

500 Items

Miscellaneous Construction

Item 500

Mobilization



1. DESCRIPTION

Establish and remove offices, plants, and facilities. Move personnel, equipment, and supplies to and from the project or the vicinity of the project site to begin work or complete work on Contract Items. Bonds and insurance are required for performing mobilization.

For Contracts with emergency mobilization, provide a person and method of contact available 24 hr. per day, 7 days per week, unless otherwise shown on the plans. The time of notice will be the transmission time of the written notice or notice provided orally by the Department's representative.

2. MEASUREMENT

This Item will be measured by the lump sum or each as the work progresses. Mobilization is calculated on the base bid only and will not be paid for separately on any additive alternate items added to the Contract.

3. PAYMENT

For this Item, the adjusted Contract amount will be calculated as the total Contract amount less the lump sum for mobilization. Material on hand will not be considered as a construction item earned when calculating mobilization payment. Except for Contracts with callout or emergency work, mobilization will be paid in partial payments as follows.

- Payment will be made upon presentation of a paid invoice for the payment or performance bonds and required insurance.
- Payment will be made upon verification of documented expenditures for plant and facility setup. The combined amount for all these facilities will be no more than 10% of the mobilization lump sum or 1% of the total Contract amount, whichever is less.
- When 1% of the adjusted Contract amount for construction Items is earned, 50% of the mobilization lump sum bid or 5% of the total Contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.
- When 5% of the adjusted Contract amount for construction Items is earned, 75% of the mobilization lump sum bid or 10% of the total Contract amount, whichever is less, will be paid. Previous payments under the Item will be deducted from this amount.
- When 10% of the adjusted Contract amount for construction Items is earned, 90% of the mobilization lump sum bid or 10% of the total Contract amount, whichever is less, will be paid. Previous payments under this Item will be deducted from this amount.
- Upon final acceptance, 97% of the mobilization lump sum bid will be paid. Previous payments under this Item will be deducted from this amount.
- Payment for the remainder of the lump sum bid for "Mobilization" will be made after all submittals are received, after final quantities have been determined, and when any separate vegetative establishment and maintenance, test, and performance periods provided for in the Contract have been successfully completed.

For projects with extended maintenance or performance periods, payment for the remainder of the lump sum bid for "Mobilization" will be made 6 mo. after final acceptance.

For Contracts with callout or emergency work, "Mobilization" will be paid as follows.

- Payment will be made upon presentation of a paid invoice for the payment of performance bonds and required insurance.
- Mobilization for callout work will be paid for each callout work request.
- Mobilization for emergency work will be paid for each emergency work request.

Item 502

Barricades, Signs, and Traffic Handling



1. DESCRIPTION

Provide, install, move, replace, maintain, clean, and remove all traffic control devices shown on the plans and as directed.

Temporary work zone (TWZ) traffic control devices manufactured after December 31, 2019, must have been successfully tested to the crashworthiness requirements of the 2016 edition of the AASHTO *Manual for Assessing Safety Hardware* (MASH). An exception to the manufacture date applies when, based on the project's date of letting, a category of MASH-2016 compliant TWZ traffic control devices was not approved, or was not self-certified. In such case, devices that meet NCHRP-350 or MASH-2009 may be used.

Temporary work zone (TWZ) traffic control devices manufactured on or before December 31, 2019, must at a minimum have been successfully tested to the crashworthiness requirements of NCHRP-350 or MASH-2009. These devices may continue to be used throughout their normal service lives.

Such TWZ traffic control devices include:

- portable sign supports,
- barricades,
- portable traffic barriers designated exclusively for use in TWZs,
- crash cushions designated exclusively for use in TWZs,
- longitudinal channelizers, and
- truck-mounted attenuators (TMAs) and trailer attenuators (TAs).

Category I devices (i.e., lightweight devices), such as cones, tubular markers, and drums without lights or signs attached, may be self-certified by the vendor or provider, with documentation provided to the Department, or as shown on Department's Compliant Work Zone Traffic Control Device List.

2. CONSTRUCTION

Comply with the requirements of Article 7.2., "Safety."

Implement the traffic control plan (TCP) shown on the plans.

Install traffic control devices straight and plumb. Make changes to the TCP only as approved. Minor adjustments to meet field conditions are allowed.

Submit Contractor-proposed TCP changes, signed and sealed by a licensed professional engineer, for approval. The Engineer may develop, sign, and seal Contractor-proposed changes. Changes must conform to guidelines established in the TMUTCD using approved products from the Department's Compliant Work Zone Traffic Control Device List.

Maintain traffic control devices by taking corrective action when notified. Corrective actions include, but are not limited to, cleaning, replacing, straightening, covering, and removing devices. Maintain the devices such that they are properly positioned and spaced, are legible, and have retroreflective characteristics that meet requirements day or night and in all weather conditions.

The Engineer may authorize or direct in writing the removal or relocation of project limit advance warning signs. When project limit advance warning signs are removed before final acceptance, provide traffic control in accordance with the TMUTCD for minor operations as approved.

Remove all traffic control devices upon completion of the work as shown on the plans or as directed.

3. MEASUREMENT

“Barricades, Signs, and Traffic Handling” will be measured by the month. Law enforcement personnel with patrol vehicles will be measured by the hour for each person.

4. PAYMENT

- 4.1. **Barricades, Signs, and Traffic Handling.** Except for Contracts with callout work and work orders, the work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Barricades, Signs, and Traffic Handling.” This price is full compensation for installation, maintenance, adjustments, replacements, removal, materials, equipment, labor, tools, and incidentals.

When the plans establish pay items for particular work in the TCP, that work will be measured and paid for under pertinent Items.

TMA and TA will be paid for under Item 505, “Truck-Mounted Attenuator (TMA) and Trailer Attenuator (TA).” Portable changeable message signs will be paid for under Item 503, “Portable Changeable Message Sign.” Portable traffic signals will be paid for under Item 510, “One-Way Traffic Control,” unless otherwise shown on the plans.

In accordance with Section 7.2.3., “Safety Contingency,” funds have been included in the project budget to improve the effectiveness of traffic handling and enhance safety during the course of this project.

- 4.1.1. **Initiation of Payment.** Payment for this Item will begin on the first estimate after barricades, signs, and traffic handling devices have been installed in accordance with the TCP.
- 4.1.2. **Paid Months.** Monthly payment will be made each succeeding month for this Item provided the barricades, signs, and traffic handling devices have been installed and maintained in accordance with the TCP until the Contract amount has been paid.
- If, within the timeframe established by the Engineer, the Contractor fails to provide or properly maintain signs and barricades in compliance with the Contract requirements, as determined by the Engineer, the Contractor will be considered in noncompliance with this Item. No payment will be made for the months in question, and the total final payment quantity will be reduced by the number of months the Contractor was in noncompliance.
- 4.1.3. **Maximum Total Payment Before Acceptance.** The total payment for this Item will not exceed 10% of the total Contract amount before final acceptance in accordance with Article 5.12., “Final Acceptance.” The remaining balance will be paid in accordance with Section 502.4.1.5., “Balance Due.”
- 4.1.4. **Total Payment Quantity.** The quantity paid under this Item will not exceed the total quantity shown on the plans, except as modified by change order and as adjusted in accordance with Section 502.4.1.2., “Paid Months.” An overrun of the plans quantity for this Item will not be allowed for approving designs; testing; material shortages; closed construction seasons; curing periods; establishment, performance, test, and maintenance periods; failure to complete the work in the number of months allotted; or delays caused directly or indirectly by Contract requirements.

- 4.1.5. **Balance Due.** The remaining unpaid months of barricades less non-compliance months will be paid on final acceptance of the project, if all work is complete and accepted in accordance with Article 5.12., "Final Acceptance."
- 4.1.6. **Contracts with Callout Work and Work Orders.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be subsidiary to pertinent Items, except for federally funded Contracts.
- 4.2. **Law Enforcement Personnel.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid by Contractor force account for "Law Enforcement Personnel." This price is full compensation for furnishing all labor, materials, supplies, equipment, patrol vehicles, fees, and incidentals necessary to complete the work as directed.

Item 503

Portable Changeable Message Sign



1. DESCRIPTION

Furnish, operate, and maintain trailer-mounted portable changeable message sign (PCMS) units.

2. MATERIALS

Furnish new or used material in accordance with this Item and as shown on the plans. Provide a self-contained PCMS unit with the following:

- sign controller,
- changeable message sign,
- trailer, and
- power source.

Paint the exterior surfaces of the power supply housing, supports, trailer, and sign with Federal Orange No. 22246 or Federal Yellow No. 13538 of Federal Standard 595C, except paint the sign face assembly flat black.

2.1. Sign Controller. Provide the following.

- A controller with permanent storage of at least 75 pre-programmed messages
- An external input device for random programming and storage of at least 75 additional messages
- A controller capable of displaying up to three messages sequentially
- A controller with adjustable display rates

Enclose sign controller equipment in a lockable enclosure.

2.2. Changeable Message Sign. Provide the following.

- A sign capable of being elevated to at least 7 ft. above the roadway surface from the bottom of the sign
- A sign capable of being rotated 360° and secured against movement in any position
- A sign with three separate lines of text and eight characters per line minimum
- A minimum 18-in. character height
- A 5 × 7-character pixel matrix
- A message legibility distance of 600 ft. for nighttime conditions and 800 ft. for normal daylight conditions
- Capability for manual and automatic dimming light sources

The following are descriptions for three screen types of PCMS.

- **Character Modular Matrix.** This screen type comprises of character blocks.
- **Continuous Line Matrix.** This screen type uses proportionally spaced fonts for each line of text.
- **Full Matrix.** This screen type uses proportionally spaced fonts, varies the height of characters, and displays simple graphics on the entire sign.

2.3. Trailer. Provide a two-wheel trailer with square top fenders, four leveling jacks, and trailer lights. Do not exceed an overall trailer width of 96 in. Shock mount the electronics and sign assembly.

2.4. Power Source. Provide a diesel generator, solar powered power source, or both. Provide a backup power source as necessary.

- 2.5. **Cellular Modem.** When shown on the plans, provide a cellular modem connection to communicate with the PCMS unit remotely.

3. CONSTRUCTION

Place or relocate PCMS units as shown on the plans or as directed. The plans will show the number of PCMS units needed, for how many days, and for which construction phases.

Maintain the PCMS units in good working condition. Repair damaged or malfunctioning PCMS units as soon as possible. PCMS units will remain the property of the Contractor.

4. MEASUREMENT

This Item will be measured by each PCMS or by the day used. All PCMS units must be set up on a work area and operational before a calendar day can be considered measurable. When measurement by the day is specified, a day will be measured for each PCMS set up and operational on the worksite.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Portable Changeable Message Sign." This price is full compensation for PCMS units; setup; relocating; removing; replacement parts; batteries (when required); fuel, oil, and oil filters (when required); cellular telephone charge (when required); software; and equipment, materials, tools, labor, and incidentals. Reimbursement for the repair of damaged devices will be in accordance with Section 7.17.1., "Reimbursable Repair."

Item 504

Field Office and Laboratory



1. DESCRIPTION

Provide field offices and laboratories for exclusive use of the Engineer and inspection staff of the type shown on the plans.

2. EQUIPMENT

2.1. **General.** Furnish facilities after receipt of the work order and before beginning physical work on the project. Provide field offices of the type and number specified near the worksite at an acceptable location. Use of permanent buildings or rental space meeting the requirements for field offices and laboratories instead of portable buildings is allowed. Maintain the field office until the Department accepts the project.

Provide inspection laboratories of the type specified before beginning the fabrication of products required by the Contract. Locate the building so that plant operations are visible from the building. Maintain the laboratories until the production of the associated product is complete.

Immediately repair or replace facilities if damaged in any manner. Payment for repair will not be made unless it is the result of negligence by the Department. Reimburse the Department for equipment damaged by the Contractor's operations. Remove buildings and other facilities and restore the right of way before project acceptance when facilities are allowed in the right of way.

Provide a partitioned restroom furnished with restroom supplies, a lavatory, and a flush toilet. A portable toilet is allowed unless otherwise shown on the plans. The restroom facility or portable toilet may be a shared facility but must be accessible and in proximity to the Engineer's field office and laboratory.

