZ) - The area within a "X" distance from the tree, starting from the perimeter of the tree trunk. It is determined by measuring the tree at 54 inches above natural grade, where for every 1 inch of the trees diameter equals 1 foot radius. This area does not necessarily have to be centered exactly on the tree trunk and can overlap with groups of trees. The City Arborist retains the right to extend or modify the RPZ at any time.

Example: A 12 inch diameter tree measured at 54 inches would have a 12 foot radial area of protection or a 24 foot diameter root protection zone.

Removal –mean any of the following:

1. Complete tree removal such as cutting to the ground or extraction of the tree.
2. Taking any action foreseeable leading to the death of a tree or permanent damage to its health or structural integrity; including but not limited to excessive pruning, cutting, girdling, poisoning, over watering, trenching, excavation, altering the grade, or paving within the root protection zone of the tree.

Topping - The severe cutting back of limbs to stubs larger than three inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree.

610S.2 Submittals

Add the following:

F. Proposed other tree health improvements not limited to watering, integrated pest management, and soil aeration.

610S.3.A Protective Fencing and Signage

Delete and Replace with the following:

Protective fencing is designated as the materials used to protect the root zones of trees as illustrated in City of San Marcos Standard Detail 610S-1-SM. Type A shall be installed where damage potential to a tree root system is high. Type B and Type C are not allowed.

610S.3.A (4) Signage

Delete and Replace with the following:

A laminated sign, no smaller than 8.5" X 11", shall be posted on each tree protective device, and at least every 50 linear feet on protective fencing, identifying the following information: "Keep Out, Tree Protection Area". This protective device is to remain in place for the entirety of the construction project and illegal removal is subject to fines and work suspensions. Additional information can be obtained from the City Arborist (512-393-8486).

610S.3.C Tree Dressing

Delete and Replace with the following:

Wound treatments should not be used to cover wounds or pruning cuts, except when recommended for disease prevention and control such as of oak wilt adhere to the Texasoakwilt.org. Pruning guidelines (see section 610S.4 (H)), insect, mistletoe, or sprout control (most recent version of ANSI A300 Pruning standards

610S.3.G Board Pads *(Add New Section)*

Board pads made either of wood or metal that are placed over areas where the Tree's root protection zone fencing has been offset to provide access for heavy equipment, roads or building work. Minimum board thickness of plywood sheeting for high use areas within the CRZ is ¾" thick with 2x4 wood attached to secure any overlapping sheeting. See standard detail for further information. The area shall be mulched with 8-12 inches of mulch; board pads shall be located to overlap to

prevent heavy machinery from displacing mulch and impacting the soil and trees roots in the root protection zone.

610S.3.H Water *(Add New Section)*

Reclaimed reuse water is acceptable when tested for sodium content and approved by the City Arborist and or potable water.

610S.4.A.2 (c) Protective Fencing

Modify the last sentence as indicated below:

Delete: Apply organic mulch to a depth of 8 inches [30.48 cm] in the unprotected root zone area;

Replace With: Apply organic mulch to a depth of 8 inches to 12 inches in the unprotected root zone area and add board pads located over the mulched area to prevent mulch from being displaced;

610S.4.B Pruning and Repair of Damage

Add the following:

Prior to the start of construction the Contractor shall schedule an on-site meeting with the City Inspector and the Contracts' Certified Arborist to:

1. Identify tree pruning needs for minimum overhead clearance to perform the work.
2. Identify any hazardous tree conditions that may need repair for site safety.
3. Identify areas where exhaust diverters will be required to prevent scorching of trees.

Contractor shall provide a representative who is familiar with the type of equipment that will be used on the project and the arborist that will be performing or supervising all tree work. Tree work must be performed under the direct supervision of a Certified Arborist and shall be in accordance with the current adopted industry standards (ANSI A300 and ANSI Z133, and Best Management Practices).

The Contractor is responsible to protect preserved trees against injury or damage, including cutting, soil compaction, and breaking or skinning of roots.

At the end of the day the Contractor will cover exposed roots using soil, mulch or wet burlap.

Modify the third paragraph as indicated below:

Delete: 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.

Replace With: Trees damaged or lost due to the Contractor's negligence during construction shall be mitigated to the City's satisfaction and in accordance with section 5.5.2.2 "Tree Protection Standards" of the land development code.

610S.4.E Tree Removal

Delete the first paragraph and replace with the following:

Tree removal shall comply with Chapter 6 of the Land Development Code. Trees 9 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. The removal of any protected or heritage tree for the purpose of development without City approval is expressly prohibited.

610S.4.G Root Zone Aeration and Fertilization

Modify the last sentence of the second paragraph as indicated below:

Delete: Treatment should include, but not limited to, fertilization, soil treatment, mulching, and proper pruning.

Replace With: Treatment should include, but not limited to, fertilization, integrated pest management, soil aeration treatment, mulching, and proper pruning.

Add the following to the end of this section:

The Contractor will protect all existing landscape and trees from a change in the soil ph factor by preventing the disposal of lime based materials such as concrete, plaster, or lime treatment at the pavement subgrade in the proximity of preserved tree areas.

610S.4.H.3 (c) Prevention Policy

Add the following to the end of this section:

All wounds shall be treated with paint within 20 minutes of pruning, wounding or injury.

610S.4.H.4 (b) Disposal Policy

Add the following:

Burning diseased wood must occur on-site, if outside the City Limits.

610S.4.H.4 (c) Disposal Policy

Replace with the following:

Logs from diseased Red Oaks, that are not chipped, shredded, or burned shall wrapped immediately in clear plastic to be disposed of at a landfill.

610S.5 Measurement

Modify the first sentence of the first paragraph as indicated below:

Delete: Tree and shrub pruning, fencing, drains, fertilization, etc. will not be measured for payment unless included as a contract pay item.

Replace With: Tree and shrub pruning, fencing, drains, integrated pest management, watering, soil aeration treatment, fertilization, etc. will not be measured for payment unless included as a contract pay item.

Item No. 648S Mulch Sock

648S.4 Installation

Delete all sub-sections and replace with the following:
Install mulch socks per COSM Detail 648S-1-SM.

Install the mulch socks per the size specified. If a size is not specified, a 12" mulch sock shall be used.

648S.6 Payment

Add the following:
If a size is not specified, a 12" mulch sock shall be used.

Pay Item No. 648S-6:	Mulch Sock, 6" Dia	Per Lineal Foot.
Pay Item No. 648S-8:	Mulch Sock, 8" Dia	Per Lineal Foot.
Pay Item No. 648S-12:	Mulch Sock, 12" Dia	Per Lineal Foot.
Pay Item No. 648S-18:	Mulch Sock, 18" Dia	Per Lineal Foot.

Item No. 700S Mobilization

700S.3 Payment

Modify the fourth sentence of the first paragraph as indicated below:
Delete:

"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. 700STM), 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.

ITEM NO. 639S
ROCK BERM

639S.1 Description

This item shall govern the construction of a temporary berm of open graded rock that is installed at the toe of a slope on the perimeter of a developing area. Rock berms are appropriate for use as flow diverters, energy dissipators, grade control, and level spreaders to release the water in sheet flow (Environmental Criteria Manual Section 1.4.5.E). This item shall also govern the removal of the "Rock Berm" and re-vegetation of the area.

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

639S.2 Submittals

The submittal requirements for this specification item shall include:

A. Function (flow diversion, grade control, energy dissipator, level spreader, or other) and dimensions of the rock berm

B. Source, type and gradation of rock

C. Re-vegetation program, including:

1. Identification of the type, source, mixture, Pure Live Seed (PLS) and rate of application of the seeding.
2. Type of mulch.
3. Type of tacking agent.
4. Type and rate of application of fertilizer.

639S.3 Design Criteria

A detailed design is not required for the installation of a rock berm; however, the following criteria shall be observed:

Drainage area	less than 5 acres (2 hectares).
Height	18 inches (450 mm) minimum height, measured vertically from the top of the existing ground at the upslope toe to the top of the berm.
Top width	2 feet (0.6 meter) minimum.
Side slopes	2:1 or flatter.
Grade	Berms will be built along a contour as near possible to a 0 percent grade.

639S.4 Materials

Surplus rock excavated from utility trenches or from other excavations may be used in construction of these berms. In general, the rocks shall be sound with a minimum of 3 inches (75 mm) in smallest dimension and shall weigh between 10 and 30 pounds (4.5 to 13.6 kilograms) each. Seeding for re-vegetation shall conform to Item No. 604S, "Seeding for Erosion Control".

Use only open-graded rock of the size indicated on Standard Detail No. 639S-1, with most of the fines removed.

639S.5 Construction Methods

All trees, brush, stumps and objectionable material shall be removed and disposed in a manner that will not interfere with the construction of the berm.

A trench shall be excavated to a minimum depth of 4 inches (100 mm) below existing grade for placement of the rock as indicated on Standard Detail No. 639S-1 and the Drawings. The rocks shall be placed in interlocking layers with close joints starting at the base. Open joints shall be filled with rock-spalled materials as required to stabilize the berm.

The area upstream from the rock berm shall be maintained in a condition, which will allow sediment to be removed following the runoff from a rainfall event. After each rainfall event with an accumulation of 1 inch (25 mm) or more, an inspection of the rock berm will be made by the Contractor and the stone shall be replaced, when the structure ceases to function as intended because of sediment accumulation among the rocks, washout, construction traffic damage, etc.

If the sediment reaches a depth equal to 1/3 the height of the berm or 6 inches (150 mm), whichever is less, the Contractor will remove the accumulated sediment and dispose of it at an approved disposal site in a manner that will not contribute to additional sedimentation. The berm will be reshaped as needed during construction.

When the site is completely stabilized, the berm will be removed and disposed of in a manner approved by the Engineer or designated representative.

The area will be re-vegetated as required by Item No. 604S, "Seeding for Erosion Control".

639S.6 Measurement

Acceptable work performed and prescribed in this item will be measured by the linear foot (lineal meter: 1 lineal meter equals 3.281 lineal feet) along the centerline of top of berm.

639S.7 Payment

The work performed and material furnished and measured as provided under "Measurement" to construct this item will be paid for at the unit bid price per linear foot of rock berm barrier as indicated on the Drawings. The Unit Bid Price shall include full compensation for:

(a) furnishing, hauling and placing all materials including all labor, tools, equipment and incidentals needed to complete the work,
(b) maintaining the berm,
(c) removing sediment accumulations,
(d) rock replacement,
(e) removing and disposing of all materials when the berm is no longer required and
(f) re-vegetating the site upon removal of the berm.

Payment will be made under:

Pay Item No. 639S: Rock Berm Per Lineal Foot.

End

Item No. 641S
Stabilized Construction Entrance

641S.1 Description

This item governs the construction of a stabilized pad of crushed stone located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk or parking area. The removal of the stabilized pad of crushed stone shall also be included in the item. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking or deposition of sediment onto public right of way (Environmental Criteria Manual Section 1.4.2.N.4).