Dispose of trash collected by the Department associated with the facility provided. Provide for janitorial services for floors and toilets.

Provide reliable internet access when shown on the plans.

When detailed on the plans, provide for storage of the nuclear gauge that meets the exposure and security requirements of the Department and Texas Department of State Health Services (DSHS).

2.2. **Parking and Fencing.** Provide an all-weather parking area for the sole use of at least two State-owned vehicles unless otherwise shown on the plans. Situate the area near the field office or laboratory at an acceptable location. Maintain the parking area until the project is completed and restore the area in the right of way to a condition acceptable to the Engineer upon project completion.

Enclose the parking area and buildings with a 6-ft. chain-link fence, top-mounted three-strand barbed wire, and a 12-ft. gate when shown on the plans.

2.3. **Buildings.** Buildings that were considered adequate by the Department before the implementation of these Standard Specifications, except for Type E structures, may remain in service for their useful life. Buildings may either be under shared roofs with the Contractor and supplier facilities or separate facilities. Provide secured Department-only access to secure the Department's furnished equipment and files by partitioning the rooms, separate laboratories, or other approved methods.

Provide buildings with roof, floor, secured doors, and screened windows with blinds. All rooms will have a minimum 8-ft. ceiling and aisles at least 5 ft. in width. Provide floors that are strong and stable with an

impervious floor covering for interior rooms. For portable facilities, install tie downs. Ensure that the building is weatherproof, piped for water, piped for fuel (when needed for heating), and electrically wired by personnel meeting the requirements of Article 7.18., "Electrical Requirements." Provide electricity in sufficient amperage to meet the needs of the type of facility.

Furnish and install adequate outlets, lighting, air conditioning, heating, and ventilation.

Furnish strong and stable landings, ramps, and steps to all exterior doors of the building if needed for access.

Provide potable water or water from a potable source for testing and cleaning.

Provide secured and controlled access to the field office or laboratory. Provide bars on the windows. When shown on the plans, provide security fencing with a 6-ft. chain link fence, top-mounted three-strand barbed wire, and a 12-ft. gate.

For new buildings, coordinate with the Engineer on the layout to meet the requirements of this Item.

- 2.3.1. **Field Office.** Provide at least two workbenches or tables at least 30 in. wide and 5 ft. long, at least four chairs, at least three drawers of filing cabinets, and at least one desk at least 30 in. wide and 5 ft. long, or as approved.
- 2.3.2. **Laboratory.** Provide the following items unless otherwise shown on the plans:
- a minimum 4 × 4-ft. landing on all exterior doors when steps are necessary;
 - stable platforms for testing equipment;
 - a floor strong and stable enough to support testing equipment;
 - a 10-lb. ABC fire extinguisher with up-to-date inspection tag and a working smoke detector;
 - exhaust fans for removing volatiles and aggregate fines from room air. Position exhaust fans to pull volatiles and fines away from the technician. Vent all equipment exhaust to the outside of the structure in conformance with manufacturer requirements;
 - an area for a desk that is a minimum 30 in. × 5 ft., at least three drawers of filing cabinets, and at least one chair; and
 - a laboratory sink measuring at least approximately 24 × 30 in. and 12 in. deep.
- 2.3.3. **Structure Types.**
- 2.3.3.1. **Type A Structure (Concrete Laboratory).** Provide at least 100 sq. ft. of gross floor area with at least two windows and one exterior door. Provide a minimum 30-in. × 6-ft. stable work counter. Meet requirements in accordance with Section 504.2.3.2., "Laboratory," except filing cabinets, a sink, and exhaust fans are not required unless otherwise shown on the plans.
- 2.3.3.2. **Type B Structure (Field Office and Concrete Laboratory).** Provide at least 320 sq. ft. of gross floor area. Partition the floor area into at least three interconnected rooms with doors, two windows in each room, and two exterior doors. Provide enough 30-in. width counter space for performing testing, to place test equipment, for a preparation area, and for a sink.
- 2.3.3.3. **Type C Structure (Field Office).** Provide at least 200 sq. ft. of gross floor area with at least one exterior door and two windows.
- 2.3.3.4. **Type D Structure (Hot-Mix Asphalt Laboratory).** Provide enough floor area that will accommodate 30-in. width counter space for performing testing, to place test equipment, for a preparation area, and for a sink. Partition the floor area into at least two interconnected rooms with interior doors, at least two windows in each room, and two exterior doors. Provide an electrical outlet with sufficient power within 3 ft. of the ignition oven location and vent the ignition oven separately to the outside in conformance with the manufacturer's

requirements. Provide a surface for the ignition oven that is level, sturdy, and fireproof with at least 6 in. of clearance between the furnace and other vertical surfaces.

For gyratory presses that are shared, the equipment is not required to be locked behind the Department's secured access but must be under the same roof or in proximity to the Department's laboratory and must meet the Department's requirements including the requirements in test procedures, comparable and consistent test results, safety, efficiency, and accessibility.

2.3.3.5. **Type E Structure.** Provide building as shown on the plans.

3. **MEASUREMENT AND PAYMENT**

The work performed, equipment, utilities, testing equipment as specified for Department use, labor, tools, and incidentals will not be measured or paid for directly, but will be subsidiary to pertinent Items.

Item 505

Truck-Mounted Attenuator (TMA) and Trailer Attenuator (TA)



1. DESCRIPTION

Furnish, operate, maintain, and remove upon completion of work, a truck-mounted attenuator (TMA) or trailer attenuator (TA).

2. MATERIALS

Furnish, operate, and maintain new or used TMAs or TAs. Assure used attenuators are in good working condition and are approved for use. A list of approved TMA and TA units can be found on the Department's Compliant Work Zone Traffic Control Devices List. The host vehicle for the TMA and TA must weigh at least 19,000 lb. Host vehicles may be ballasted to achieve the required weight. Any weight added to the host vehicle must be properly attached to or contained within the vehicle so that the weight does not present a hazard and that proper energy dissipation occurs if the attenuator is impacted from behind. The weight of a TA will not be considered in the weight of the host vehicle, but the weight of a TMA may be included in the weight of the host vehicle. Upon request, provide either a manufacturer's curb weight or a certified scale weight ticket to the Engineer.

3. CONSTRUCTION

Place or relocate TMAs or TAs as shown on the plans or as directed. The plans show the number of TMAs or TAs required, the number of days or hours, and for which construction phases.

4. MEASUREMENT

- 4.1. **Truck-Mounted Attenuator or Trailer Attenuator (Stationary).** This Item will be measured by the day. TMAs or TAs must be set up in a work area and operational before a calendar day can be considered measurable. A day will be measured for each TMA or TA set up and operational on the worksite.
- 4.2. **Truck-Mounted Attenuator or Trailer Attenuator (Mobile Operation).** This Item will be measured by the hour or by the day. The time begins once the TMA or TA is ready for operation at the predetermined site and stops when notified by the Engineer. When measurement by the hour is specified, at least 4 hr. will be paid each day for each operating TMA or TA used in a mobile operation. When measurement by the day is specified, a day will be measured for each TMA or TA set up and operational on the worksite.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Truck-Mounted Attenuators/Trailer Attenuators (Stationary)" or "Truck-Mounted Attenuators/Trailer Attenuators (Mobile Operation)." This price is full compensation for furnishing TMA or TA; setup; relocating; removing; operating; fuel; and equipment, materials, tools, labor, and incidentals. Reimbursement for the repair of damaged devices will be in accordance with Section 7.17.1., "Reimbursable Repair."

Item 506

Temporary Erosion, Sedimentation, and Environmental Controls



1. DESCRIPTION

Install, maintain, and remove erosion, sedimentation, and environmental control measures to prevent or reduce the discharge of pollutants and protect environmental resources in accordance with the Stormwater Pollution Prevention Plan (SWP3) and environmental layout shown on the plans. Comply with Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit (CGP) TXR150000 requirements. Control measures are defined as Best Management Practices (BMPs) used to prevent or reduce the discharge of pollutants and measures to protect environmental resources. Control measures include, but are not limited to, rock filter dams, temporary pipe slope drains, temporary paved flumes, construction exits, earthwork for erosion control, pipe, construction perimeter fence, sandbags, temporary sediment control fence, biodegradable erosion control logs, vertical tracking, temporary or permanent seeding, and other measures. Erosion and sediment control devices must be selected from the Erosion Control Approved Products List. Perform work in a manner to prevent degradation of receiving waters, protect environmental resources, facilitate project construction, and comply with applicable federal, state, and local regulations. Ensure the installation and maintenance of control measures are performed in conformance with the manufacturer's or designer's specifications.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 161, "Compost"
- Item 432, "Riprap"
- Item 556, "Pipe Underdrains"

2.1. Rock Filter Dams.

2.1.1. **Aggregate.** Furnish aggregate with approved hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding. Provide the following.

- **Types 1, 2, and 4 Rock Filter Dams.** Use 3–6-in. aggregate.
- **Type 3 Rock Filter Dams.** Use 4–8-in. aggregate.

2.1.2. **Wire.** Provide minimum 20-gauge galvanized wire for the steel wire mesh and tie wires for Types 2 and 3 rock filter dams. Type 4 dams require:

- a double-twisted, hexagonal weave with a nominal mesh opening of 2-1/2 × 3-1/4 in.,
- minimum 0.0866-in. steel wire for netting,
- minimum 0.1063-in. steel wire for selvages and corners, and
- minimum 0.0866 in. for binding or tie wire.

2.1.3. **Sandbag Material.** Furnish sandbags meeting Section 506.2.8., "Sandbags," except that any gradation of aggregate may be used to fill the sandbags.

2.2. **Temporary Pipe Slope Drains.** Provide corrugated metal pipe, polyvinyl chloride (PVC) pipe, flexible tubing, watertight connection bands, grommet materials, prefabricated fittings, and flared entrance sections as shown on the plans. Recycled and other materials meeting these requirements are allowed if approved.

Furnish concrete in accordance with Item 432.

- 2.3. **Temporary Paved Flumes.** Furnish asphalt concrete, hydraulic cement concrete, or other comparable non-erodible material as shown on the plans. Provide rock or rubble with a minimum diameter of 6 in. and a maximum volume of 1/2 cu. ft. for the construction of energy dissipaters.
- 2.4. **Construction Exits.** Provide materials as shown on the plans and in accordance with this Section.
- 2.4.1. **Rock Construction Exit.** Provide crushed aggregate for long- and short-term construction exits. Furnish aggregates that are clean, hard, durable, and free of adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft or flaky materials, and organic and injurious matter. Use 4–8-in. aggregate for Type 1. Use 2–4-in. aggregate for Type 3.
- 2.4.2. **Timber Construction Exit.** Furnish No. 2 quality or better railroad ties and timbers for long-term construction exits, free of large and loose knots and treated to control rot. Fasten timbers using nuts and bolts or lag bolts, of at least 1/2 in. diameter, unless otherwise shown on the plans or allowed. Provide plywood or pressed wafer board at least 1/2 in. thick for short-term exits.
- 2.4.3. **Foundation Course.** Provide a foundation course consisting of flexible base, bituminous concrete, hydraulic cement concrete, or other materials as shown on the plans or directed.
- 2.5. **Embankment for Erosion Control.** Provide rock, loam, clay, topsoil, or other earth materials that will form a stable embankment to meet the intended use.
- 2.6. **Pipe.** Provide pipe outlet material in accordance with Item 556 and as shown on the plans.
- 2.7. **Construction Perimeter Fence.**
- 2.7.1. **Posts.** Provide essentially straight wood or steel posts that are at least 60 in. long. Furnish soft wood posts with a minimum diameter of 3 in. or use nominal 2 × 4-in. boards. Furnish hardwood posts with a minimum cross-section of 1-1/2 × 1-1/5 in. Furnish T- or L-shaped steel posts with a minimum weight of 1.25 lb. per foot.
- 2.7.2. **Fence.** Provide orange construction fencing as approved.
- 2.7.3. **Fence Wire.** Provide 14-gauge or larger galvanized smooth or twisted wire. Provide 16-gauge or larger tie wire.
- 2.7.4. **Flagging.** Provide brightly colored flagging that is fade-resistant and at least 3/4 in. wide to provide maximum visibility both day and night.
- 2.7.5. **Staples.** Provide staples with a crown at least 1/2 in. wide and legs at least 1/2 in. long.
- 2.7.6. **Used Materials.** Previously used materials meeting the applicable requirements may be used if approved.
- 2.8. **Sandbags.** Provide sandbag material of polypropylene, polyethylene, or polyamide woven fabric with a minimum unit weight of 4 oz. per square yard, a Mullen burst-strength exceeding 300 psi, and an ultraviolet (UV) stability exceeding 70%.
- Use natural coarse sand or manufactured sand meeting the gradation shown in Table 1 to fill sandbags. Filled sandbags must be 24–30 in. long, 16–18 in. wide, and 6–8 in. thick.

**Table 1
Sand Gradation**

Sieve Size	Retained (% by Weight)
#4	Maximum 3%
#100	Minimum 80%
#200	Minimum 95%

Aggregate may be used instead of sand for situations where sandbags are not adjacent to traffic. The aggregate size must not exceed 3/8 in.

- 2.9. **Temporary Sediment Control Fence.** Provide a net-reinforced fence using woven geotextile fabric. Logos visible to the traveling public will not be allowed.
 - 2.9.1. **Fabric.** Provide fabric materials in accordance with [DMS-6230](#), “Temporary Sediment Control Fence Fabric.”
 - 2.9.2. **Posts.** Provide essentially straight wood or steel posts with a minimum length of 48 in., unless otherwise shown on the plans. Furnish soft wood posts at least 3 in. in diameter or use nominal 2 × 4-in. boards. Furnish hardwood posts with a minimum cross-section of 1-1/2 × 1-1/2 in. Furnish T- or L-shaped steel posts with a minimum weight of 1.25 lb. per foot.
 - 2.9.3. **Net Reinforcement.** Provide net reinforcement of at least 12.5-gauge (Standard Wire Gauge) galvanized welded wire mesh, with a maximum opening size of 2 × 4 in., at least 24 in. wide, unless otherwise shown on the plans.
 - 2.9.4. **Staples.** Provide staples with a crown at least 3/4 in. wide and legs 1/2 in. long.
 - 2.9.5. **Used Materials.** Use recycled material meeting the applicable requirements if approved.
- 2.10. **Biodegradable Erosion Control Logs.**
 - 2.10.1. **Core Material.** Furnish core material that is biodegradable or recyclable. Use compost, mulch, aspen excelsior wood fibers, chipped site vegetation, agricultural rice or wheat straw, coconut fiber, 100% recyclable fibers, or any other acceptable material unless specifically shown on the plans. Permit no more than 5% of the material to escape from the containment mesh. Furnish compost in accordance with Item 161.
 - 2.10.2. **Containment Mesh.** Furnish containment mesh that is 100% biodegradable, photodegradable, or recyclable, such as burlap, twine, UV photodegradable plastic, polyester, or any other acceptable material.

Furnish biodegradable or photodegradable containment mesh when log will remain in place as part of a vegetative system.

Furnish recyclable containment mesh for temporary installations.
 - 2.10.3. **Size.** Furnish biodegradable erosion control logs with diameters as shown on the plans or as directed. Stuff containment mesh densely so logs do not deform.

3. QUALIFICATIONS, TRAINING, AND EMPLOYEE REQUIREMENTS

- 3.1. **Contractor Responsible Person Environmental (CRPE) Qualifications and Responsibilities.** Provide and designate in writing at the preconstruction conference a CRPE and alternate CRPE who have overall responsibility for managing environmental compliance. The CRPE will implement stormwater and erosion control practices, oversee and observe stormwater control measure monitoring and management, oversee environmental compliance requirements, and monitor the project site daily and produce daily monitoring reports as long as there are BMPs in place or soil disturbing activities are evident to ensure compliance with the SWP3 and TPDES CGP TXR150000. Take required training in accordance with Section 7.7.4.4, “Training.”

Maintain daily monitor reports and make them available within 24 hr. upon request. During time suspensions when work is not occurring or on Contract non-work days, daily inspections are not required unless a rain event has occurred. The CRPE will provide recommendations on how to improve the effectiveness of control measures. Attend the Department's preconstruction conference for the project.

Ensure training is completed in accordance with Section 7.7.4.4., "Training," by all applicable personnel before employees work on the project. Document, maintain, and make available within 24 hr. of a request, a list, signed by the CRPE, of all applicable Contractor and subcontractor employees who have completed the training. Include the employee's name, the training course name, and the date the employee completed the training.

- 3.2. **Contractor Superintendent Qualifications and Responsibilities.** Provide a superintendent who is competent, has experience with and knowledge of stormwater management, and is knowledgeable of the requirements and the conditions of the TPDES CGP TXR150000. The superintendent will manage and oversee the day-to-day operations and activities at the project site, work with the CRPE to provide effective stormwater management at the project site, represent and act on behalf of the Contractor, and attend the Department's preconstruction conference for the project. Take training as required in Section 7.7.4.4., "Training."

4. CONSTRUCTION

- 4.1. **Contractor Responsibilities.** Implement the SWP3 for the project site in accordance with the plans and specifications, TPDES CGP TXR150000, and as directed. Coordinate stormwater management with all other work on the project. Develop and implement an SWP3 for project-specific material supply plants within and outside the Department's right of way in conformance with the specific or general stormwater permit requirements. Prevent water pollution from stormwater associated with construction activity from entering any surface water or private property on or adjacent to the project site.
- 4.2. **Implementation.** The CRPE, or alternate CRPE, must be accessible by telephone and able to respond to project-related stormwater management or other environmental emergencies 24 hr. per day.
- 4.2.1. **Commencement.** Implement the SWP3 as shown on the plans and as directed. Contractor-proposed recommendations for changes will be allowed as approved. Conform to the established guidelines in the TPDES CGP TXR150000 to make changes. Do not implement changes until approval has been received and changes have been incorporated into the plans. Minor adjustments to meet field conditions are allowed and will be recorded in the SWP3.
- 4.2.2. **Phasing.** Implement control measures before the commencement of activities that result in soil disturbance. Phase and minimize the soil disturbance to the areas shown on the plans. Coordinate temporary control measures with permanent control measures and all other work activities on the project to assure economical, effective, safe, and continuous water pollution prevention. Provide control measures that are appropriate to the construction means, methods, and sequencing allowed by the Contract. Exercise precaution throughout the life of the project to prevent pollution of ground waters and surface waters. Schedule and perform clearing and grubbing operations so that stabilization measures will follow immediately thereafter if project conditions permit. Bring all grading sections to final grade as soon as possible and implement temporary and permanent control measures at the earliest time possible. Implement temporary control measures when required by TPDES CGP TXR150000 or otherwise necessitated by project conditions.
- Do not prolong final grading and shaping. Preserve vegetation where possible throughout the project, and minimize clearing, grubbing, and excavation within stream banks, bed, and approach sections.
- 4.3. **General.**
- 4.3.1. **Temporary Alterations or Control Measure Removal.** Altering or removal of control measures is allowed when control measures are restored within the same working day.

- 4.3.2. **Stabilization.** Initiate stabilization for disturbed areas no more than 14 days after the construction activities in that portion of the site have temporarily or permanently ceased. Establish a uniform vegetative cover or use another stabilization practice in accordance with TPDES CGP TXR150000.
- 4.3.3. **Finished Work.** Remove and dispose of all temporary control measures upon acceptance of vegetative cover or other stabilization practice unless otherwise directed. Complete soil disturbing activities and establish a uniform perennial vegetative cover. A project will not be considered for acceptance until a vegetative cover of 70% density of existing adjacent undisturbed areas is obtained or equivalent permanent stabilization is obtained in accordance with TPDES CGP TXR150000. The Engineer may accept the work before vegetative cover of 70% density of existing adjacent undisturbed areas. An exception will be allowed in arid areas as defined in TPDES CGP TXR150000.
- 4.3.4. **Restricted Activities and Required Precautions.** Do not discharge onto the ground or into surface waters any pollutants such as chemicals, raw sewage, fuels, lubricants, coolants, hydraulic fluids, bitumens, or any other petroleum product. Operate and maintain equipment onsite to prevent actual or potential water pollution. Manage, control, and dispose of litter onsite such that no adverse impacts to water quality occur. Prevent dust from creating a potential or actual unsafe condition, public nuisance, or condition endangering the value, utility, or appearance of any property. Wash out concrete trucks only as described in TPDES CGP TXR150000. Use appropriate controls to minimize the offsite transport of suspended sediments and other pollutants if it is necessary to pump or channel standing water (i.e., dewatering). Immediately address chemical and hydrocarbon spills caused by the Contractor. Keep a spill kit onsite. Prevent discharges that would contribute to a violation of Edwards Aquifer Rules, water quality standards, the impairment of a listed water body, or other state or federal law.
- 4.4. **Installation, Maintenance, and Removal Work.** Perform work in accordance with the SWP3, in conformance with manufacturers' guidelines, and in accordance with TPDES CGP TXR150000. Install and maintain the integrity of temporary erosion and sedimentation control devices to accumulate silt and debris until soil disturbing activities are completed and permanent erosion control features are in place, or the disturbed area has been adequately stabilized as approved.

The Department will inspect and document the condition of the control measures at the frequency shown on the plans and will provide the Construction SWP3 Field Inspection and Maintenance Reports to the Contractor. Make corrections as soon as possible before the next anticipated rain event or within 7 calendar days after being able to enter the worksite for each control measure. The only acceptable reason for not accomplishing the corrections within the timeframe specified is when site conditions are considered "too wet to work." Take immediate action if a correction is deemed critical as directed. When corrections are not made within the established timeframe, all work will cease on the project and time charges will continue while the control measures are brought into compliance. Commence work once the Engineer reviews and documents the project is in compliance. Commencing work does not release the Contractor of the liability for noncompliance with the SWP3, the plans, or TPDES CGP TXR150000.

The Engineer may limit the disturbed area if the Contractor cannot control soil erosion and sedimentation resulting from the Contractor's operations. Implement additional controls as directed.

Remove devices upon approval or as directed. Finish-grade and dress the area upon removal. Stabilize disturbed areas in accordance with TPDES CGP TXR150000, and as shown on the plans or directed. Materials removed are considered consumed by the project. Retain ownership of stockpiled material and remove it from the project when new installations or replacements are no longer required.

- 4.4.1. **Rock Filter Dams for Erosion Control.** Remove trees, brush, stumps, and other objectionable material that may interfere with the construction of rock filter dams. Place sandbags as a foundation when required or at the Contractor's option.

Place the aggregate to the lines, height, and slopes specified, without undue voids for Types 1, 2, 3, and 5. Place the aggregate on the mesh and then fold the mesh at the upstream side over the aggregate and secure it to itself on the downstream side using wire ties, or hog rings for Type 2 and Type 3, or as directed.

Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed. Construct filter dams in accordance with the following criteria unless otherwise shown on the plans.