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

641S.2 Submittals

The submittal requirements for this specification item shall include:

A. Source, type and gradation of rock

B. Drainage technique (i.e. drainage swale or entrance grading) proposed to prevent runoff from exiting the construction site.

641S.3 Materials

Aggregate for construction shall conform to the following gradation:

Table 1: Aggregate Gradation Chart (TEX 401-A, % Retained per sieve)	
US 5 inch (SI 125 mm)	US 3 inch (SI 75 mm)
0	100

641S.4 Construction Methods

All trees, brush, stumps, obstructions and other objectionable material shall be removed and disposed of in a manner that will not interfere with the excavation and construction of the entrance as indicated on the Drawings or as presented in Standard Details No. 641S-1. The entrance shall not drain onto the public right of way or shall not allow surface water runoff to exit the construction site.

When necessary, vehicle wheels shall be cleaned to remove sediment prior to entrance onto public right of way. When vehicle washing is required, it shall be done on an area stabilized with crushed stone, which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, boards, silt fence (Standard Specification Item No 642S) or other methods approved by the Engineer or designated representative.

The entrance shall be maintained in a condition that will prevent tracking or disposition of sediment onto public right of way. This restriction may require periodic top dressing with additional stone as conditions demand, as well as the repair and/or cleanout of any measures used to trap sediment. All sediment that is spilled, dropped, washed or tracked onto public right of way must be removed immediately.

641S.5 Measurement

Acceptable work performed as prescribed in this item will be measured by unit of each stabilized construction entrance installed.

641S.6 Payment

The work performed and materials furnished and measured as provided under "Measurement" will be paid for at the unit bid price per lineal foot of "Stabilized Construction Entrance". The price shall include full compensation for furnishing, hauling and placing all materials, labor, tools, equipment and incidentals necessary to complete the work including inspecting, repairing, replacing and relocating existing fencing, removal of silt and removal and disposal of all materials at the completion of construction.

Payment, when included as a contract pay item, will be made under:

Pay Item No. 641S: Stabilized Construction Entrance Per Each.

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification 641S, "Stabilized Construction Entrance (SCE)"

City of Austin Environmental Criteria Manual

Designation	Description
Section 1.4.2.N.4	Stabilized Construction Entrance "Design Criteria"

City of Austin Standard Details

Designation	Description
Number 641S-1	Stabilized Construction Entrance

City of Austin Standard Specifications

Designation	Description
Item No. 642S	Silt Fence (SF)

RELATED CROSS REFERENCE MATERIALS

City of Austin Environmental Criteria Manual

Designation	Description
Section 1.4.2.J	Sandbag Berm
Figure 1-11	Sand Bag Berm
Section 1.4.2.G	Silt Fence

City of Austin Standard Specifications

Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 401S	Structural Excavation and Backfill
Item No. 610S	Preservation of Trees and Other Vegetation

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

Designation	Description
Item No. 100	Preparing Right of Way

Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 168	Vegetative Watering

Item No. 628S
Sediment Containment Dikes

628S.1 Description

This item shall govern the provision and placement of temporary filtration dikes along or across such areas as indicated on the Drawings. This method shall be used during construction only and its purpose shall be to temporarily control erosion by intercepting and retaining sediment.

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

628S.2 Submittals

The submittal requirements for this specification item shall include:

A. Locations and Types of containment dikes (hay Bales, Triangular Sediment Filter Dike or Filter Curb Inlet Protection).

B. Seeding

1. Identification of the type, source, mixture, pure live seed (PLS) and rate of application of the seeding.
2. Type of mulch.
3. Type of tacking agent.
4. Type and rate of application of fertilizer.

628S.3 Materials

A. Hay Bales

"Hay Bales" shall be free of Johnson Grass or other nocuous weeds. The bales shall consist of either hay or straw in good condition and be securely tied with wire. Stakes for anchoring bales shall be #4 (10M) reinforcing bars, 1/2 inch (12.5 mm) steel pickets, or 2 x 2 inch (50 x 50 mm) wooden stakes. Hay bales shall be limited to drainage areas less than 2,500 square feet (0.02 hectares).

B. Filter Dike

"Filter Dike" shall be prefabricated from 6x6-D2.9xD2.9 (150x150-MW19xMW19) WWF and 4.5 oz. (127 grams) non-woven polyester filter fabric securely fastened to WWF with galvanized shoat rings or j-clips. A 12-inch (300-mm) skirt shall be a continuous extension of the filter fabric on the upstream face.

The filter fabric shall extend beyond the dike joints to provide a 3-inch (75-mm) overlap. Ends of dike not lapped with filter fabric shall be plugged with filter fabric.

C. Filter Curb Inlet Protection

The fabric must correspond to the following requirements:

ASTM

Property	Test method	Requirements
Fabric Weight	D 3776	≥3.0 ounces/square yard
Ultraviolet (UV) Radiation Stability retained min., after 500 hours in xenon arc device	D 4355	70% strength
Mullen Burst Strength	D 3786	≥120 pound per square inch
Water Flow Rate	D 4491	≥275 gallons/minute/square feet

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, 628S-1 and 628S-2.

Bales shall be placed with ends tightly abutting the adjacent bales. Each bale shall be embedded in the soil a minimum of 4 inches (100 mm) and a maximum of 6 inches (150 mm). Bales shall be securely anchored in place by a minimum of 2 stakes per bale. The first stake in each bale shall be angled toward the previously placed bale to force the bales together. Stakes shall be embedded in the soil a minimum of 1 1/2 feet (0.45 meters). Bales that are not able to be imbedded and are place on impervious cover should be placed level with the concrete and have all bales butted end to end with no voids or gaps between them. Bales shall be bound by either wire or nylon string. Bales shall be replaced every 2 months or more often during wet periods.

For filter dikes, the filters shall be placed with ends tightly abutting the adjacent filter. Each filter and skirt shall be securely anchored in place using 6 inch (150 mm) staples at a maximum spacing of 12 inches (300 mm) on center. Anchoring on impervious areas shall be accomplished with gravel bags placed at 18 inches (450 mm) on center or with a nominal 1 inch by 4 inch (25 mm by 100 mm) board nailed at 18 inches (450 mm) on center.

For curb inlet protection, the fabric/wire should completely cover the opening of the inlet and devices should be installed without protruding parts that could be a traffic, worker, or pedestrian hazard. Where sections of the fabric overlap, they shall overlap at least three (3) inches. The inlet filter shall be attached in a way that they can easily be removed and are not secured or attached by the use of sand bags.

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. Silt accumulation behind filter dikes for curb inlet protection shall be removed at a maximum depth of 2 inches (50 mm).

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.

The work and materials prescribed for curb Inlet protection (Standard Detail 628S-2, "Filter Curb Inlet Protection") shall be included in the unit price bid for the item of construction in which this activity is used, unless Pay Item No. 628S-C is indicated on the Drawings and identified in Standard Contract Bid Form 00300U.

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.
Pay Item No. 628S-C:	Filter Curb Inlet Protection (New Inlet)	Per each.
Pay Item No. 628S-D:	Filter Curb Inlet Protection (Existing Inlet)	Per each.

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification 628S, "Sediment Containment Dike"

City of Austin Standard Details

Designation	Description
Number 628S	Triangular Sediment Filter Dike
Number 628S-1	Hay Bale Dike
Number 628S-2	Filter Curb Inlet Protection

City of Austin Standard Specifications

Designation	Description
Item No. 604S	Seeding for Erosion Control

City of Austin Standard Contract

Section	Description
00300U	Bid Form (Unit Prices)

RELATED CROSS REFERENCE MATERIALS
Specification 628S, "Sediment Containment Dike"

City of Austin Standard Specifications

Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 111S	Excavation
Item No. 120S	*Channel Excavation*
Item No. 401S	Structural Excavation and Backfill
Item No. 406S	Reinforcing Steel
Item No. 602S	Sodding for Erosion Control
Item No. 605S	Soil Retention Blanket
Item No. 606S	Fertilizer
Item No. 608S	Planting
Item No. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric

RELATED CROSS REFERENCE MATERIALS (Continued)
Specification 628S, "Sediment Containment Dike"

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

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work
Item No. 166	Fertilizer
Item No. 168	Vegetative Watering
Item No. 169	Soil Retention Blanket
Item No. 204	Sprinkling

SS.900 Special Specifications

SS901 Required Construction Equipment

Description

Industry standard trackhoe with hydraulic thumb, of sufficient specification, condition, and design, as required to perform the work.

Methods and Materials

The Contractor is required to install in-stream structures using a trackhoe with a hydraulic thumb of sufficient specification, condition, and design, to move specified boulders, stone, logs, wood mats, and other required construction materials.

Method of Measurement and Payment

Required Construction Equipment: **Incidental to Mobilization and Demobilization**

SS902 Coir Fiber Matting

Description

Coir fiber matting will consist of C-7 or comparable coir fiber matting to be installed in locations and as specified on the construction plans. Locations will primarily be on newly restored streambanks. Other areas may also require the installation of coir fiber matting as shown on the construction plans or as directed by the Engineer. Both netting and thread material must be biodegradable.

Methods and Materials

Coir Fiber Matting - The coir fiber matting shall be a machine-produced mat or erosion control blanket of 100% coconut fiber intended for use as a channel lining with the following specifications and properties:

Matrix	100% Coconut Fiber (w/ biodegradable netting and thread)
Weight	20 oz/SY (678 gm/m2)
Open Area (measured)	50%
Max Flow Velocity	11.0 ft/sec (3.35 m/s)
Functional Longevity	24 Months
Size	6.67 x 164 ft (120 SY) or (100 SM)
"C" Factor	0.002

Property	Test Method	Typical
Thickness	ASTM D5199	0.28 in. (7.11 mm)
Resiliency	ECTC Guidelines	85%
Mass per Unit Area	ASTM D5261	10.72 oz/yd2 (360 g/m2)
Water Absorption	ASTM D1117/ECTC	155%
Swell	ECTC Guidelines	40%
Stiffness/Flexibility	ASTM D1388	0.11 oz-in (1,218 mg-cm)
Light Penetration	ECTC Guidelines	16.40%
Smolder Resistance	ECTC Guidelines	Yes
MD Tensile Strength	ASTM D6818	342.0 lbs/ft (4.98 kN/m)
MD Elongation	ASTM D6818	7.60%
TD Tensile Strength	ASTM D6818	211.00 lbs/ft (3.08 kN/m)
TD Elongation	ASTM D6818	11.10%

Small Anchors - Small anchors shall be made from hardwood and not less than 12 inches in length with a notch cut 1 inch from the top. These stakes shall be used to stake and secure the coir fiber matting to the underlying restored soil surface and shall be installed on a spacing approximately one (1) foot apart across the entire surface of the coir fiber matting.