- 4.4.1.1. **Type 1 (Non-Reinforced).**
- **Height.** At least 18 in. measured vertically from existing ground to top of filter dam.
 - **Top Width.** At least 2 ft.
 - **Slopes.** No steeper than 2:1.
- 4.4.1.2. **Type 2 (Reinforced).**
- **Height.** At least 18 in. measured vertically from existing ground to top of filter dam.
 - **Top Width.** At least 2 ft.
 - **Slopes.** No steeper than 2:1.
- 4.4.1.3. **Type 3 (Reinforced).**
- **Height.** At least 36 in. measured vertically from existing ground to top of filter dam.
 - **Top Width.** At least 2 ft.
 - **Slopes.** No steeper than 2:1.
- 4.4.1.4. **Type 4 (Sack Gabions).** Unfold sack gabions and smooth out kinks and bends. Connect the sides by lacing in a single-loop-double-loop pattern on 4–5-in. spacing for vertical filling. Pull the end lacing rod at one end until tight, wrap around the end, and twist four times. Fill with stone at the filling end, pull the rod tight, cut the wire with approximately 6 in. remaining, and twist wires four times.
- Place the sack flat in a filling trough, fill with stone, connect sides, and secure ends as described above for horizontal filling.
- Lift and place without damaging the gabion. Shape sack gabions to existing contours.
- 4.4.1.5. **Type 5.** Provide rock filter dams as shown on the plans.
- 4.4.2. **Temporary Pipe Slope Drains.** Install pipe with a slope as shown on the plans or as directed. Construct embankment for the drainage system in 8-in. lifts to the required elevations. Hand-tamp the soil around and under the entrance section to the top of the embankment as shown on the plans or as directed. Form the top of the embankment or earth dike over the pipe slope drain at least 1 ft. higher than the top of the inlet pipe at all points. Secure the pipe with hold-downs or hold-down grommets spaced at most 10 ft. on center. Construct the energy dissipaters or sediment traps as shown on the plans or as directed. Construct the sediment trap using concrete or rubble riprap in accordance with Item 432, when shown on the plans.
- 4.4.3. **Temporary Paved Flumes.** Construct paved flumes as shown on the plans or as directed. Provide excavation and embankment (including compaction of the subgrade) of material to the dimensions shown on the plans unless otherwise indicated. Install a rock or rubble riprap energy dissipater, constructed from the materials specified above, to a minimum depth of 9 in. at the flume outlet to the limits shown on the plans or as directed.
- 4.4.4. **Construction Exits.** Prevent traffic from crossing or exiting the construction site or moving directly onto a public roadway, alley, sidewalk, parking area, or other right of way areas other than at the location of construction exits when tracking conditions exist. Construct exits for either long- or short-term use.
- 4.4.4.1. **Long-Term.** Place the exit over a foundation course as required. Grade the foundation course or compacted subgrade to direct runoff from the construction exits to a sediment trap as shown on the plans or as directed. Construct exits with a width of at least 14 ft. for one-way and 20 ft. for two-way traffic for the full width of the exit, or as directed.
- 4.4.4.1.1. **Type 1.** Construct to a depth of at least 8 in. using crushed aggregate as shown on the plans or as directed.

- 4.4.4.1.2. **Type 2.** Construct using railroad ties and timbers as shown on the plans or as directed.
- 4.4.4.2. **Short-Term.**
- 4.4.4.2.1. **Type 3.** Construct using crushed aggregate, plywood, or wafer board. This type of exit may be used for daily operations where long-term exits are not practical.
- 4.4.4.2.2. **Type 4.** Construct as shown on the plans or as directed.
- 4.4.5. **Earthwork for Erosion Control.** Perform excavation and embankment operations to minimize erosion and to remove collected sediments from other erosion control devices.
- 4.4.5.1. **Excavation and Embankment for Erosion Control Features.** Place earth dikes, swales, or combinations of both along the low crown of daily lift placement, or as directed, to prevent runoff spillover. Place swales and dikes at other locations as shown on the plans or as directed to prevent runoff spillover or to divert runoff. Construct cuts with the low end blocked with undisturbed earth to prevent erosion of hillsides. Construct sediment traps at drainage structures in conjunction with other erosion control measures as shown on the plans or as directed.
- Create a sediment basin, where required, providing 3,600 cu. ft. of storage per acre drained, or equivalent control measures for drainage locations that serve an area with 10 or more disturbed acres at one time, not including offsite areas.
- 4.4.5.2. **Excavation of Sediment and Debris.** Remove sediment and debris when accumulation affects the performance of the devices, after a rain, and when directed.
- 4.4.6. **Construction Perimeter Fence.** Construct, align, and locate fencing as shown on the plans or as directed.
- 4.4.6.1. **Installation of Posts.** Embed posts 18 in. deep or adequately anchor in rock, with a spacing of 8–10 ft.
- 4.4.6.2. **Wire Attachment.** Attach the top wire to the posts at least 3 ft. from the ground. Attach the lower wire midway between the ground and the top wire.
- 4.4.6.3. **Flag Attachment.** Attach flagging to both wire strands midway between each post. Use flagging at least 18 in. long. Tie flagging to the wire using a square knot.
- 4.4.7. **Sandbags for Erosion Control.** Construct a berm or dam of sandbags that will intercept sediment-laden stormwater runoff from disturbed areas, create a retention pond, detain sediment, and release water in sheet flow. Fill each bag with sand so that at least the top 6 in. of the bag is unfilled to allow for proper tying of the open end. Place the sandbags with their tied ends in the same direction. Offset subsequent rows of sandbags 1/2 the length of the preceding row. Place a single layer of sandbags downstream as a secondary debris trap. Place additional sandbags as necessary or as directed for supplementary support to berms or dams of sandbags or earth.
- 4.4.8. **Temporary Sediment Control Fence.** Provide temporary sediment control fence near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the fence into erosion control measures used to control sediment in areas of higher flow. Install the fence as shown on the plans, in accordance with this Section, or as directed.
- 4.4.8.1. **Installation of Posts.** Embed posts at least 18 in. deep or adequately anchor, if in rock, with a spacing of 6–8 ft., and install on a slight angle toward the runoff source.
- 4.4.8.2. **Fabric Anchoring.** Dig trenches along the uphill side of the fence to anchor 6–8 in. of fabric. Provide a minimum trench cross-section of 6 × 6 in. Place the fabric against the side of the trench and align approximately 2 in. of fabric along the bottom in the upstream direction. Backfill the trench, then hand-tamp.

- 4.4.8.3. **Fabric and Net Reinforcement Attachment.** Attach the reinforcement to wooden posts using staples, or to steel posts using T-clips, in at least four places equally spaced unless otherwise shown on the plans. Sewn vertical pockets may be used to attach reinforcement to end posts. Fasten the fabric to the top strand of reinforcement using hog rings or cord every 15 in. or less.
- 4.4.8.4. **Fabric and Net Splices.** Locate splices at a fence post with a minimum lap of 6 in. attached in at least six places equally spaced unless otherwise shown on the plans. Do not locate splices in concentrated flow areas.
- Requirements for installation of used temporary sediment control fence include the following:
- fabric with minimal or no visible signs of biodegradation (weak fibers),
 - fabric without excessive patching (more than one patch every 15–20 ft.),
 - posts without bends, and
 - backing without holes.
- 4.4.9. **Biodegradable Erosion Control Logs.** Install biodegradable erosion control logs near the downstream perimeter of a disturbed area to intercept sediment from sheet flow. Incorporate the biodegradable erosion control logs into the erosion measures used to control sediment in areas of higher flow. Install, align, and locate the biodegradable erosion control logs as specified below, as shown on the plans, or as directed.
- Secure biodegradable erosion control logs in a method adequate to prevent displacement resulting from normal rain events, to prevent damage to the logs, and as approved, such that flow is not allowed under the logs. Temporarily removing and replacing biodegradable erosion logs to facilitate daily work is allowed at the Contractor's expense.
- 4.4.10. **Vertical Tracking.** Perform vertical tracking on slopes to temporarily stabilize soil. Provide equipment with a track undercarriage capable of producing a linear soil impression measuring at least 12 in. long × 2–4 in. wide × 1/2–2 in. deep. Do not exceed 12 in. between track impressions. Install continuous linear track impressions where the 12-in. length impressions are perpendicular to the slope. Vertical tracking is required on projects where soil disturbing activities have occurred, unless otherwise approved.
- 4.5. **Monitoring and Documentation.** Monitor the control measures daily as long as there are BMPs in place or soil disturbing activities are evident to ensure compliance with the SWP3 and TPDES CGP TXR150000. During time suspensions when work is not occurring or contract non-work days, daily inspections are not required unless a rain event has occurred. Monitoring will consist of, but is not limited to, observing, inspecting, and documenting site locations with control measures and discharge points to provide maintenance and inspection of controls in accordance with the SWP3. Keep written records of daily monitoring. Document in the daily monitoring report the control measure condition, the date of inspection, required corrective actions, the responsible person for making the corrections, and the date corrective actions were completed. Maintain records of all monitoring reports at the project site or at an approved place. Provide copies within 7 days. Together, the CRPE and an Engineer's representative will complete the Construction Stage Gate Checklist periodically as directed.

5. MEASUREMENT

- 5.1. **Rock Filter Dams.** Installation or removal of rock filter dams will be measured by the foot or by the cubic yard. The measured volume will include sandbags, when used.
- 5.1.1. **Linear Measurement.** When rock filter dams are measured by the foot, measurement will be along the centerline of the top of the dam.
- 5.1.2. **Volume Measurement.** When rock filter dams are measured by the cubic yard, measurement will be based on the volume of rock computed by the method of average end areas.
- 5.1.2.1. **Installation.** Measurement will be made in final position.

- 5.1.2.2. **Removal.** Measurement will be made at the point of removal.
- 5.2. **Temporary Pipe Slope Drains.** Temporary pipe slope drains will be measured by the foot.
- 5.3. **Temporary Paved Flumes.** Temporary paved flumes will be measured by the square yard of surface area. The measured area will include the energy dissipater at the flume outlet.
- 5.4. **Construction Exits.** Construction exits will be measured by the square yard of surface area.
- 5.5. **Earthwork for Erosion and Sediment Control.**
- 5.5.1. **Equipment and Labor Measurement.** Equipment and labor used will be measured by the actual number of hours the equipment is operated and the labor is engaged in the work.
- 5.5.2. **Volume Measurement.**
- 5.5.2.1. **In Place.**
- 5.5.2.1.1. **Excavation.** Excavation will be measured by the cubic yard in its original position and the volume computed by the method of average end areas.
- 5.5.2.1.2. **Embankment.** Embankment will be measured by the cubic yard in its final position by the method of average end areas. The volume of embankment will be determined between:
- the original ground surfaces or the surface upon which the embankment is to be constructed for the feature and
 - the lines, grades, and slopes of the accepted embankment for the feature.
- 5.5.2.2. **In Vehicles.** Excavation and embankment quantities will be combined and paid for under "Earthwork (Erosion and Sediment Control, In Vehicle)." Excavation will be measured by the cubic yard in vehicles at the point of removal. Embankment will be measured by the cubic yard in vehicles measured at the point of delivery. Shrinkage or swelling factors will not be considered in determining the calculated quantities.
- 5.6. **Construction Perimeter Fence.** Construction perimeter fence will be measured by the foot.
- 5.7. **Sandbags for Erosion Control.** Sandbags will be measured as each sandbag or by the foot along the top of sandbag berms or dams.
- 5.8. **Temporary Sediment Control Fence.** Installation or removal of temporary sediment control fence will be measured by the foot.
- 5.9. **Biodegradable Erosion Control Logs.** Installation or removal of biodegradable erosion control logs will be measured by the foot along the centerline of the top of the control logs.
- 5.10. **Vertical Tracking.** Vertical tracking will not be measured or paid for directly, but will be subsidiary to this Item.

6. PAYMENT

The following will not be paid for directly, but will be subsidiary to pertinent Items:

- erosion control measures for Contractor project-specific locations (PSLs) inside and outside the right of way (e.g., construction and haul roads, field offices, equipment and supply areas, plants, and material sources);
- removal of litter, unless a separate pay item is shown on the plans;
- repair to devices and features damaged by Contractor operations;

- added measures and maintenance needed due to negligence, carelessness, lack of maintenance, and failure to install permanent controls;
- removal and reinstallation of devices and features needed for the convenience of the Contractor;
- finish grading and dressing upon removal of the device; and
- minor adjustments including but not limited to plumbing posts, reattaching fabric, minor grading to maintain slopes on an erosion embankment feature, or moving small numbers of sandbags.

Stabilization of disturbed areas will be paid for under pertinent Items except vertical tacking, which will be subsidiary.

Furnishing and installing pipe for outfalls associated with sediment traps and ponds will not be paid for directly, but will be subsidiary to the excavation and embankment under this Item.

6.1. **Rock Filter Dams.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows.

6.1.1. **Installation.** Installation will be paid for as "Rock Filter Dams (Install)" of the type and slope as specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

6.1.2. **Removal.** Removal will be paid for as "Rock Filter Dams (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.

When the Engineer directs that the rock filter dam installation or portions thereof be replaced, payment will be made at the unit price bid for "Rock Filter Dams (Remove)" and for "Rock Filter Dams (Install)" of the type specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.

6.2. **Temporary Pipe Slope Drains.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Pipe Slope Drains" of the size specified. This price is full compensation for furnishing materials, removal and disposal, furnishing and operating equipment, labor, tools, and incidentals.

Removal of temporary pipe slope drains will not be paid for directly, but will be subsidiary to the installation Item. When the Engineer directs that the pipe slope drain installation or portions thereof be replaced, payment will be made at the unit price bid for "Temporary Pipe Slope Drains" of the size specified, which is full compensation for the removal and reinstallation of the pipe drain.

Earthwork required for the pipe slope drain installation, including construction of the sediment trap, will be measured and paid for under "Earthwork for Erosion and Sediment Control."

Riprap concrete or stone, when used as an energy dissipater or as a stabilized sediment trap, will be measured and paid for in accordance with Item 432.

6.3. **Temporary Paved Flumes.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Temporary Paved Flume (Install)" or "Temporary Paved Flume (Remove)." This price is full compensation for furnishing and placing materials, removal and disposal, equipment, labor, tools, and incidentals.

When the Engineer directs that the paved flume installation or portions thereof be replaced, payment will be made at the unit prices bid for "Temporary Paved Flume (Remove)" and "Temporary Paved Flume (Install)." These prices are full compensation for the removal and replacement of the paved flume and for equipment, labor, tools, and incidentals.

Earthwork required for the paved flume installation, including construction of a sediment trap, will be measured and paid for under "Earthwork for Erosion and Sediment Control."

- 6.4. **Construction Exits.** Contractor-required construction exits from off right of way locations or on right of way PSLs will not be paid for directly, but will be subsidiary to pertinent Items.

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" for construction exits needed on right of way access to work areas required by the Department will be paid for at the unit price bid for "Construction Exits (Install)" of the type specified or "Construction Exits (Remove)." This price is full compensation for furnishing and placing materials, excavating, removal and disposal, cleaning vehicles, labor, tools, and incidentals.

When the Engineer directs that a construction exit or portion thereof be removed and replaced, payment will be made at the unit prices bid for "Construction Exit (Remove)" and "Construction Exit (Install)" of the type specified. These prices are full compensation for the removal and replacement of the construction exit and for equipment, labor, tools, and incidentals.

Construction of sediment traps used in conjunction with the construction exit will be measured and paid for under "Earthwork for Erosion and Sediment Control."

- 6.5. **Earthwork for Erosion and Sediment Control.**

- 6.5.1. **Initial Earthwork for Erosion and Sediment Control.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Excavation (Erosion and Sediment Control, In Place)," "Embankment (Erosion and Sediment Control, In Place)," "Excavation (Erosion and Sediment Control, In Vehicle)," "Embankment (Erosion and Sediment Control, (In Vehicle)," or "Earthwork (Erosion and Sediment Control, In Vehicle)."

This price is full compensation for excavation and embankment, including hauling; disposal of material not used elsewhere on the project; embankments including furnishing material from approved sources and construction of erosion control features; and equipment, labor, tools, and incidentals.

Sprinkling and rolling required by this Item will not be paid for directly, but will be subsidiary to this Item.

- 6.5.2. **Maintenance Earthwork for Erosion and Sediment Control for Cleaning and Restoring Control Measures.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid under a Contractor Force Account Item from invoice provided to the Engineer.

This price is full compensation for excavation, embankment, and re-grading, including dewatering for removal of accumulated sediment, and the removal of accumulated sediment in various erosion control installations as directed, hauling, and disposal of material not used elsewhere on the project; excavation for construction of erosion control features; embankments, including furnishing material from approved sources and construction of erosion control features; and equipment, labor, tools, and incidentals.

Earthwork needed to remove and obliterate erosion control features will not be paid for directly, but will be subsidiary to pertinent Items unless otherwise shown on the plans.

Sprinkling and rolling required by this Item will not be paid for directly, but will be subsidiary to this Item.

- 6.6. **Construction Perimeter Fence.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Construction Perimeter Fence." This price is full compensation for furnishing and placing the fence; digging, fence posts, wire, and flagging; removal and disposal; and materials, equipment, labor, tools, and incidentals.

Removal of construction perimeter fence will not be paid for directly, but will be subsidiary to the installation Item. When the Engineer directs that the perimeter fence installation or portions thereof be removed and replaced, payment will be made at the unit price bid for "Construction Perimeter Fence," which is full compensation for the removal and reinstallation of the construction perimeter fence.

- 6.7. **Sandbags for Erosion Control.** Sandbags will be paid for at the unit price bid for "Sandbags for Erosion Control" (of the height specified when measurement is by the foot). This price is full compensation for materials, placing sandbags, removal and disposal, equipment, labor, tools, and incidentals.
- Removal of sandbags will not be paid for directly, but will be subsidiary to the installation Item. When the Engineer directs that the sandbag installation or portions thereof be replaced, payment will be made at the unit price bid for "Sandbags for Erosion Control," which is full compensation for the reinstallation of the sandbags.
- 6.8. **Temporary Sediment Control Fence.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows.
- 6.8.1. **Installation.** Installation will be paid for as "Temporary Sediment-Control Fence (Install)." This price is full compensation for furnishing and operating equipment, finish backfill and grading, lacing, proper disposal, labor, materials, tools, and incidentals.
- 6.8.2. **Removal.** Removal will be paid for as "Temporary Sediment-Control Fence (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.
- 6.9. **Biodegradable Erosion Control Logs.** The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows.
- 6.9.1. **Installation.** Installation will be paid for as "Biodegradable Erosion Control Logs (Install)" of the size specified. This price is full compensation for furnishing and operating equipment, finish backfill and grading, staking, proper disposal, labor, materials, tools, and incidentals.
- 6.9.2. **Removal.** Removal will be paid for as "Biodegradable Erosion Control Logs (Remove)." This price is full compensation for furnishing and operating equipment, proper disposal, labor, materials, tools, and incidentals.
- 6.10. **Vertical Tracking.** Vertical tracking will not be measured or paid for directly, but will be subsidiary to this Item.

Item 508

Constructing Detours



1. DESCRIPTION

Construct and maintain detours. Remove detours unless otherwise directed or shown on the plans.

2. MATERIALS

2.1. **Embankment.** Use roadway excavation for embankment material or use material from other approved sources.

2.2. **Temporary Drainage Pipe.** Furnish pipe required for temporary drainage as shown on the plans or as directed. Pipe will become the property of the Contractor upon removal.

Temporary use of permanent pipe is allowable if the sequence of work permits. If pipe used temporarily is damaged such that it is not acceptable in conformance with applicable Items, it will not be acceptable for incorporation in the final project. The damaged pipe remains the property of the Contractor.

2.3. **Base and Surfacing.** Furnish base and surfacing materials in conformance with Items as shown on the plans.

3. CONSTRUCTION

Construct the detour at the locations and to the lines, grades, and typical sections shown on the plans or as directed, in conformance with pertinent Items.

Maintain detours for public travel in a safe and passable condition. Public traffic safety and convenience are essential. Maintain detours in accordance with Section 7.2.4., "Public Safety and Convenience"; Article 7.17., "Contractor's Responsibility for Work"; Section 7.17.4., "Detours"; and this Item.

Remove detours after they are no longer needed for traffic. Removed materials will become the property of the Contractor unless otherwise shown on the plans or directed. Dispose of the materials off the right of way, unless otherwise directed, in conformance with federal, state, and local requirements. If desired, dispose of materials by spreading along the adjacent roadway slopes if allowed. Salvage or stockpile in conformance with pertinent Items if embankment, base, or surfacing is to be reused within the roadway construction or stockpiled for future use.

4. MEASUREMENT

This Item will be measured by the square yard of pavement area, or surface area if not paved.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Constructing Detours," for "Constructing Detours by Type" as shown on the plans, or for "Constructing Detours (EBSS)." "Embankment Base Surface Separate (EBSS)" will be used when embankment, base, and surface are paid for separately.

The bid price for "Constructing Detours" or for "Constructing Detours by Type" as shown on the plans is full compensation for furnishing all materials required, including embankment, base, and surfacing; excavation

and hauling of excavated material; sprinkling and compacting; furnishing, installing, and removing drainage structures; removal of detour; disposal of materials; and equipment, labor, tools, and incidentals.

The price bid for "Construction Detours (EBSS)" is full compensation for furnishing, installing, and removing drainage structures; removal of detour; disposal of materials; and equipment, labor, tools, and incidentals, except that embankment, flexible base, and surfacing will be measured and paid for in conformance with other pertinent Items.

Maintenance of detours will be paid for in accordance with Section 7.17.4., "Detours."

When the plans require the base and surfacing to be removed and incorporated in the final roadway or stockpiled after use on the detour, the work will be performed, measured, and paid for in conformance with the pertinent Items shown for salvaging, replacing, or stockpiling materials.

All other Items not specifically addressed in this Article will be paid for under pertinent Items unless otherwise shown on the plans.

Item 510

One-Way Traffic Control



1. DESCRIPTION

Provide one-way traffic control using one of the methods shown on the plans.

2. WORK METHODS

- 2.1. **Flagger Control Method.** Furnish flaggers in accordance with Article 7.2., "Safety," on each approach to the activity area to control traffic. Furnish additional flaggers at all intersections, public driveways, and commercial driveways as determined by the Engineer. Furnish a STOP/SLOW paddle in conformance with the TMUTCD for each flagger. If desired, use automated flagger assistance devices if approved.
- 2.2. **Pilot Car Method.** Furnish a licensed driver and pilot vehicle with required signs attached. Furnish flaggers in accordance with Article 7.2. on each approach to the activity area to control traffic. Furnish additional flaggers at all intersections, public driveways, and commercial driveways as determined by the Engineer. Furnish STOP/SLOW paddles and signs in conformance with the TMUTCD. Instruct drivers to follow the pilot vehicle and to not pass the cars ahead.
- 2.3. **Portable Traffic Signal Method.** Furnish, operate, and maintain new or used portable traffic signal units. Assure used units are in good working condition and are approved before use. Approved units are on the Department's *Compliant Work Zone Traffic Control Device List*. Units will remain the property of the Contractor.

3. MEASUREMENT

When shown on the plans as a bid item, this Item will be measured as follows.

- 3.1. **Flagger Control Method.** By the actual number of hours flaggers are engaged in flagging activities. Each flagger will be measured separately.
- 3.2. **Pilot Car Method.** By the actual number of hours of use for the combination of two flaggers and pilot vehicle. Additional flaggers, when directed by the Engineer, will be measured by the flagger control method.
- 3.3. **Portable Traffic Signal Method.** By the month, including two units operated by a single controller set up and operational on the worksite.

4. PAYMENT

Unless otherwise shown on the plans, the work performed and materials furnished in accordance with this Item will not be paid for directly but will be subsidiary to pertinent Items.

When shown on the plans as a bid item, the work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for the method specified. This price is full compensation for furnishing and operating equipment, pilot car, pilot vehicle driver, flaggers, signs, labor, tools, and incidentals. Payment for "Portable Traffic Signal Units" and "Portable Traffic Signals" is full compensation for the units, setup, relocating, removing, replacing parts, batteries, fuel, oil, and incidentals.

Item 512

Portable Traffic Barrier



1. DESCRIPTION

Furnish, install, move, and remove portable traffic barrier.

2. MATERIALS

2.1. Furnished by the Contractor.

2.1.1. **Concrete.** Furnish barrier of the class of concrete shown on the plans and using materials that meet the pertinent requirements of the following Items.

- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 424, "Precast Concrete Structural Members (Fabrication)"
- Item 440, "Reinforcement for Concrete"
- Item 442, "Metal for Structures"

2.1.2. **Steel.** Barrier sections will be furnished when shown on the plans.

2.1.3. **Concrete and Steel.** When barrier is to be furnished and retained by the Contractor, products from non-approved sources or previously used products may be provided if the Contractor submits written certification that the barrier sections and materials substantially conform to the requirements of this Item. The Engineer may approve the use of the product if:

- the barrier sections substantially meet typical cross-section dimension requirements,
- there is no evidence of structural damage such as major spalls or cracks,
- the general condition of both the barrier sections and their connectors is acceptable,
- the barrier is new,
- the barrier is being reused, and
- the applicable crash test criteria in accordance with Item 502, "Barricades, Signs, and Traffic Handling," are met.

2.1.4. **Connection Hardware.** When shown on the plans, provide connection hardware for Department-furnished barrier sections. Provide the type of connection hardware shown on the plans that meets the requirements of Item 442. Connection hardware is defined as being sufficient hardware for one complete connection between two traffic barrier sections, including the required bolts, nuts, washers, structural steel shapes, and dowels. Connection hardware will be retained by the Department unless otherwise shown on the plans.