Large Anchors - Large anchors shall be made from hardwood and shall have a minimum 1.5-inch by 1.5-inch cross-section, shall taper to a point, and shall be a minimum length of two (2) feet. The large anchors shall have a 2.5 inch galvanized roofing nail driven horizontally and perpendicularly through the square end of the stake so that 0.5 inches of nail is extruding from both sides of the stake. The nail is to be installed in the large stakes so the coir fiber matting will not slide past the exposed end of the stake once installed. Large anchors shall be used to secure the coir fiber matting at the toe of slope, along all matting seams, and in the center of the coir fiber matting, and shall be spaced a minimum of 36 inches apart.

Prior to beginning of coir fiber matting installation, complete finished grading activities in area to receive matting installation in order to provide a smooth soil surface free from stones, clods, or debris that will prevent the contact of the coir fiber matting with the underlying soil. Install coir fiber matting immediately upon final grading. Take care to preserve the required line, grade, and cross section of the area to receive coir fiber matting. Apply all soil amendments, fertilizer, temporary and permanent seed, and mulch immediately prior to installing coir fiber matting. Refer to City of San Marcos Standard Specification Items No. 609S – Native Grassland Seeding and Planting for Erosion Control and No. 601S.3(A) – Topsoil for soil preparation and standards.

Unroll the coir fiber matting onto the prepared soil surface without stretching the coir fiber matting such that the matting will lie smoothly but loosely on the entire soil surface. Excavate a narrow trench a minimum of 6 inches deep along the upper edge of the coir fiber matting to bury, stake, and secure the upper edge of the coir fiber matting. Use small anchors to secure the outer edges of the coir fiber matting in the trench at a maximum spacing of 24 inches apart prior to backfilling over the coir fiber matting. Bury and tamp the trench fill firmly over the installed and staked coir fiber matting edge. Where one roll of coir fiber matting ends and a second roll begins, overlap the end of the upper roll over the buried end of the second roll so there is an overlap of at least 6 inches. Construct check trenches at least 12 inches deep every 50 feet longitudinally along the edges of the coir fiber matting, or as directed by the Engineer. Fold over and bury the coir fiber matting to the full depth of the trench, close and tamp firmly. Overlap coir fiber matting edges at least 6 inches where 2 or more widths of matting are installed side by side.

Install large anchors at a maximum of 36 inches apart along the toe and down the center of each length of coir fiber matting. Install large anchors across the coir fiber matting at matting ends, junctions, and check trenches approximately 1 foot apart.

Install large anchors at a maximum of 3 feet apart along all lapped edges or seams of the coir fiber matting.

Install small anchors at a maximum spacing of 12 inches over the entire surface of the coir fiber matting. Use small anchors to secure the outer edges of the coir fiber matting in the trenches at a maximum spacing of 24 inches apart prior to burying and tamping the trench fill over the install coir fiber matting.

When planting is to occur in coir fiber matting locations, stretch the matting by hand to plant through the matting. If the plant is too big to be placed through the matting, hand cut the matting to the minimum extent to be able to plant through the matting. Only enough of the matting may be cut to properly plant vegetation.

The Engineer may require adjustments to the coir fiber matting trenching and/or staking requirements to fit individual site conditions.

Method of Measurement and Payment

Coir Fiber Matting: **Square Yard (SY)**

Small Anchors: **Incidental to Coir Fiber Matting (Incidental)**

Large Anchors: **Incidental to Coir Fiber Matting (Incidental)**

SS903 In-Stream Structures

Description

The work shall consist of constructing and installing permanent structural measures, constructed primarily of natural stone materials, to stabilize the project stream channel systems, including streambed, streambanks, and floodplain, and to improve aquatic habitats and bedform diversity. In-stream structures include rock cross vanes and constructed riffles. The quantity of in-stream structures to be constructed will be affected by actual conditions that occur during the construction of the project. The type and quantity of structures may be increased or decreased at the direction of the Engineer. Such variations in

Item No. 591S
Riprap for Slope Protection

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.

* See Modifications for additional information

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 Product 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.

* See Modifications for additional information

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 visual inspection and 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

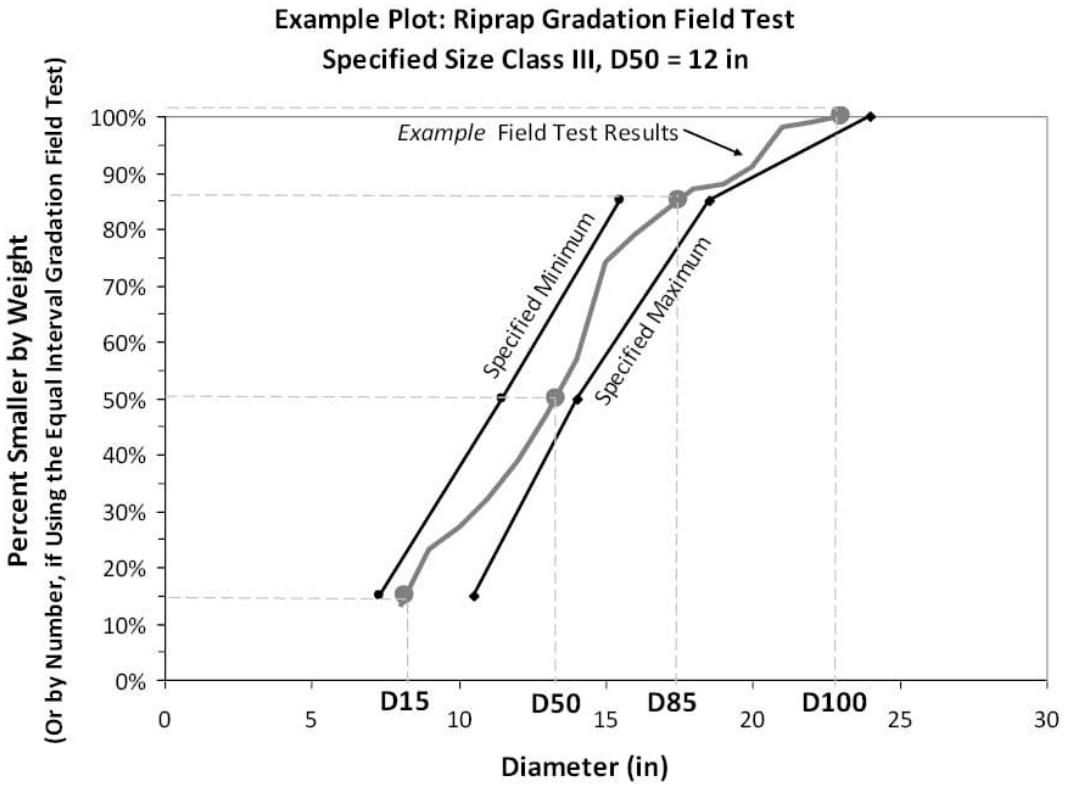
1. Reference: NCHRP Report 568
2. Conversion to weight-based gradation: $W = 0.0275D^3Sg$ where W is rock size in lbs, D is diameter in inches and Sg is the specific gravity of the rock.

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 meting 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 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 large 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 rip-rap 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.5, "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 rip-rap, soil shall be integrated with the rock rip-rap 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 rip-rap 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 rip-rap top surface shall be topsoil material as described in Item No, 601S Salvaging and Placing Topsoil, Section 3.

K. For vegetated soil-rock rip-rap, 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 rip-rap, soil retention blanket shall be a TxDoT approved Class I 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.

* See Modifications for additional information on new sections

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 Contractor's property and 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 maximum stone size (D100) or 1.5 times the D50, which ever 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.

B. Vegetated Soil-Rock Riprap

Adjacent stockpiles of rock riprap, fill soil, and topsoil shall be treated and there shall be no premixing of fill soil, top soil 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 of 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 (± 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.

C. Concrete Riprap * See Modifications for additional information

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 x 6 W1.4 x W1.4 (150 x 150 MW9 x 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".

D. 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

* See Modifications for additional information

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

* See Modifications for additional information

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.

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End

SPECIFIC CROSS REFERENCE MATERIALS
Specification 591S, “Riprap for Slope Protection"

International Fire Code

Designation	Description
Chapter 27	Hazardous Materials
Chapter 33	Explosives and Fireworks

City of Austin Standard Contract Documents

Designation	Description
01550	Public Safety and Convenience

City of Austin Standard Specifications

Designation	Description
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. 610S	Preservation of Trees and Other Vegetation
Item No. 620S	Filter Fabric

American Society for Testing and Materials, ASTM

Designation	Description
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 Method 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

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
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

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

Designation	Description
Item No. 432	Riprap

RELATED CROSS REFERENCE MATERIALS
Specification 591S, “Riprap for Slope Protection"

City of Austin Standard Specifications

Designation	Description
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.

Specification Item No. 594S
Gabions and Revet Mattresses

594S.1 Description

The work to be performed under this specification shall include furnishing, assembling, filling, and tying rock-filled wire mesh compartmented gabions and revet mattresses in accordance with the lines, grades, and dimensions shown on the Drawings or otherwise established in the field by the Engineer or designated representative. The type of construction (i.e. twisted woven mesh, welded mesh or both) and wire sizes [i.e. 13.5 gage (2.2 mm), 12 gage (2.7 mm) or 10 gage (3.4 mm)] shall be as defined in the Drawings or otherwise 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.

594S.2 Materials

Gabions and revet mattresses shall be constructed of galvanized steel wire with polyvinyl-chloride (PVC) flexible coating. The gabions and revet mattresses shall be of the construction and sizes specified in the Drawings and shall meet the specifications presented herein. Unless otherwise specified in the Drawings or approved by the Engineer or designated representative, the gabions and revet mattresses may be constructed of either double twist woven mesh or welded wire mesh.

Gabions shall be furnished in the specified dimensions within a tolerance of ± 5 percent. Revet mattresses shall be furnished in the specified dimensions within a tolerance of ± 5 percent for the length and width and ± 10 percent for the height. For each individual gabion or revet mattress, the same mesh style shall be used for the base, front, ends, back, diaphragms and lid panels. Each gabion or revet mattress shall be manufactured and divided into cells of equal length, no greater than 3 feet (0.9 meter), by diaphragm panels.

(1) Gabion and Revet Mattress Wire

Gabion wire shall be galvanized steel, Class 3 or A coating, soft temper conforming to ASTM A 641, and shall specifically meet the requirements given below for gabions (12 gage wire) and/or revet mattresses (13.5 wire gage) as called for in the Drawings. PVC coating of the wire may be fuse-bonded or extruded onto the wire. Galvanization of welded wire shall be performed either before or after welding.