2.1.5. **Furnished by the Department.** Department-furnished barrier sections will be at a stockpile location or an existing traffic barrier installation shown on the plans. The Department will furnish connection hardware for Department-furnished barrier sections unless otherwise shown on the plans. Connection hardware is defined as being sufficient hardware for one complete connection between two traffic barrier sections, including the required bolts, nuts, washers, structural steel shapes, and dowels.

3. CONSTRUCTION

Notify the Engineer of the location of the casting site and the date on which the work will begin. Multi-project fabrication plants as defined in Item 424 that produce concrete traffic barrier, except temporary barrier

furnished and retained by the Contractor, must be qualified in accordance with [DMS-7350](#), "Qualification Procedure for Multi-Project Fabrication Plants of Precast Concrete Traffic Barrier." See the Department's MPL for approved fabricators. Construct barrier in accordance with Item 420 to the dimensions and cross-sections shown on the plans. Provide forms and cure concrete in accordance with Item 424.

Provide a rough texture to the bottom surface of single-slope or F-shape barriers and to the top of low-profile barriers similar to a wood float finish.

Once concrete has attained sufficient strength to resist stresses due to handling, remove formwork and place barrier sections on blocking in a designated storage area.

Produce precast barrier to the tolerances shown in Table 1 unless otherwise shown on the plans.

**Table 1
Precast Barrier Tolerances**

Dimension	Tolerance
Length	±1 in.
Insert placement	±1/2 in.
Horizontal alignment	±1/8 in. per 10 ft. of length
Deviation of Ends	
Horizontal skew	±1/4 in.
Vertical batter	±1/8 in. per foot of depth

Install the barrier sections as shown on the plans or as directed. For concrete barrier, the areas that require pinning will be shown on the plans. For steel barrier, the acceptable deflection distance will be shown on the plans.

After use, stockpile barrier sections and connection hardware that will be retained by the Department at the location shown on the plans or as otherwise directed. Obtain assembly and installation information for the portable steel traffic barrier from the manufacturer and provide the Engineer with an installation and repair manual specific to the portable steel traffic barrier.

Repair or replace all traffic barrier or connecting hardware damaged by the Contractor's operations at the Contractor's expense.

Repair or replace any pavement damaged in the process of installing, moving, or removing barrier sections at the Contractor's expense.

4. MEASUREMENT

This Item will be measured by the foot based on the nominal lengths of the barrier sections.

When shown on the plans, connection hardware will be measured by each complete connection between two traffic barrier sections for Department-furnished barrier.

When pinning of concrete barrier is shown on the plans, pinning of the barrier will be measured by each pin.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid as follows.

- For concrete barrier only, bid for "Portable Traffic Barrier" of the work category (Furnish and Install, Designated Source, Move, Stockpile, Remove, or Connection Hardware), shape (e.g., Single Slope, F-Shape, or Low Profile) and Type (e.g., 1, 2, or 3) of barrier sections specified. This price includes equipment, labor, tools, and incidentals.

- For concrete and steel barrier, bid for “Portable Traffic Barrier” of the work category (Furnish and Install, Designated Source, Move, Stockpile, or Remove), shape (e.g., Single Slope, F-Shape, or Low Profile) and Type (e.g., 1, 2, or 3) of barrier sections specified, or “Steel.” This price includes equipment, labor, tools, and incidentals.

- 5.1. **Furnish and Install.** This price is full compensation for furnishing and installing barrier sections and connection hardware.
- 5.2. **Designated Source.** This price is full compensation for delivering and installing Department-furnished barrier sections and connection hardware from a designated location.
- 5.3. **Move.** This price is full compensation for moving barrier section installations on the project from one location to another (including disassembly and reassembly costs), moving barrier sections from an installation on the project to a temporary storage area (including disassembly costs), or moving barrier sections from a temporary storage area to an installation site on the project (including assembly costs).
- 5.4. **Stockpile.** This price is full compensation for removing barrier sections and connection hardware from the project and delivering to the Department stockpile area shown on the plans or as directed.
- 5.5. **Remove.** This price is full compensation for removing barrier and connection hardware from the project that are retained by the Contractor.
- 5.6. **Connection Hardware.** This price is full compensation for furnishing and installing connection hardware on Department-furnished barrier sections.
- 5.7. **Pinning.** This price is full compensation for furnishing, installing, and removal of pins for pinned placement of concrete barrier. Pinning of steel barrier will not be paid for directly, but will be subsidiary to pertinent Items.

Item 514

Permanent Concrete Traffic Barrier



1. DESCRIPTION

Construct permanent concrete traffic barrier.

2. MATERIALS

Furnish new barrier using materials that meet the pertinent requirements of the following Items.

- Item 416, "Drilled Shaft Foundations"
- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 424, "Precast Concrete Structural Members (Fabrication)"
- Item 440, "Reinforcement for Concrete"
- Item 442, "Metal for Structures"

Furnish the class of concrete shown on the plans.

3. CONSTRUCTION

- 3.1. **General.** Perform excavation and embankment work in accordance with Item 400, "Excavation and Backfill for Structures," except for measurement and payment.

Place reinforcing steel in accordance with Item 440. Welding of additional bars to the reinforcing cage is allowable, if approved, when slipform placement is used. Weld in accordance with Item 448, "Structural Field Welding."

Cast barrier in place, slipform barrier, or construct barrier using precast concrete sections unless otherwise shown on the plans. Use forms meeting the requirements of Item 424 for precast sections. Wood forms are allowable for curves and transitions. Construct formwork in accordance with Item 420, "Concrete Substructures."

Multi-project fabrication plants (as defined in Item 424) that produce concrete traffic barrier must be qualified in accordance with [DMS-7350](#), "Qualification Procedure for Multi-Project Fabrication Plants of Precast Concrete Traffic Barrier." See the Department's MPL for approved fabricators. Construct drilled shaft foundations in accordance with Item 416, when required.

Construct barrier in accordance with Item 420. Form-cure or water-cure concrete, except for precast sections, for at least 4 days, or cure with Type 1-D or Type 2 membrane curing compound. Cure precast sections in accordance with Item 424.

Remove concrete, mortar, oil, and other substances leaked onto the roadway.

- 3.2. **Cast-in-Place Barrier.**

- 3.2.1. **Conventionally Formed Barrier.** Accurately set forms for conventionally formed barrier. Secure the forms in a manner that is not detrimental to roadway pavement and will maintain barrier in a true position during concrete placement. Remove forms after the concrete has reached sufficient strength to prevent physical damage to the barrier.

- 3.2.2. **Slipformed Barrier.** Ensure slipformed barriers are within a vertical and horizontal alignment tolerance of $\pm 1/4$ in. in 10 ft. Construct barrier with a smooth and uniform appearance. Remove and replace unsatisfactory barrier at the Contractor’s expense. Consolidate concrete so it is free of honeycomb. Provide concrete with a consistency that will maintain the shape of the barrier without support. Minimize starting and stopping of the slipform operation by ensuring a continuous supply of concrete. Provide a wire line to maintain vertical and horizontal alignment of the slipform machine. Attach a grade line gauge or pointer to the machine so a continuous comparison can be made between the barrier being placed and the established grade line. Do not exceed the manufacturer’s recommended speed for the slipform machine. Rails or supports at the required grade are allowed instead of sensor controls.
- 3.3. **Precast Sections.** Notify the Engineer of the location of the casting site and date on which work will begin if precast sections are used. Form cure concrete until the concrete has reached sufficient strength to permit handling without visible cracks or other damage to the sections. Produce precast barrier sections to the tolerances shown in Table 1 unless otherwise shown on the plans.

**Table 1
Precast Barrier Tolerances**

Dimension	Tolerance
Length	± 1 in.
Insert placement	$\pm 1/2$ in.
Horizontal alignment	$\pm 1/8$ in. per 10 ft. of length
Deviation of Ends	
Horizontal skew	$\pm 1/4$ in.
Vertical batter	$\pm 1/8$ in. per foot of depth

Repair or replace concrete traffic barrier damaged during fabrication, curing, handling, or placing, as directed.

4. MEASUREMENT

This Item will be measured by the foot. Barriers with two longitudinal half-sections will be measured once along the centerline between the two halves.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Permanent Concrete Traffic Barrier” of the shape (e.g., Single Slope or F Shape), Type (e.g., 1, 2, or 3); and height (for Single Slope) specified. This price is full compensation for furnishing and placing materials, including footings and drilled shaft anchors, and excavation and embankment, equipment, labor, tools, and incidentals.

Unless shown on the plans as a bid item, asphalt concrete pavement used for lateral support will not be paid for directly, but will be subsidiary to this Item.

Item 520

Weighing and Measuring Equipment



1. DESCRIPTION

Provide weighing and measuring equipment for materials measured or proportioned by weight or volume.

2. EQUIPMENT

Provide certified scales, scale installations, and measuring equipment meeting the requirements of *NIST Handbook 44*, except that the required accuracy must be 0.4% of the material being weighed or measured.

Provide personnel, facilities, and equipment for checking the scales as approved. Check all weighing and measuring equipment after each move and at least once every 6 mo. or when requested.

Calibrate truck scales using weights certified by the Texas Department of Agriculture or an equivalent agency as approved. Provide a written calibration report from a scale mechanic for truck scale calibrations. Cease plant operations during the checking operation. Do not use inaccurate or inadequate scales. Bring performance errors as close to zero as practicable when adjusting equipment.

Furnish enough certified weights to check the accuracy and sensitivity of the scales. Insulate scales against shock, vibrations, or movement of other operating equipment. Provide an automated ticket printout for each truckload of material daily where payment is determined by weight. Each loading ticket must show the ticket number, truck number, gross weight, tare weight, and net weight. At the Contractor's option, an electronic ticket delivery system (e-ticketing) may be used instead of printed tickets. The use of e-ticketing will require written approval of the Engineer. At minimum, the approved system must:

- provide real-time e-tickets in conformance with the applicable bid items,
- automatically generate e-tickets using software and hardware fully integrated with the automated scale system used to weigh the material and designed such that data input cannot be altered by the Contractor or the Engineer,
- provide the Engineer access to the e-ticketing data in real time using a web-based or app-based system compatible with iOS,
- provide offline capabilities to prevent data loss if power or connectivity is lost; and
- require the Contractor and the Engineer to accept or reject the e-ticket and provide the ability to record the information required by the applicable bid items, as well as any comments. Record the time of the approval or rejection and include it in the summary spreadsheet described below. Provide each party the capability to edit their respective actions and any entered information.

The Contractor may discontinue use of the e-ticket system and provide printed tickets as needed to meet the requirements of the applicable bid items.

Provide a summary spreadsheet that lists separately the ticket number, truck number, gross weight, tare weight, net weight, overload weight, and payment weight amounts as shown in Table 1 if required on the plans for materials paid by the ton. Provide this spreadsheet:

- for each lot when materials are paid for in increments of sublots or lots, and
- daily for other materials.

Provide the totals for net weight and overload amounts to be deducted for all summary sheets within 2 days of delivery of materials. Include the overload deduction in the total amount reported for payment. Submissions are subject to verification.

**Table 1
Example Spreadsheet**

Ticket No.	Truck No.	Gross Wt.	Tare Wt.	Net Wt.	Overload Wt.	Payment Wt.
				Totals	Totals	Totals

Furnish leak-free weighing containers large enough to hold a complete batch of the material being measured.