Table 1: Requirements – Mesh Wire for Gabions and Revet Mattress Units

Characteristic	Gabions	Revet Mattresses
Wire Gage	12 gage	13.5 gage
Maximum Tensile Strength (ASTM 641)	70,000 psi (483 mPa)	75,000 psi (517 mPa)
Nominal Wire Diameter (ASTM A 641)	0.106 inch (2.7 mm)	0.0866 inch (2.2 mm)
Minimum Diameter (ASTM A 641, Table 3)	0.102 inch (2.6 mm)	0.0826 inch (2.9 mm)
Galvanizing, Zinc (ASTM A 641, Table 1)	0.80 oz/ft^2 (245 gr/m^2)	0.70 oz/ft^2 (215 gr/m^2)

(2) Gabion Mesh

(A) Woven Mesh

Woven mesh shall be of a uniform non-raveling, double twist hexagonal pattern nominally of dimensions 3.25 inches by 4.5 inches (83 mm by 114 mm). Selvedge wire shall be 10 gage (nominal diameter of 3.4 mm).

(B) Welded Mesh

Mesh opening shall be nominally 3 inches by 3 inches (75 mm by 75 mm). Strength of welds shall meet the following requirements when tested in accordance with section 13.4 of ASTM A-974:

Table 2: Minimum Weld Strength Requirements

Type of Structure	Wire Size (Diameter) Gage (mm)	Minimum Average Weld Shear Strength English Units (SI Units)
Gabions	12 (2.7)	472 lbf (2.10 kN)
Revet Mattress	13.5 (2.2)	292 lbf (1.30 kN)

(C) Manufacturing

Twisted wire mesh gabions shall be manufactured in conformance with ASTM A-975, while welded wire mesh gabions shall be manufactured in conformance with ASTM A-974.

(3) Revet Mattresses

(A) Woven Mesh

Woven mesh shall be of a uniform non-raveling, double twist hexagonal pattern, nominally of dimensions 2.5" x 3.25" (64 mm by 83 mm). Selvedge wire shall be 12 gage (nominal diameter of 2.7 mm).

(B) Welded Mesh

Mesh opening shall be nominally 1.5" x 3.0" (38 mm by 76 mm). Strength of welds shall meet the requirements listed in Table 2 for 13.5 gage (2.2 mm) wire, when tested in accordance with section 13.4 of ASTM A-974:

(C) Manufacturing

Twisted wire mesh revet mattresses shall be manufactured in conformance with ASTM A-975, while welded wire mesh revet mattresses shall be manufactured in conformance with ASTM A-974.

(4) PVC Coating

All wire used in fabrication of the gabions, revet mattresses and wiring operations during construction shall, after zinc coating, have a fuse-bonded or extruded coating of PVC. The coating shall be gray in color. The thickness shall be nominally 0.020 inch (0.5 mm), and shall not be less than 0.015 inch (0.38 mm) in thickness. It shall be capable of resisting deleterious effects of natural weather exposure, and immersion in salt water.

For PVC-coated welded wire fabric panel, cutting of the panels shall not be allowed closer than 1/4 inch ± 1/8 inch (6 mm ± 3.18 mm) after fabrication in order to prevent exposure near the welds.

(A) Initial Properties:

1) Woven Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-975:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.3 to 1.35.

b) Durometer Hardness:

The hardness as determined in accordance with ASTM D-2240 shall be between 50 to 60, Shore D.

c) Tensile Strength:

The tensile strength when tested in accordance with ASTM D-412 shall not be less than 2985 psi (20.6 mPa).

d) Modulus of Elasticity at 100% Elongation:

The Modulus of Elasticity when determined in accordance with ASTM D-412 shall not be less than 2700 psi (18.6 mPa).

e) Resistance to Abrasion:

The percentage loss in weight (mass) during abrasion testing in accordance with ASTM D-1242 shall be less than 12%.

f) Brittleness Temperature:

The brittleness temperature shall not be higher than 15^0F (–9.0^0C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 15^0F (8^0C) below the minimum temperature at which the gabion will be handled or filled.

2) Welded Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-974:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.20 and 1.40.

b) Durometer Hardness:
The hardness as determined in accordance with ASTM D-2240 shall not be less than 75, Shore A.

c) Tensile Strength:
The tensile strength when tested in accordance with ASTM D-638 shall not be less than 2275 psi (15.7 mPa).

d) Modulus of Elasticity:

The Modulus of Elasticity when determined in accordance with ASTM D-638 shall not be less than 1980 psi (13.7 mPa).

e) Resistance to Abrasion:

The percentage loss in weight (mass) shall be less than 12 % during abrasion testing in accordance with ASTM D-1242, Method B, at 200 cycles, CSI-A abrader tape, 80 grit.

f) Brittleness Temperature:

The brittleness temperature shall not be higher than 15^0F (-9.0^0C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 15^0F (8^0C) below the minimum temperature at which the gabion will be handled or filled.

g) Adhesion:

The PVC coating on the wire shall adhere to the wire such that the coating breaks rather than separates from the wire, when tested in accordance with the PVC Adhesion Test described in Section 13.3 of ASTM A-974.

h) Mandrel Bend:

The PVC-coated wire, when subjected to a single 360^0 bend at 0^0F (-18^0C) around a mandrel ten times the diameter of the wire, shall not exhibit breaks or cracks in the PVC coating.

(B) Performance Tests:

The PVC coating shall have the demonstrated ability to withstand the specified exposure testing.

1) Exposure to Salt Spray: The PVC shall show no effect after 3000 hours of salt spray exposure in accordance with ASTM Test Method B-117.

2) Exposure to Ultraviolet Rays: The PVC shall show no effect of exposure to ultraviolet light with test exposure of 3000 hours, using apparatus Type E and 145°F (63°C), when tested in accordance with ASTM Practice D-1499 and G-23.

(C) Properties After Exposure Tests:

After conclusion of the salt spay and exposure to ultraviolet light tests, the PVC shall not show cracks, blisters or splits, nor any noticeable change in color. In addition the PVC coating shall not show cracks or breaks after the wires are twisted in the fabrication of the mesh, nor shall there be any moisture intrusion under the PVC coating as a result of the test.

After completion of the exposure tests the following criteria shall also be met:

1) Woven Mesh:

a) The Specific Gravity shall not change more than 6% of its initial value.

b) The Durometer Hardness shall not change more than 10% of its initial value.

c) The Tensile Strength shall not change more than 25% of its initial value.

d) The Resistance to Abrasion shall not change more than 10% of its initial value.

2) Welded Mesh:

a) The Specific Gravity shall not change more than 6% of its initial value.

b) The Modulus of Elasticity shall not change more than 25% of its initial value.

c) The Tensile Strength shall not change more than 25% of its initial value.

d) The Resistance to Abrasion shall not change more than 10% of its initial value.

(D) Salt Spray Resistance for Fastener:

The fasteners for twisted mesh wire gabions and revet mattresses shall be subjected to Salt Spray Test of Test Method B-117 for a period of not less than 48 ± 1 hour cycle length. After testing the fasteners, the selvedge, or mesh wire confined by the fasteners shall show no rusty spots on any part of the surface excluding the cut ends.

(5) Stone

(A) Gabion Basket Stones

Stone fill shall be durable and of suitable quality to ensure permanence in the structure. The stone used to fill the gabion baskets shall be a clean, sound, and durable rock meeting the following requirements. It shall have a wearing loss less than 35 percent when the stone is tested with the Los Angeles Abrasion Machine in accordance with ASTM Test Method C535 (TxDOT Test Method Tex-410-A). The loss of material experienced during five cycles of magnesium sulfate exposure conducted in accordance with TxDOT Test Method Tex-411-A for Rock RipRap shall not exceed 18 percent. The stone shall be well graded to produce a dense fill, angular in texture, while meeting the following gradation requirements:

Table 3: Gabion Stone Gradation Requirements

Sieve Size US	(SI)	Percent by Weight (Mass) % Passing Each Individual Sieve
8 Inch	(200 mm)	100
4 Inch	(100 mm)	0 - 5
3 Inch	(75 mm)	0

The minimum unit weight (unit mass) of a rock-filled gabion shall be 120 pcf [1.92 megagrams (mg) per cubic meter]. Verification of unit weight (mass) shall be performed when ordered by the Engineer, by constructing a test gabion with materials supplied for construction with the same effort and method intended for production gabions.

(B) Revet Mattress Stone:

The stone used to fill the revet mattresses shall be as specified for gabions except that it shall have a maximum dimension of 5 inches (125mm) and a minimum dimension of 3 inches (75 mm). The majority of the stone shall be in the 3 to 4 inch (75 to 100 mm) range; cubical or rounded in shape. A tolerance of 5% shall be allowed on the upper and lower dimensions of the rock.

(6) Connections

(A) Wire

Lacing wire and connecting wire shall be 13.5 gage [0.087 inch (2.20 mm)] PVC coated galvanized steel, Class 3, soft temper, conforming to ASTM A-641. During

testing, any separation of 2 inches (50 mm) or more between connecting wires shall be considered as a failure.

(B) Spiral Binder for Welded Wire Mesh

Spiral binders shall consist of 0.106 inch (2.7 mm) PVC coated wire for the gabion and 0.087 inch (2.2 mm) PVC coated wire for the revet mattresses. Spiral binders shall have a 3.0 inch (75 mm) maximum separation between continuous successive loops (3 inch or 75mm pitch).

The binder shall be made of galvanized steel, Class 3, soft temper, conforming to ASTM A-641.

(C) Alternate Fasteners for Twisted Woven Mesh

Alternate fasteners, acceptable for use by the intended gabion basket manufacturer, may be submitted to the Engineer for consideration and approval prior to construction. The fasteners may consist of split ring or interlocking fasteners. Alternate fasteners systems shall produce a joint that meets the requirements of ASTM A-975, Section 7, Table 2.

(7) Fastener System

The Contractor shall provide a complete description of the fastener system, including the number of fasteners required for all vertical and horizontal connections for single- and multiple-basket joinings, as well as the number and size wires the fastener is capable of properly joining. The Contractor shall provide a description of a properly installed fastener, including test reports, drawings and/or photographs. Properly formed fasteners shall meet the requirements of ASTM A-974 for welded wire mesh or ASTM A-975 for twisted woven mesh.

(A) Each interlocking fastener shall be locked and closed.

(B) Each overlapping ring fastener shall be closed and the free ends shall overlap an average of 1 inch (25 mm).

(C) Spiral binders shall be screwed into position such that they pass through each mesh opening along the joint. In order to prevent unraveling, both ends of the spiral shall be crimped back around itself.

(D) Wire fasteners shall not be used to join more wires, or larger wires, than tested and approved for the application.

(8) Panel to Panel Joint Strength

The minimum strength of the joined panels shall be as specified in Section 7.3 of ASTM A-974 for Welded wire panels or Section 7.3 of ASTM A-975 for twisted woven mesh.

(9) Miscellaneous

Aggregate bedding, geotextiles or other materials shall conform to the requirements established on the Drawings.