- 2.1. **Truck Scales.** Furnish platform truck scales capable of weighing the entire truck or truck-trailer combination in a single draft.
- 2.2. **Aggregate Batching Scales.** Equip scales used for weighing aggregate with a quick adjustment at zero that provides for any change in tare. Provide a visual means that indicates the required weight for each aggregate.
- 2.3. **Suspended Hopper.** Provide a means for the addition or the removal of small amounts of material to adjust the quantity to the exact weight per batch. Ensure the scale equipment is level.
- 2.4. **Belt Scales.** Use belt scales for proportioning aggregate that are accurate to within 1.0% based on the average of three test runs, where no individual test run exceeds 2.0% when checked, in accordance with [Tex-920-K](#).
- 2.5. **Asphalt Material Meter.** Provide an asphalt material meter with an automatic digital display of the volume or weight of asphalt material. Verify the accuracy of the meter in accordance with [Tex-921-K](#). Ensure the accuracy of the meter is within 0.4% when using the asphalt meter for payment purposes. Ensure the accuracy of the meter is within 1.0% when used to measure component materials only and not for payment.
- 2.6. **Liquid Asphalt Additive Meters.** Provide a means to check the accuracy of meter output for asphalt primer, fluxing material, and liquid additives. Furnish a meter that reads in increments of 0.1 gal. or less. Verify accuracy of the meter in accordance with [Tex-923-K](#). Ensure the accuracy of the meter within 5.0%.
- 2.7. **Particulate Solid and Slurry Additive Meters.** Provide a means to check the accuracy of meter output for particulate solids (e.g., hydrated lime or mineral filler) and slurries (e.g., hydrated lime slurry). Ensure the accuracy of the meter within 5.0%.

3. MEASUREMENT AND PAYMENT

The work performed, materials furnished, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent items.

Item 527

Colored Textured Concrete



1. DESCRIPTION

Furnish and place colored textured concrete.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"

Use Class A concrete unless otherwise shown on the plans.

When approved, use fibers listed on the Department's MPL or fibers meeting the requirements of [DMS-4550](#), "Fibers for Concrete," to replace reinforcing steel in Class A concrete.

Use dry-shake color hardener or integral concrete colorant unless otherwise specified on the plans. Ensure integral color, if used, meets the requirements of ASTM C979. Provide colored wax as a curing membrane meeting the requirements of ASTM C309 or as shown on the plans.

3. CONSTRUCTION

Prepare for approval a 9-sq. ft., 3-in. thick specimen for each color, pattern, and texture required before beginning work.

Prepare the subgrade, base, or both as shown on the plans and in conformance with pertinent Items. Place and screed concrete to the proper grade and wood-float to a uniform surface in accordance with Item 420.

When dry-shake color hardener is used, apply evenly to the plastic surface in conformance with the manufacturer's directions. Use at least 65 lb. per 12 sq. yd. Apply in two separate applications, and wood-float after each application. Trowel only after the final floating.

Place dies with a repetitive pattern on the concrete surface, and hand-tamp to create the required texture or imprint shown on the plans. Apply colored curing and finishing compound in conformance with the manufacturer's directions. If no type, size, color, or pattern is specified, use a brick shape with a minimum size of 3-3/4 in. long and 7-3/4 in. wide with 3/8-in. joints and a red color using a running bond pattern.

4. MEASUREMENT

This Item will be measured by the square yard.

5. PAYMENT

Excavation and embankment will be paid for separately unless otherwise shown on the plans. The work performed and measured as provided under "Measurement" will be paid for at the unit price bid for "Colored Textured Concrete" of the thickness specified. This price is full compensation for surface preparation of subgrade and base; furnishing, placing, finishing, and curing colored, textured concrete; and equipment, labor, materials, tools, and incidentals. Preparation of approval specimens will not be paid for directly but will

be subsidiary to this Item. Base under colored textured concrete will be paid for under pertinent Items unless otherwise shown on the plans.

Item 528

Landscape Pavers



1. DESCRIPTION

- 1.1. **Landscape Pavers.** Furnish and install landscape pavers.
- 1.2. **Landscape Pavers (Furnished).** Landscape pavers will be furnished by the Department. Load and transport from the location shown on the plans to the project and install.
- 1.3. **Remove, Store, and Relay Landscape Pavers.** Remove, store, and relay landscape pavers as shown on the plans or as directed. Furnish and lay replacement pavers.

2. MATERIALS

- 2.1. **Landscape Pavers.** Furnish materials in accordance with the details shown on the plans and the following.
 - Item 132, "Embankment"
 - Item 247, "Flexible Base"
 - Item 275, "Cement Treatment (Road-Mixed)"
 - Item 401, "Flowable Backfill"
 - Item 421, "Hydraulic Cement Concrete"

2.1.1. **Pavers.** Furnish pavers meeting the requirements of ASTM C936; made using normal-weight aggregates in accordance with ASTM C33; and conforming to the shape, color, laying pattern, and dimensions shown on the plans. If no type, size, color, or pattern is given, use a brick type paver with a minimum size of 3-3/4 in. long, 7-3/4 in. wide, and 2-3/8 in. tall, with a river red color or equivalent using a running bond pattern. Furnish certification from the manufacturer stating that the interlocking paving units have been tested and meet all the requirements of ASTM C936. Furnish additional paving units when required for testing by the Department.

2.1.2. **Bedding Sand.** Furnish fine aggregate as specified in Item 421, with the gradation shown in Table 1.

**Table 1
Bedding Sand Gradation**

Sieve Size	Passing (%)
3/8"	100
#4	85-100
#100	10-30

2.1.3. **Joint-Filling Sand.** Meet the requirements for bedding sand, except with the gradation shown in Table 2.

**Table 2
Joint-Filling Sand Gradation**

Sieve Size	Passing (%)
#4	100
#8	90-100
#16	60-100
#30	25-70
#50	10-30
#100	2-15
#200	<10

3. CONSTRUCTION

- 3.1. **Removing and Relaying Existing Pavers.** Exercise care to remove existing pavers with minimal damage. Removal by mechanical means is allowed unless otherwise shown on the plans. Ensure that any removed pavers remain in good, reusable condition. Dispose of stained or damaged pavers. Palletize reusable pavers, and completely wrap the pavers and pallets with plastic to protect them during storage. Safeguard the pavers from theft and vandalism while the Contract is in progress. Deliver salvageable excess pavers to a stockpile location on the project site unless otherwise shown on the plans. Dispose of unsalvageable pavers in conformance with federal, state, and local regulations. Replace any pavers deemed unusable with new materials as necessary and as directed. Remove paver units damaged during compaction, and replace them with pavers of equivalent size, shape, and color.
- 3.1.1. **Base Installation.** Perform excavation and embankment work for the subgrade. Replace unsuitable material encountered in the subgrade and compact to a uniform grade. Stabilize subgrade if specified. Place and compact the base to ordinary compaction requirements in conformance with the pertinent Item, and to the depth specified on the plans. Grade the base surface so that the finished grade of the pavers meets the requirements shown on the plans.
- 3.1.2. **Bedding Sand Installation.** Screed a layer of uncompacted sand to a depth of 1–1-1/2 in. over the compacted base. Do not use bedding sand for leveling.
- Spread the sand at a uniform moisture content of 3–7%. Protect onsite-stockpiled sand against rain before spreading.
- Maintain the spread sand in a loose condition and protect against pre-compaction before and after screeding. Protect screeded sand against accidental precompaction, including compaction by rain or dew. Loosen precompacted sand or screeded sand in advance of the laying face only to an extent to which paving will be completed that day. Lightly screed the sand in a loose condition to the predetermined depth slightly ahead of laying the paving units.
- 3.1.3. **Paver Installation.** Place paving units on an uncompacted, screeded sand bed to the required laying pattern shown on the plans. Align all joints and provide nominal 1/8-in. gaps between adjacent units.
- Place the first row to abut an edge restraint with a gap of 1/8 in. Place at a suitable angle to the edge restraint to achieve the required visual orientation of paving units in the completed pavement. Lay full-size units in each row first, followed by closure units consisting of at least 25% of a full unit. Cut units using a power saw. To fill smaller edge spaces, use a grout mix matching the color of the pavers that consists of one part hydraulic cement to two parts concrete sand. Use cement and sand in accordance with Item 421.
- Do not allow construction traffic on pavers during installation and compaction.
- 3.1.4. **Paver Compaction.** Provide a high-frequency, low-amplitude mechanical flat plate vibrator compactor with a plate area large enough to cover at least 12 paving units and that can deliver a 3,500–5,000-lb. centrifugal compaction force. Compact paving units immediately after placement to achieve consolidation of the sand bedding before any traffic is allowed. Bring to design levels and profiles by at least two passes of the plate compactor.
- Do not compact within 3 ft. of the laying face. Continue compaction until lipping has been eliminated between the adjoining units. Compact all work to within 3 ft. of the laying face at the completion of each workday.
- Spread joint-filling sand as soon as practical after compaction but in all cases before the termination of each workday, before acceptance of the day's work, and before permitting construction traffic. Allow joint-filling sand to dry, and then sweep to fill the joints. Compact the pavers and joint-filling sand by one pass of the compactor.

4. MEASUREMENT

This Item will be measured by the square yard. Removed pavers to be relayed, salvaged, or disposed of will be measured by the square yard in their original position. Replacement pavers will be measured by the square yard in the final position of replacement pavers.

5. PAYMENT

- 5.1. **Landscape Pavers.** The work performed and measured as provided under "Measurement" will be paid for at the unit price bid for "Landscape Pavers." This price is full compensation for furnishing, placing, and compacting pavers; bedding and joint-filling sand; and equipment, labor, materials, tools, and incidentals. Paver units damaged during compaction will be replaced at the Contractor's expense. Base required for landscape pavers will not be paid for directly but will be subsidiary to this Item.
- 5.2. **Landscape Pavers (Furnished).** The work performed and measured as provided under "Measurement" will be paid for at the unit price bid for "Landscape Pavers (Furnished)." This price is full compensation for loading and transporting, placing, and compacting pavers; bedding and joint-filling sand; and equipment, labor, materials, tools, and incidentals. Paver units damaged during loading, transport, or compaction will be replaced at the Contractor's expense. Base required for landscape pavers will not be paid for directly but will be subsidiary to this Item.
- 5.3. **Removing and Relaying Existing Pavers.** The work performed and measured as provided under "Measurement" will be paid for at the unit price bid for "Remove and Relay Pavers" and "Replacement Pavers." Base required for landscape pavers will not be paid for directly but will be subsidiary to this Item. Paver units damaged during removal, loading, transport, or compaction will be replaced at the Contractor's expense.
- 5.3.1. **Remove and Relay Pavers.** Removing and relaying pavers will be paid for at the unit price bid for "Remove and Relay Landscape Pavers." This price is full compensation for removing and storing pavers; placing and compacting salvaged pavers; preparing bedding; bedding and joint-filling sand; stockpiling salvaged pavers; disposing of pavers; and equipment, labor, materials, tools, and incidentals.
- 5.3.2. **Replacement Pavers.** Furnishing and placement of replacement pavers will be paid for at the unit price bid for "Replacement Pavers." This price is full compensation for furnishing replacement pavers; placing and compacting pavers; preparing bedding; bedding and joint-filling sand; and equipment, labor, materials, tools, and incidentals.

Item 529

Concrete Curb, Gutter, and Combined Curb and Gutter



1. DESCRIPTION

Construct hydraulic cement concrete curb, gutter, and combined curb and gutter.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 360, "Concrete Pavement"
- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"

Use Class A concrete or material specified on the plans. Use Grade 8 coarse aggregate for extruded Class A concrete. Use other grades if approved. When curbs are monolithically placed with the concrete pavements, use the same class of concrete as the concrete pavement.

Use of fibers in accordance with [DMS-4550](#), "Fibers for Concrete," to replace reinforcing steel in Class A concrete is allowed unless otherwise shown on the plans. Dose fibers in accordance with the Department's MPL of pre-qualified fibers for concrete.

3. CONSTRUCTION

Provide finished work with a well-compacted mass and a surface free of voids and honeycomb, in the required shape, line, and grade. Round exposed edges using an edging tool of the radius shown on the plans. Mix, place, and cure concrete in accordance with Item 420. Construct joints at locations shown on the plans. Cure for at least 72 hr.

Furnish and place reinforcing steel in accordance with Item 440 unless fiber reinforced concrete is used.

Set and maintain a guideline that conforms to alignment data shown on the plans, with an outline that conforms to the details shown on the plans. Ensure that changes in curb grade and alignment do not exceed 1/4 in. between any two contacts on a 10-ft. straightedge.

- 3.1. **Conventionally Formed Concrete.** Shape and compact subgrade, foundation, or pavement surface to the line, grade, and cross-section shown on the plans. Lightly sprinkle subgrade or foundation material immediately before concrete placement.

Pour concrete into forms, and strike off with a template 1/4–3/8 in. less than the dimensions of the finished curb unless otherwise approved. After initial set, plaster surface with mortar consisting of one part hydraulic cement and two parts fine aggregate. Brush exposed surfaces to a uniform texture.