(10) Certificate of Compliance

The Contractor shall submit Certificates of Compliance for all materials proposed for use to the Engineer for review and approval one week prior to construction.

594S.3 Construction

Twisted wire mesh Gabon's and revote mattresses shall be supplied in the forms allowed in ASTM A-975, while welded wire mesh Gabon's and revote mattresses shall be supplied in a form allowed in ASTM A-974.

The Gabon/revote mattress manufacturer/supplier will be required to have a qualified representative on site at the start of gabion/revet mattress construction. The Contractor shall submit work experience documentation of the representative for review/approval by the Engineer or designated representative. The representative shall be available for consultation as needed throughout the gabion construction.

Gabions and revet mattresses shall be constructed to the lines and grades shown on the Drawings. Individual or groups of gabions or revet mattresses, which deviate from line and grade, shall, at the direction of the Engineer or designated representative, be removed and replaced at no cost to the owner. Gabions or revet mattresses, which are constructed with bulges, and/or underfilled, loosely filled, or otherwise lacking a neat and compact appearance shall, at the direction of the Engineer or designated representative, be repaired/replaced at no cost to the owner. Underfilling of gabion/revet mattress corners to facilitate insertion of spirals shall not be permitted.

(1) Foundation Preparation

The foundation shall be excavated to the extent shown on the Drawings or as directed by the Engineer or designated representative. All loose or otherwise unsuitable materials shall be removed. All depressions shall be carefully backfilled to grade. The depressions shall be backfilled with suitable materials from adjacent required excavation, or other approved source, and compacted to a density at least equal to that of the adjacent foundation. If pervious materials are encountered in the foundation depressions, the areas shall be backfilled with free draining materials.

Any buried debris protruding from the foundation that will impede the proper installation and detrimentally impact the final appearance of the gabion, shall also be removed, and the voids carefully backfilled and compacted as specified above. Immediately prior to gabion or revet mattress placement, the prepared foundation surface shall be inspected and approved by the Engineer and no material shall be placed thereon until that area has been approved.

Placement of filter material and/or filter fabric shall be as shown on the Drawings or directed by the Engineer.

(2) Gabion/Revet Mattress Basket Assembly

No work shall take place using PVC coated materials unless both the ambient air temperature and the temperature of the PVC materials are at least 15°F (8^0C) above the brittleness temperature of the PVC materials.

Assembly of gabions and revet mattresses shall consist of shaping and tying each individual basket. Baskets shall be assembled by connecting all untied edges including diaphragms with lacing wire, spirals or approved fasteners. The connections for the completed assemblies shall conform to the requirements of Section 7 of ASTM specifications A-974 (welded wire) and Section 7.3 and Table 2 of A-975 (double twisted).

Assembly of baskets, connection of baskets together and lid closures shall be accomplished in accordance with one of the following approved procedures:

(A) Lacing Wire:

Using lacing wire of appropriate length, secure one end of the wire onto the basket corner by looping and twisting the lacing wire together. Proceed along the joint by tying with double loops every other mesh opening at intervals not more than 6 inches (150 mm) apart, while pulling the basket elements tightly together. Secure the other end of the lacing wire again by looping and twisting the wire around itself.

(B) Spiral Binders for Welded Wire Mesh:

Spiral binders, meeting the minimum acceptance criteria of article 594S.2 (6) c) shall be screwed into position such that they pass through each mesh opening along the joint. To prevent unraveling, each end of the spiral binder shall be crimped back against itself.

C) Alternate Fasteners for Twisted Woven Mesh:

Interlocking fasteners meeting the minimum acceptance criteria of article 594S.2 (6) c), shall be installed with, as a minimum, one interlocking fastener in every other opening.

Ring fasteners meeting the minimum acceptance criteria of 594S.2 (6)c), shall be installed with, as a minimum, one split ring fastener in every opening, having a minimum 1 inch (25 mm) total overlap and securing only the number and diameter of wires for which tested.

Placing of gabions and revet mattresses shall consist of installing baskets to the lines and grades shown on the Drawings. Gabions and revet mattresses shall be securely fastened to each adjoining unit along the vertical and top reinforced edges of all contact surfaces. Overlying rows of baskets shall be staggered appropriately. Empty sections stacked on a filled line of gabions and revet mattresses shall be securely fastened to the bottom unit along the front, back and ends.

Prior to the placement of rock, the baskets used in the front vertical exposed faces of retaining walls shall be aligned. To facilitate alignment, tension may be applied to empty units at the direction of the Engineer or designated representative.

(3) Filling of Gabions and Revet Mattresses

The gabions and revet mattresses may be filled by machine, in maximum lifts of 12 inches (300 mm). The machine work shall be supplemented with handwork to avoid bulges and provide a compact mass with a minimum of voids. Care will be exercised so as not to damage the gabion/revet mattress elements or wire coating by limiting height of drop during filling to 3.0 feet (0.9 meter) for Gabions and 1.5 feet (0.5 meter) for revet mattresses. Undue deformation or bulging of the mesh shall be corrected prior to further stone filling. Where specified on the Drawings, select large stone shall be hand placed on vertical outside faces to achieve a desired neat appearance.

During placement, the depth of stone in any cell shall not exceed the depth in an adjoining cell by more than one foot (300 mm). Stone smaller than the mesh opening found against vertical faces shall be removed.

Two connecting wires in each direction for end units and two parallel connecting wires perpendicular to the exposed face for exposed face units shall be installed at every 12 inch (300 mm) lift. The connecting wires shall loop around two mesh openings, and the ends of wires shall be securely twisted with a minimum of three twists after looping. Prefabricated connecting wire may be used in lieu of connecting wire.

Connecting wires associated with 18-inch (450 mm) gabions shall be installed when and as specified on the Drawings or as recommended by the gabion/revet mattress manufacturer.

The gabion or revet mattress unit shall be overfilled by 1 1/2 to 2 inches (37.5 to 50 mm) and the lid shall be bent and stretched until it meets the perimeter edges of the front and end panels. The stretching shall be accomplished using an approved lid closing tool in order to prevent damage to the PVC coating. Crow bars or similar single point leverage devices will not be allowed. The lid shall then be securely tied with lacing wire, spirals or approved fasteners to the fronts, ends and diaphragms. Excessive deformation of the lid panel to facilitate closing of a bulging gabion or revet mattress will not be permitted.

All backfill shall be placed and compacted in sequence with the filling of the baskets; however, care shall be exercised in compacting the fill behind a single row of baskets since excessive compaction effort can displace the gabions/revet mattresses from the desired alignment.

Gabion or revet mattress units may be cut or shaped to fit odd length or odd shaped areas. They shall be cut at least 6" to 8" (150 mm to 200 mm) larger than the opening to allow sufficient material for overlap and lacing. All edges or faces formed in this manner shall be adjusted to present a finished and pleasing appearance.

At all times, care shall be taken to turn all loose and projecting ends of wire into the gabion units to prevent injury.

594S.4 Workmanship

Wire of proper grade and quality, when fabricated and installed in the manner herein required, shall result in a strong, serviceable mesh-type product having substantially uniform openings. It shall be fabricated and finished in a workmanlike manner, as determined by visual inspection, and shall conform to this specification.

594S.5 Measurement

Measurement of acceptable "Gabions and Revet Mattresses", complete in place, will be made on the basis of volume determined by the actual length, width and height.

594S.6 Payment

The Gabion and revet mattress quantities, measured as described above, will be paid for at the unit bid prices per cubic yard (cubic meter: 1 cubic meter equals 1.308 cubic yards) of the various types indicated. The price shall include full compensation for furnishing, hauling and placing all materials, including filter fabric, wire containers, connectors, reinforcement stones and backfill; for all labor, tools, equipment and incidentals needed to complete the work.

Excavation and all subgrade preparation required for shaping the foundation for the wire containers shall be included in the unit bid price for "Gabions and Revet Mattresses".

Payment will be made under one of the following:

Pay Item No. 594S-A:	Gabions, Twisted Woven Wire ----------Per Cubic Yard.
Pay Item No. 594S-B:	Gabions, Welded Wire ---------- Per Cubic Yard.
Pay Item No. 594S-C:	Revet Mattresses, Twisted Woven Wire --- Per Cubic Yard.
Pay Item No. 594S-D:	Revet Mattresses, Welded Wire---------- Per Cubic Yard.

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification Item 594S, "GABIONS and REVET MATTRESSES"

City of Austin Environmental Criteria Manual

Designation	Description
Section 1.4.3.E	Permanent Structural Practices-Gabions
Figure 1.23	Gabions

City of Austin Standard Details

Designation	Description
594S-1	Gabions
594S-2	Gabion Details

American Society for Testing and Materials (ASTM)

Designation	Description
A-974	Standard Specifications for Welded Wire Fabric Gabions and Gabion Mattresses (Metallic-Coated or Polyvinyl Chloride (PVC) Coated)
A-975	Standard Specifications for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel with Poly (Vinyl Chloride)(PVC) Coating)

RELATED CROSS REFERENCE MATERIALS

City of Austin Technical Specifications

Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 120S	Channel Excavation
Item No. 130S	Borrow
Item No. 132S	Embankment
Item No. 220S	Sprinkling for Dust Control
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 236S	Proof Rolling
Item No. 510	Pipe
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. 606S	Fertilizer
Item No. 607S	Slope Stabilization
Item No. 608S	Planting

City of Austin Standard Details

Designation	Description
642S-1	Silt Fence

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
411-A	Soundness of Aggregate By Use of Sodium Sulfate or Magnesium Sulfate

RELATED CROSS REFERENCE MATERIALS - Contibued
Specification Item 594S, "GABIONS and REVET MATTRESSES"

American Society for Testing and Materials (ASTM)

Designation	Description
A-313	Standard Specification for Stainless Steel Spring Wire
A-370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
A-641	Specification for Zinc Coated (Galvanized) Carbon Steel Wire
A-853	Standard Specification for Steel Wire, Carbon, for General Use
B-117	Test Method of Salt Spray (Fog) Testing
C-535	Standard Test Method for Resistance of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
D-412	Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
D-638	Test Method for Tensile Properties of Plastics
D-746	Test Methods for Brittleness Temperature of Plastic and Elastomers by Impact
D-792	Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement
D-1203	Standard Test Methods for Volative Loss from Plastics Using Activated Carbon Methods
D-1242	Test Methods for Resistance of Plastics Materials to Abrasion
D-1499	Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics
D-2240	Test Method for Rubber Property-Durometer Hardness
D-2287	Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
G-23	Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Non-metallic Materials

Specification Item No. 594S
Gabions and Revet Mattresses

594S.1 Description

The work to be performed under this specification shall include furnishing, assembling, filling, and tying rock-filled wire mesh compartmented gabions and revet mattresses in accordance with the lines, grades, and dimensions shown on the Drawings or otherwise established in the field by the Engineer or designated representative. The type of construction (i.e. twisted woven mesh, welded mesh or both) and wire sizes [i.e. 13.5 gage (2.2 mm), 12 gage (2.7 mm) or 10 gage (3.4 mm)] shall be as defined in the Drawings or otherwise 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.

594S.2 Materials

Gabions and revet mattresses shall be constructed of galvanized steel wire with polyvinyl-chloride (PVC) flexible coating. The gabions and revet mattresses shall be of the construction and sizes specified in the Drawings and shall meet the specifications presented herein. Unless otherwise specified in the Drawings or approved by the Engineer or designated representative, the gabions and revet mattresses may be constructed of either double twist woven mesh or welded wire mesh.

Gabions shall be furnished in the specified dimensions within a tolerance of ± 5 percent. Revet mattresses shall be furnished in the specified dimensions within a tolerance of ± 5 percent for the length and width and ± 10 percent for the height. For each individual gabion or revet mattress, the same mesh style shall be used for the base, front, ends, back, diaphragms and lid panels. Each gabion or revet mattress shall be manufactured and divided into cells of equal length, no greater than 3 feet (0.9 meter), by diaphragm panels.

(1) Gabion and Revet Mattress Wire

Gabion wire shall be galvanized steel, Class 3 or A coating, soft temper conforming to ASTM A 641, and shall specifically meet the requirements given below for gabions (12 gage wire) and/or revet mattresses (13.5 wire gage) as called for in the Drawings. PVC coating of the wire may be fuse-bonded or extruded onto the wire. Galvanization of welded wire shall be performed either before or after welding.

Table 1: Requirements – Mesh Wire for Gabions and Revet Mattress Units

Characteristic	Gabions	Revet Mattresses
Wire Gage	12 gage	13.5 gage
Maximum Tensile Strength (ASTM 641)	70,000 psi (483 mPa)	75,000 psi (517 mPa)
Nominal Wire Diameter (ASTM A 641)	0.106 inch (2.7 mm)	0.0866 inch (2.2 mm)
Minimum Diameter (ASTM A 641, Table 3)	0.102 inch (2.6 mm)	0.0826 inch (2.9 mm)
Galvanizing, Zinc (ASTM A 641, Table 1)	0.80 oz/ft^2 (245 gr/m^2)	0.70 oz/ft^2 (215 gr/m^2)

(2) Gabion Mesh

(A) Woven Mesh

Woven mesh shall be of a uniform non-raveling, double twist hexagonal pattern nominally of dimensions 3.25 inches by 4.5 inches (83 mm by 114 mm). Selvedge wire shall be 10 gage (nominal diameter of 3.4 mm).

(B) Welded Mesh

Mesh opening shall be nominally 3 inches by 3 inches (75 mm by 75 mm). Strength of welds shall meet the following requirements when tested in accordance with section 13.4 of ASTM A-974:

Table 2: Minimum Weld Strength Requirements

Type of Structure	Wire Size (Diameter) Gage (mm)	Minimum Average Weld Shear Strength English Units (SI Units)
Gabions	12 (2.7)	472 lbf (2.10 kN)
Revet Mattress	13.5 (2.2)	292 lbf (1.30 kN)

(C) Manufacturing

Twisted wire mesh gabions shall be manufactured in conformance with ASTM A-975, while welded wire mesh gabions shall be manufactured in conformance with ASTM A-974.

(3) Revet Mattresses

(A) Woven Mesh

Woven mesh shall be of a uniform non-raveling, double twist hexagonal pattern, nominally of dimensions 2.5" x 3.25" (64 mm by 83 mm). Selvedge wire shall be 12 gage (nominal diameter of 2.7 mm).

(B) Welded Mesh

Mesh opening shall be nominally 1.5" x 3.0" (38 mm by 76 mm). Strength of welds shall meet the requirements listed in Table 2 for 13.5 gage (2.2 mm) wire, when tested in accordance with section 13.4 of ASTM A-974:

(C) Manufacturing

Twisted wire mesh revet mattresses shall be manufactured in conformance with ASTM A-975, while welded wire mesh revet mattresses shall be manufactured in conformance with ASTM A-974.

(4) PVC Coating

All wire used in fabrication of the gabions, revet mattresses and wiring operations during construction shall, after zinc coating, have a fuse-bonded or extruded coating of PVC. The coating shall be gray in color. The thickness shall be nominally 0.020 inch (0.5 mm), and shall not be less than 0.015 inch (0.38 mm) in thickness. It shall be capable of resisting deleterious effects of natural weather exposure, and immersion in salt water.

For PVC-coated welded wire fabric panel, cutting of the panels shall not be allowed closer than 1/4 inch ± 1/8 inch (6 mm ± 3.18 mm) after fabrication in order to prevent exposure near the welds.

(A) Initial Properties:

1) Woven Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-975:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.3 to 1.35.

b) Durometer Hardness:

The hardness as determined in accordance with ASTM D-2240 shall be between 50 to 60, Shore D.

c) Tensile Strength:

The tensile strength when tested in accordance with ASTM D-412 shall not be less than 2985 psi (20.6 mPa).

d) Modulus of Elasticity at 100% Elongation:

The Modulus of Elasticity when determined in accordance with ASTM D-412 shall not be less than 2700 psi (18.6 mPa).

e) Resistance to Abrasion:

The percentage loss in weight (mass) during abrasion testing in accordance with ASTM D-1242 shall be less than 12%.

f) Brittleness Temperature:

The brittleness temperature shall not be higher than 15^0F (-9.0^0C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 15^0F (8^0C) below the minimum temperature at which the gabion will be handled or filled.

2) Welded Mesh:

The initial properties of the PVC coating material shall have a demonstrated ability to conform to the following requirements specified in ASTM A-974:

a) Specific Gravity:

The specific gravity as determined in accordance with ASTM D-792 shall be between 1.20 and 1.40.

b) Durometer Hardness:
The hardness as determined in accordance with ASTM D-2240 shall not be less than 75, Shore A.

c) Tensile Strength:
The tensile strength when tested in accordance with ASTM D-638 shall not be less than 2275 psi (15.7 mPa).

d) Modulus of Elasticity:

The Modulus of Elasticity when determined in accordance with ASTM D-638 shall not be less than 1980 psi (13.7 mPa).

e) Resistance to Abrasion:

The percentage loss in weight (mass) shall be less than 12 % during abrasion testing in accordance with ASTM D-1242, Method B, at 200 cycles, CSI-A abrader tape, 80 grit.

f) Brittleness Temperature:

The brittleness temperature shall not be higher than 15^0F (–9.0^0C) or a lower temperature specified by the Engineer, when tested in accordance with ASTM D-746. The maximum brittleness temperature should be at least 15^0F (8^0C) below the minimum temperature at which the gabion will be handled or filled.

g) Adhesion:

The PVC coating on the wire shall adhere to the wire such that the coating breaks rather than separates from the wire, when tested in accordance with the PVC Adhesion Test described in Section 13.3 of ASTM A-974.

h) Mandrel Bend:

The PVC-coated wire, when subjected to a single 360^0 bend at 0^0F (-18^0C) around a mandrel ten times the diameter of the wire, shall not exhibit breaks or cracks in the PVC coating.

(B) Performance Tests:

The PVC coating shall have the demonstrated ability to withstand the specified exposure testing.

1) Exposure to Salt Spray: The PVC shall show no effect after 3000 hours of salt spray exposure in accordance with ASTM Test Method B-117.

2) Exposure to Ultraviolet Rays: The PVC shall show no effect of exposure to ultraviolet light with test exposure of 3000 hours, using apparatus Type E and 145°F (63°C), when tested in accordance with ASTM Practice D-1499 and G-23.

(C) Properties After Exposure Tests:

After conclusion of the salt spay and exposure to ultraviolet light tests, the PVC shall not show cracks, blisters or splits, nor any noticeable change in color. In addition the PVC coating shall not show cracks or breaks after the wires are twisted in the fabrication of the mesh, nor shall there be any moisture intrusion under the PVC coating as a result of the test.

After completion of the exposure tests the following criteria shall also be met:

1) Woven Mesh:

a) The Specific Gravity shall not change more than 6% of its initial value.

b) The Durometer Hardness shall not change more than 10% of its initial value.

c) The Tensile Strength shall not change more than 25% of its initial value.

d) The Resistance to Abrasion shall not change more than 10% of its initial value.

2) Welded Mesh:

a) The Specific Gravity shall not change more than 6% of its initial value.

b) The Modulus of Elasticity shall not change more than 25% of its initial value.

c) The Tensile Strength shall not change more than 25% of its initial value.

d) The Resistance to Abrasion shall not change more than 10% of its initial value.

(D) Salt Spray Resistance for Fastener:

The fasteners for twisted mesh wire gabions and revet mattresses shall be subjected to Salt Spray Test of Test Method B-117 for a period of not less than 48 ± 1 hour cycle length. After testing the fasteners, the selvedge, or mesh wire confined by the fasteners shall show no rusty spots on any part of the surface excluding the cut ends.

(5) Stone

(A) Gabion Basket Stones

Stone fill shall be durable and of suitable quality to ensure permanence in the structure. The stone used to fill the gabion baskets shall be a clean, sound, and durable rock meeting the following requirements. It shall have a wearing loss less than 35 percent when the stone is tested with the Los Angeles Abrasion Machine in accordance with ASTM Test Method C535 (TxDOT Test Method Tex-410-A). The loss of material experienced during five cycles of magnesium sulfate exposure conducted in accordance with TxDOT Test Method Tex-411-A for Rock RipRap shall not exceed 18 percent. The stone shall be well graded to produce a dense fill, angular in texture, while meeting the following gradation requirements:

Table 3: Gabion Stone Gradation Requirements

Sieve Size US (SI)	Percent by Weight (Mass) % Passing Each Individual Sieve
8 Inch (200 mm)	100
4 Inch (100 mm)	0 - 5
3 Inch (75 mm)	0

The minimum unit weight (unit mass) of a rock-filled gabion shall be 120 pcf [1.92 megagrams (mg) per cubic meter]. Verification of unit weight (mass) shall be performed when ordered by the Engineer, by constructing a test gabion with materials supplied for construction with the same effort and method intended for production gabions.

(B) Revet Mattress Stone:

The stone used to fill the revet mattresses shall be as specified for gabions except that it shall have a maximum dimension of 5 inches (125mm) and a minimum dimension of 3 inches (75 mm). The majority of the stone shall be in the 3 to 4 inch (75 to 100 mm) range; cubical or rounded in shape. A tolerance of 5% shall be allowed on the upper and lower dimensions of the rock.

(6) Connections

(A) Wire

Lacing wire and connecting wire shall be 13.5 gage [0.087 inch (2.20 mm)] PVC coated galvanized steel, Class 3, soft temper, conforming to ASTM A-641. During testing, any separation of 2 inches (50 mm) or more between connecting wires shall be considered as a failure.

(B) Spiral Binder for Welded Wire Mesh

Spiral binders shall consist of 0.106 inch (2.7 mm) PVC coated wire for the gabion and 0.087 inch (2.2 mm) PVC coated wire for the revet mattresses. Spiral binders shall

have a 3.0 inch (75 mm) maximum separation between continuous successive loops (3 inch or 75mm pitch).

The binder shall be made of galvanized steel, Class 3, soft temper, conforming to ASTM A-641.

(C) Alternate Fasteners for Twisted Woven Mesh

Alternate fasteners, acceptable for use by the intended gabion basket manufacturer, may be submitted to the Engineer for consideration and approval prior to construction. The fasteners may consist of split ring or interlocking fasteners. Alternate fasteners systems shall produce a joint that meets the requirements of ASTM A-975, Section 7, Table 2.

(7) Fastener System

The Contractor shall provide a complete description of the fastener system, including the number of fasteners required for all vertical and horizontal connections for single- and multiple-basket joinings, as well as the number and size wires the fastener is capable of properly joining. The Contractor shall provide a description of a properly installed fastener, including test reports, drawings and/or photographs. Properly formed fasteners shall meet the requirements of ASTM A-974 for welded wire mesh or ASTM A-975 for twisted woven mesh.

(A) Each interlocking fastener shall be locked and closed.

(B) Each overlapping ring fastener shall be closed and the free ends shall overlap an average of 1 inch (25 mm).

(C) Spiral binders shall be screwed into position such that they pass through each mesh opening along the joint. In order to prevent unraveling, both ends of the spiral shall be crimped back around itself.

(D) Wire fasteners shall not be used to join more wires, or larger wires, than tested and approved for the application.

(8) Panel to Panel Joint Strength

The minimum strength of the joined panels shall be as specified in Section 7.3 of ASTM A-974 for Welded wire panels or Section 7.3 of ASTM A-975 for twisted woven mesh.

(9) Miscellaneous

Aggregate bedding, geotextiles or other materials shall conform to the requirements established on the Drawings.

(10) Certificate of Compliance

The Contractor shall submit Certificates of Compliance for all materials proposed for use to the Engineer for review and approval one week prior to construction.

594S.3 Construction

Twisted wire mesh Gabon's and revote mattresses shall be supplied in the forms allowed in ASTM A-975, while welded wire mesh Gabon's and revote mattresses shall be supplied in a form allowed in ASTM A-974.

The Gabon/revote mattress manufacturer/supplier will be required to have a qualified representative on site at the start of gabion/revet mattress construction. The Contractor shall submit work experience documentation of the representative for review/approval by the Engineer or designated representative. The representative shall be available for consultation as needed throughout the gabion construction.

Gabions and revet mattresses shall be constructed to the lines and grades shown on the Drawings. Individual or groups of gabions or revet mattresses, which deviate from line and grade, shall, at the direction of the Engineer or designated representative, be removed and replaced at no cost to the owner. Gabions or revet mattresses, which are constructed with bulges, and/or underfilled, loosely filled, or otherwise lacking a neat and compact appearance shall, at the direction of the Engineer or designated representative, be repaired/replaced at no cost to the owner. Underfilling of gabion/revet mattress corners to facilitate insertion of spirals shall not be permitted.

(1) Foundation Preparation

The foundation shall be excavated to the extent shown on the Drawings or as directed by the Engineer or designated representative. All loose or otherwise unsuitable materials shall be removed. All depressions shall be carefully backfilled to grade. The depressions shall be backfilled with suitable materials from adjacent required excavation, or other approved source, and compacted to a density at least equal to that of the adjacent foundation. If pervious materials are encountered in the foundation depressions, the areas shall be backfilled with free draining materials.

Any buried debris protruding from the foundation that will impede the proper installation and detrimentally impact the final appearance of the gabion, shall also be removed, and the voids carefully backfilled and compacted as specified above. Immediately prior to gabion or revet mattress placement, the prepared foundation surface shall be inspected and approved by the Engineer and no material shall be placed thereon until that area has been approved.

Placement of filter material and/or filter fabric shall be as shown on the Drawings or directed by the Engineer.

(2) Gabion/Revet Mattress Basket Assembly

No work shall take place using PVC coated materials unless both the ambient air temperature and the temperature of the PVC materials are at least 15°F (8^0C) above the brittleness temperature of the PVC materials.

Assembly of gabions and revet mattresses shall consist of shaping and tying each individual basket. Baskets shall be assembled by connecting all untied edges including diaphragms with lacing wire, spirals or approved fasteners. The connections for the completed assemblies shall conform to the requirements of Section 7 of ASTM specifications A-974 (welded wire) and Section 7.3 and Table 2 of A-975 (double twisted).

Assembly of baskets, connection of baskets together and lid closures shall be accomplished in accordance with one of the following approved procedures:

(A) Lacing Wire:

Using lacing wire of appropriate length, secure one end of the wire onto the basket corner by looping and twisting the lacing wire together. Proceed along the joint by tying with double loops every other mesh opening at intervals not more than 6 inches (150 mm) apart, while pulling the basket elements tightly together. Secure the other end of the lacing wire again by looping and twisting the wire around itself.

(B) Spiral Binders for Welded Wire Mesh:

Spiral binders, meeting the minimum acceptance criteria of article 594S.2 (6) c) shall be screwed into position such that they pass through each mesh opening along the joint. To prevent unraveling, each end of the spiral binder shall be crimped back against itself.

C) Alternate Fasteners for Twisted Woven Mesh:

Interlocking fasteners meeting the minimum acceptance criteria of article 594S.2 (6) c), shall be installed with, as a minimum, one interlocking fastener in every other opening.

Ring fasteners meeting the minimum acceptance criteria of 594S.2 (6)c), shall be installed with, as a minimum, one split ring fastener in every opening, having a minimum 1 inch (25 mm) total overlap and securing only the number and diameter of wires for which tested.

Placing of gabions and revet mattresses shall consist of installing baskets to the lines and grades shown on the Drawings. Gabions and revet mattresses shall be securely fastened to each adjoining unit along the vertical and top reinforced edges of all contact surfaces. Overlying rows of baskets shall be staggered appropriately. Empty sections stacked on a filled line of gabions and revet mattresses shall be securely fastened to the bottom unit along the front, back and ends.

Prior to the placement of rock, the baskets used in the front vertical exposed faces of retaining walls shall be aligned. To facilitate alignment, tension may be applied to empty units at the direction of the Engineer or designated representative.

(3) Filling of Gabions and Revet Mattresses

The gabions and revet mattresses may be filled by machine, in maximum lifts of 12 inches (300 mm). The machine work shall be supplemented with handwork to avoid bulges and provide a compact mass with a minimum of voids. Care will be exercised so as not to damage the gabion/revet mattress elements or wire coating by limiting height of drop during filling to 3.0 feet (0.9 meter) for Gabions and 1.5 feet (0.5 meter) for revet mattresses. Undue deformation or bulging of the mesh shall be corrected prior to further stone filling. Where specified on the Drawings, select large stone shall be hand placed on vertical outside faces to achieve a desired neat appearance.

During placement, the depth of stone in any cell shall not exceed the depth in an adjoining cell by more than one foot (300 mm). Stone smaller than the mesh opening found against vertical faces shall be removed.

Two connecting wires in each direction for end units and two parallel connecting wires perpendicular to the exposed face for exposed face units shall be installed at every 12 inch (300 mm) lift. The connecting wires shall loop around two mesh openings, and the ends of wires shall be securely twisted with a minimum of three twists after looping. Prefabricated connecting wire may be used in lieu of connecting wire.

Connecting wires associated with 18-inch (450 mm) gabions shall be installed when and as specified on the Drawings or as recommended by the gabion/revet mattress manufacturer.

The gabion or revet mattress unit shall be overfilled by 1 1/2 to 2 inches (37.5 to 50 mm) and the lid shall be bent and stretched until it meets the perimeter edges of the front and end panels. The stretching shall be accomplished using an approved lid closing tool in order to prevent damage to the PVC coating. Crow bars or similar single point leverage devices will not be allowed. The lid shall then be securely tied with lacing wire, spirals or

approved fasteners to the fronts, ends and diaphragms. Excessive deformation of the lid panel to facilitate closing of a bulging gabion or revet mattress will not be permitted.

All backfill shall be placed and compacted in sequence with the filling of the baskets; however, care shall be exercised in compacting the fill behind a single row of baskets since excessive compaction effort can displace the gabions/revet mattresses from the desired alignment.

Gabion or revet mattress units may be cut or shaped to fit odd length or odd shaped areas. They shall be cut at least 6" to 8" (150 mm to 200 mm) larger than the opening to allow sufficient material for overlap and lacing. All edges or faces formed in this manner shall be adjusted to present a finished and pleasing appearance.

At all times, care shall be taken to turn all loose and projecting ends of wire into the gabion units to prevent injury.

594S.4 Workmanship

Wire of proper grade and quality, when fabricated and installed in the manner herein required, shall result in a strong, serviceable mesh-type product having substantially uniform openings. It shall be fabricated and finished in a workmanlike manner, as determined by visual inspection, and shall conform to this specification.

594S.5 Measurement

Measurement of acceptable "Gabions and Revet Mattresses", complete in place, will be made on the basis of volume determined by the actual length, width and height.

594S.6 Payment

The Gabion and revet mattress quantities, measured as described above, will be paid for at the unit bid prices per cubic yard (cubic meter: 1 cubic meter equals 1.308 cubic yards) of the various types indicated. The price shall include full compensation for furnishing, hauling and placing all materials, including filter fabric, wire containers, connectors, reinforcement stones and backfill; for all labor, tools, equipment and incidentals needed to complete the work.

Excavation and all subgrade preparation required for shaping the foundation for the wire containers shall be included in the unit bid price for "Gabions and Revet Mattresses".

Payment will be made under one of the following:

Pay Item No. 594S-A: Gabions, Twisted Woven Wire ----------Per Cubic Yard.
Pay Item No. 594S-B: Gabions, Welded Wire ---------- Per Cubic Yard.
Pay Item No. 594S-C: Revet Mattresses, Twisted Woven Wire --- Per Cubic Yard.
Pay Item No. 594S-D: Revet Mattresses, Welded Wire---------- Per Cubic Yard.

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification Item 594S, "GABIONS and REVET MATTRESSES"

City of Austin Environmental Criteria Manual

Designation	Description
Section 1.4.3.E	Permanent Structural Practices-Gabions
Figure 1.23	Gabions

City of Austin Standard Details

Designation	Description

594S-1	Gabions
594S-2	Gabion Details

American Society for Testing and Materials (ASTM)

Designation	Description
A-974	Standard Specifications for Welded Wire Fabric Gabions and Gabion Mattresses (Metallic-Coated or Polyvinyl Chloride (PVC) Coated)
A-975	Standard Specifications for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel with Poly (Vinyl Chloride)(PVC) Coating)

RELATED CROSS REFERENCE MATERIALS

City of Austin Technical Specifications

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Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
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Item No. 130S	Borrow
Item No. 132S	Embankment
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Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 236S	Proof Rolling
Item No. 510	Pipe
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. 606S	Fertilizer
Item No. 607S	Slope Stabilization
Item No. 608S	Planting

City of Austin Standard Details

Designation	Description
642S-1	Silt Fence

Texas Department of Transportation; Manual of Testing Procedures

Designation	Description
410-A	Abrasion of Coarse Aggregate Using The Los Angeles Machine
411-A	Soundness of Aggregate By Use of Sodium Sulfate or Magnesium Sulfate

RELATED CROSS REFERENCE MATERIALS - Contibued

Specification Item 594S, "GABIONS and REVET MATTRESSES"

American Society for Testing and Materials (ASTM)

Designation	Description
A-313	Standard Specification for Stainless Steel Spring Wire
A-370	Standard Test Methods and Definitions for Mechanical Testing of Steel Products
A-641	Specification for Zinc Coated (Galvanized) Carbon Steel Wire

A-853	Standard Specification for Steel Wire, Carbon, for General Use
B-117	Test Method of Salt Spray (Fog) Testing
C-535	Standard Test Method for Resistance of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
D-412	Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
D-638	Test Method for Tensile Properties of Plastics
D-746	Test Methods for Brittleness Temperature of Plastic and Elastomers by Impact
D-792	Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement
D-1203	Standard Test Methods for Volative Loss from Plastics Using Activated Carbon Methods
D-1242	Test Methods for Resistance of Plastics Materials to Abrasion
D-1499	Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Plastics
D-2240	Test Method for Rubber Property-Durometer Hardness
D-2287	Standard Specification for Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
G-23	Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Non-metallic Materials

Item No. 132S
Embankment

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 2 1/2 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.

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification 132S, "EMBANKMENT"

City of Austin Standard Specifications

Designation	Description
Item No. 101S	Preparing Right of Way
Item No. 102S	Clearing and Grubbing
Item No. 104S	Removing Portland Cement Concrete
Item No. 110S	Street Excavation
Item No. 111S	Excavation
Item No. 130S	Borrow
Item No. 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: Manual of Testing Procedures

Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-104-E	Determination of Liquid Limit of Soils
Tex-105-E	Determination of Plastic Limit of Soils
Tex-106-E	Method of Calculating the Plasticity Index of Soils
Tex-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

RELATED CROSS REFERENCE MATERIALS - Continued

City of Austin Standard Contract Documents

Designation	Description
00700	General Conditions

City of Austin Standard Specifications

Designation	Description
Item No. 230S	Rolling (Flat Wheel)
Item No. 232S	Rolling (Pneumatic Tire)
Item No. 234S	Rolling (Tamping)
Item No. 602S	Sodding for Erosion Control
Item No. 604S	Seeding for Erosion Control
Item No. 622S	Diversion Dike
Item No. 628S	Sediment Containment Dikes
Item No. 642S	Silt Fence

City of Austin Standard Details

Designation	Description
No. 610S-1	Tree Protection Fence Locations
No. 610S-2	Tree Protection Fence, Type B Chainlink
No. 610S-3	Tree Protection Fence, Type B Wood
No. 610S-4	Tree Protection Fence, Modified Type A
No. 610S-5	Tree Protection Fence, Modified Type B
No. 621S-1	Diversion
No. 622S-1	Diversion Dike
No. 624S-1	Earth Outlet Sediment Trap
No. 625S-1	Grade Stabilization Structure
No. 627S-1	Grass Lined Swale
No. 627S-2	Grass Lined Swale With Stone Center
No. 628S	Triangular Sediment Filter Dike
No. 628S-1	Hay Bale Dike
No. 629S-1	Brush Berm
No. 630S-1	Interceptor Dike
No. 631S-1	Interceptor Swale
No. 632S-1	Storm Inlet Sediment Trap
No. 633S-1	Landgrading
No. 634S-1	Level Spreader
No. 635S-1	Perimeter Dike
No. 636S-1	Perimeter Swale
No. 637S-1	Pipe Slope Drain (Flexible)
No. 637S-2	Pipe Slope Drain (Flexible)
No. 638S-1	Pipe Outlet Sediment Trap
No. 639S-1	Rock Berm
No. 641S-1	Stabilized Construction Entrance
No. 642S-1	Silt Fence
No. 643S-1	Stone Outlet Structure

No. 644S-1 Stone Outlet Sediment Trap

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

Designation	Description
Item No. 100	Preparing Right of Way
Item No. 110	Excavation
Item No. 132	Embankment
Item No. 158	Specialized Excavation Work

RELATED CROSS REFERENCE MATERIALS - Continued
Specification 132S, "EMBANKMENT"

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

Designation	Description
Item No. 160	Furnishing and Placing Topsoil
Item No. 164	Seeding for Erosion Control
Item No. 204	Sprinkling
Item No. 210	Rolling (Flat Wheel)
Item No. 211	Rolling (Tamping)
Item No. 213	Rolling (Pneumatic Tire)

Texas Department of Transportation: Manual of Testing Procedures

Designation	Description
Tex-103-E	Determination of Moisture Content of Soil Materials
Tex-107-E	Determination of Bar Linear Shrinkage of Soils

Item No. 702S
Removal and Relocation of Existing Fences

702S.1 Description

This item shall govern the removal and relocation of existing fence, gates and hardware to a new alignment at the location in conformance to the typical details indicated on the Drawings or as directed by the Engineer or designated representative.

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

702S.2 Removal of Existing Materials

The existing boards, fabric, posts, wire, rails, braces, hardware, gates and miscellaneous items shall be carefully removed, bundled, rolled and stockpiled as indicated on the Drawings for installation at the new fence assignment. The removal and handling shall be such that the fence materials may be reused in the relocated fence.

A. Removal of Fabric and Wire

Fabric and wire of all types shall be carefully untied or disassembled from the posts and other appurtenances and shall be rolled in bundles of a size that will allow handling with ordinary equipment.

B. Removal of Posts

Posts shall be carefully removed from the ground and the concrete footing removed. The concrete shall be disposed of off site. Post holes shall be filled with suitable embankment material and thoroughly compacted.

C. Removal of Boards

Boards of all types shall be carefully disassembled from the rails and other appurtenances to facilitate removal in panels. Excess material removed shall be disposed of as indicated below.

D. Storage of Materials

Storage of all salvageable materials, that will be reinstalled at a new location, shall be stored on-site or at such other locations as the Contractor may elect, subject to approval by the Engineer or designated representative. Security and maintenance of the salvageable materials shall be the responsibility of the Contractor.

E. Excess Materials

Materials, that are damaged, unsuitable for reinstallation or unnecessary for completion of the scope of the fence work in the new alignment shall be considered as excess but shall be offered to the Owner before removal from the site by the Contractor.

702.S 3 New Materials

New materials that are required to complete the fence at the location indicated on the Drawings shall be of equal quality to the existing materials. Used materials from other projects or from the Contractor's own used material stocks will not be allowed. The new materials to be furnished will be those necessary to replace items from the existing fence which were damaged during removal operations or which for other reasons cannot be reused.

702S.4 Construction Methods

The removed fence shall be installed at the new assignment in accordance with the typical details indicated on the Drawings and shall comply with Standard Specification Item No. 701S, "Fencing" and the best practice for fence construction of the specified type.

702S.5 Measurement

Fences of the height and type to be relocated will be measured by the lineal foot (lineal meter: 1lineal foot equals 0.31 meters) of fence in its new location measured at the bottom of the fence along the centerline of the fence from center to center of terminal posts, excluding gates.

702S.6 Payment

The work performed and material furnished as prescribed by this item measured under "Measurement" will be paid for at the unit bid price for "Removing and Relocating Fences" of the size and type specified to be relocated. The unit bid price shall include full compensation for removing, salvaging, storing and handling all existing fence materials; furnishing new posts, boards, rails, braces, tie wires, connection clips, fabric, rails, brace rods and any other fence component items that were damaged during removal and necessitating new material being furnished to complete the project; digging post holes and grouting in rock where required; furnishing concrete for post footings; and for all manipulations, labor, tools, equipment and incidentals necessary to complete the work including excavation, backfilling and disposal of surplus materials.

Gates as provided under "Measurement" will be paid for at the unit bid price for Removal and Relocation of Existing Pedestrian or Vehicular Gates of the type and size specified to be relocated. The unit bid price shall include full compensation for removing the gate from the existing locations, handling, storing and hauling all gate materials, furnishing any new materials necessary for installing at new locations; providing new center anchorage blocks, latches and catch blocks and for manipulations, labor, tools, equipment and incidentals necessary to complete the gate relocation.

Payment will be made under one of the following:

Pay Item No. 702S -A:	Removing and Relocating Existing _Ft. Chain Link Fence	Per Lineal Foot.
Pay Item No. 702S -B:	Removing and Relocating Existing _Ft. x _Ft. Chain Link Pedestrian Gate	Per Each.
Pay Item No. 702S-C:	Removing and Relocating Existing _Ft. x _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. x _Ft. Wooden Pedestrian Gate — Per Each.

Pay Item No. 702S-F: Removing and Relocating
Existing _Ft. x _Ft. Wooden Vehicular Gate — Per Each.

Pay Item No. 702S-G: Removing and Relocating
Existing _Ft. Wire Fence — Per Lineal Foot.

Pay Item No. 702S-H: Removing & Relocating Existing __Ft. x _Ft. Metal Gate — Per Each.

End

SPECIFIC CROSS REFERENCE MATERIALS
Specification 702S, "Removal and Relocation of Existing Fences"

City of Austin Standard Specifications

Designation	Description
Item No. 701S	Fencing

RELATED CROSS REFERENCE MATERIALS

City of Austin Standard Specifications

Designation	Description
Item No. 403S	Concrete for Structures

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

Designation	Description
Item No. 445	Galvanizing

American Society For Testing And Materials (ASTM)

Designation	Description
A 53/A 53M	Specification For Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
A 116	Specification For Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric
A 121	Specification For Zinc-Coated (Galvanized) Steel Barbed Wire
A 153/A 153M	Specification For Zinc-Coated (Hot-Dip) on Iron and Steel Hardware
A 239	Practice for Locating the Thinnest Spot in a Zinc (Galvanized) Coating on Iron and Steel Articles
A 392	Specification For Zinc-Coated Steel Chain-Link Fence Fabric
A 491	Specification For Aluminum-Coated Steel Chain-Link Fence Fabric
A 585	Specification For Aluminum-Coated Steel Barbed Wire
B 117	Practice for Operating Salt Spray (Fog) Apparatus