Place curbs, gutters, and combined curb and gutters in 50-ft. maximum sections unless otherwise approved.

- 3.2. **Extruded or Slipformed Concrete.** Shape and compact subgrade, foundation, or pavement surface to the line, grade, and cross-section shown on the plans. Lightly sprinkle subgrade or foundation material immediately before concrete placement. Provide clean surfaces for concrete placement. Coat cleaned

surfaces, if required, with approved adhesive or coating at the rate of application shown on the plans or as directed. Place concrete using approved self-propelled equipment.

The forming tube of the extrusion machine or the form of the slipform machine must be easily adjustable vertically during the forward motion of the machine to provide variable heights necessary to conform to the established gradeline.

Attach a pointer or gauge to the machine so that a continual comparison can be made between the extruded or slipform work and the grade guideline. Other methods may be used when approved.

Finish surfaces immediately after extrusion or slipforming.

- 3.3. **Curb Joints for Concrete Pavements.** Provide transverse expansion and contraction joints in the curb of the same type and location as the adjacent or underlying pavement. Use expansion joint material of the same thickness and type required for the pavement. Extend expansion joints through the curb. Place reinforcing steel for non-monolithic curb construction joints as shown on the plans, unless otherwise approved. Form or saw the contraction joint through the full depth of the monolithic curb.

4. MEASUREMENT

This Item will be measured by the foot.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Curb," "Concrete Curb (Mono)," or "Concrete Curb and Gutter" of the type specified. This price is full compensation for surface preparation of curb foundation, equipment, labor, materials, tools, and incidentals.

Item 530

Intersections, Driveways, and Turnouts



1. DESCRIPTION

Construct and pave intersections, driveways, and turnouts. Pave existing intersections, driveways, and turnouts.

Intersections are considered areas off the travel lanes and shoulders of the Contract highway on the intersecting highway on the state system. The intersecting on-system highway work will be paid for under this Item only when shown on the plans.

Driveways are defined as private (residential or commercial) and public (county road and city street) access areas off the travel lanes and shoulders.

Turnouts include but are not limited to mailbox and litter barrel widenings.

2. MATERIALS

Furnish materials that meet the following.

- Item 247, "Flexible Base"
- Item 260, "Lime Treatment (Road-Mixed)"
- Item 275, "Cement Treatment (Road-Mixed)"
- Item 276, "Cement Treatment (Plant-Mixed)"
- Item 292, "Asphalt Treatment (Plant-Mixed)"
- Item 316, "Seal Coat"
- Item 330, "Limestone Rock Asphalt Pavement"
- Item 334, "Hot-Mix Cold-Laid Asphalt Concrete Pavement"
- Item 341, "Dense-Graded Hot-Mix Asphalt"
- Item 360, "Concrete Pavement"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"

3. CONSTRUCTION

Construct and pave intersections, driveways, and turnouts, and pave existing intersections, driveways, and turnouts as shown on the plans or as directed. Place materials in conformance with construction Articles of pertinent Items. Provide uninterrupted access to adjacent property unless otherwise directed. Ensure that abrupt elevation changes in driveway or turnout areas that serve as sidewalks do not exceed 1/4 in. and that the sidewalk area cross slope does not exceed 2%. Ready-mix concrete and hand finishing will be permitted when concrete pavement is specified unless otherwise shown on the plans for intersections.

4. MEASUREMENT

This Item will be measured by the square yard of the final pavement surface, as placed in the field, including radii and turnout.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Intersections," "Driveways," "Turnouts," "Intersections, Driveways, and Turnouts," or "Driveways and Turnouts" of the surface specified.

This price is full compensation for furnishing and operating equipment; excavation and embankment; base and pavement materials; and labor, materials, tools, and incidentals. Drainage structures will be measured and paid for in conformance with the pertinent bid Items.

Item 531

Sidewalks



1. DESCRIPTION

Construct hydraulic cement concrete sidewalks, Americans with Disabilities Act ramps, and steps.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 360, "Concrete Pavement"
- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"

Use Class A concrete unless otherwise shown on the plans. Use Grade 8 coarse aggregate for extruded Class A concrete. Use other grades if approved.

Use of fibers meeting the requirements of [DMS-4550](#), "Fibers for Concrete," to replace reinforcing steel in Class A concrete is allowed unless otherwise shown on the plans. Dose fibers in accordance with the Department's MPL of prequalified fibers for concrete.

Furnish detectable warning material in accordance with [DMS-4350](#), "Detectable Warning Material."

3. CONSTRUCTION

Shape and compact subgrade, foundation, or pavement surface to the line, grade, and cross-section shown on the plans. Lightly sprinkle subgrade or foundation material immediately before concrete placement. Hand-tamp and sprinkle foundation when placement is directly on subgrade or foundation materials. Remove and dispose of existing concrete in accordance with Item 104, "Removing Concrete." Provide a clean surface for concrete placement directly on the surface material or pavement.

Furnish and place reinforcing steel in accordance with Item 440 unless fiber reinforced concrete is used.

Mix and place concrete in conformance with the pertinent Items. Hand-finishing is allowed for any method of construction. Finish exposed surfaces to a uniform transverse broom finish surface. Curb ramps must include a detectable warning surface and conform to details shown on the plans. Install joints as shown on the plans. Ensure that abrupt changes in sidewalk elevation do not exceed 1/4 in., sidewalk cross slope does not exceed 2%, curb ramp grade does not exceed 8.3%, and flares adjacent to the ramp do not exceed 10% slope measured parallel to the curb line. Ensure that the sidewalk depth and reinforcement are not less than the driveway cross-sectional details shown on the plans where a sidewalk crosses and is part of the concrete driveway.

Use construction methods in conformance with manufacturers' recommendations when installing detectable warning surface. Install detectable warning surface as shown on the plans.

Provide finished work with a well-compacted mass, a surface free of voids and honeycomb, and the required true-to-line shape and grade. Cure for at least 72 hr. in accordance with Item 420.

- 3.1. **Conventionally Formed Concrete.** Provide pre-molded or board expansion joints of the thickness shown on the plans for sidewalk section lengths greater than 8 ft. but less than 40 ft., unless otherwise directed. Terminate workday production at an expansion joint.
- 3.2. **Extruded or Slipformed Concrete.** Provide any additional surface finishing immediately after extrusion or slipforming as shown on the plans. Construct joints at locations as shown on the plans or as directed.

4. MEASUREMENT

Sidewalks will be measured by the square yard of surface area. Curb ramps will be measured by the square yard of surface area or by each. A curb ramp consists of the ramp, landing or turning space, adjacent flares or side curb, and detectable warning surface as shown on the plans. Steps will be measured by the square yard of horizontal surface area.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Sidewalks" of the depth specified, "Concrete Sidewalk (Steps)," and "Curb Ramps" of the type specified. This price is full compensation for surface preparation of sidewalk foundation; materials; removal and disposal of existing concrete; excavation, hauling, and disposal of excavated material; drilling and doweling into existing concrete curb, sidewalk, and pavement; repair of adjacent street or pavement structure damaged by these operations; and equipment, labor, materials, tools, and incidentals.

Sidewalks that cross and are part of the concrete driveways or turnouts will be measured and paid for in accordance with Item 530, "Intersections, Driveways, and Turnouts."

Item 533

Rumble Strips



1. DESCRIPTION

Construct milled rumble strips. This Item also includes filling rumble strips in asphalt and concrete pavement to provide a smooth, stable surface with the line and grade conforming to the adjacent pavement.

2. MATERIALS

2.1. **Filling Milled Asphalt Rumble Strips.** Furnish materials in accordance with the following.

- Item 300, "Asphalts, Oils, and Emulsions"
- Item 330, "Limestone Rock Asphalt Pavement"
- Item 334, "Hot-Mix Cold-Laid Asphalt Concrete Pavement"
- Item 341, "Dense-Graded Hot-Mix Asphalt"
- Item 350, "Microsurfacing"
- [DMS-9202](#), "Asphaltic Concrete Patching Material (Stockpile Storage or Bagged)"

2.2. **Filling Milled Concrete Rumble Strips.** Provide polymeric patching material in accordance with [DMS-6170](#), "Polymeric Materials for Patching Spalls in Concrete Pavement," that is Type II material and matches the color of the pavement. The patching material must also meet the following minimum performance requirements:

- compressive strength at 24 hr. (ASTM C579, Method B): 4,500 psi; and
- must be able to carry traffic within 3 hr. of placement.

3. EQUIPMENT

3.1. **Milled Rumble Strips.** Provide a rotary-type cutting head with a maximum outside diameter of 24 in. and a minimum length of 16 in. Arrange cutting tips to provide a relatively smooth cut with approximately 1/16-in. difference in texture deviation. Provide a cutting head with independent suspension from the power unit that will self-align with the shape of the surface and irregularities in the surface. Provide a cutting tool with guides to assure consistent alignment of each cut relative to the roadway and to provide uniformity throughout the project.

3.2. **Filling Milled Asphalt Rumble Strips.** Provide required or necessary equipment in accordance with Item 320, "Equipment for Asphalt Concrete Pavement." Use of other equipment may be permitted with written approval.

4. CONSTRUCTION

4.1. **Milled Rumble Strips.** Construct milled rumble strips in a uniform position according to dimensions and at locations shown on the plans. The depressions must have well-defined edges, have a smooth interior finish, and not snag or tear the finished pavement. Control dust during grinding operations.

Do not place rumble strips across exit or entrance ramps, acceleration and deceleration lanes, crossovers, gore areas, or intersections with other roadways, or at locations not shown on the plans. Correct misplaced rumble strips at the Contractor's expense.

Clean debris from the milled depressions by blowing with compressed air or flushing with water. Remove and dispose of debris by vacuuming or sweeping before opening the adjacent lane to traffic as directed.

- 4.2. **Filling Milled Asphalt Rumble Strips.** Place material in the milled areas in accordance with one of the following operations:
- Item 330, Grade FS;
 - Item 334, Type F;
 - Item 341, Type F;
 - Item 350, or
 - [DMS-9202](#).

- 4.3. **Filling Milled Concrete Rumble Strips.** Submit product specifications, product data sheet, and installation instructions from the manufacturer for approval before beginning work.

Clean and prepare area to receive fill material in conformance with manufacturer's specified instructions. Dry and abrasive blast the repair area to ensure it is free of moisture, dirt, grease, oil, or other foreign material that may reduce bond strength. Remove dust from the abrasive blasting operation. Apply duct tape in a symmetrical manner at the perimeter of the rumble strips to obtain a uniform appearance. Apply primer to surface where fill material is to be placed in conformance with manufacturer's recommendations, and reapply primer if conditions change after initial application but before placing patching material.

Mix, place, and cure material in conformance with manufacturer's recommendations. Begin placement of material at the lower elevation of sloped areas. Screed polymeric patching material to conform to the roadway surface. Provide a non-skid finish using a notched trowel.

5. MEASUREMENT

- 5.1. **Milled rumble strips.** Measurement will be longitudinally along the roadway, by the foot. Measurement will include only the actual work performed. Measurement will not include interruptions across ramps, acceleration or deceleration lanes, crossovers, gore areas, or intersections with other roadways.
- 5.2. **Filling Milled Concrete and Asphalt Rumble Strips.** Measurement will be longitudinally along the roadway, by the foot, regardless of the rumble strip width or depth.

6. PAYMENT

- 6.1. **Milled Rumble Strips.** The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Milled Rumble Strips (Asphalt) (Shoulder)," "Milled Rumble Strips (Asphalt) (Centerline)," "Milled Rumble Strips (Concrete) (Shoulder)," and "Milled Rumble Strips (Concrete) (Centerline)." This price is full compensation for equipment, labor, materials, tools, and incidentals.
- 6.2. **Filling Milled Asphalt Rumble Strips.** The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Filling Milled Asphalt Rumble Strips (Shoulder)" or "Filling Milled Asphalt Rumble Strips (Centerline)." This price is full compensation for surface preparation, equipment, labor, materials, tools, and incidentals. Trial batches will not be paid for unless they are incorporated into pavement work approved by the Department.
- 6.3. **Filling Milled Concrete Rumble Strips.** The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Filling Milled Concrete Rumble Strips (Shoulder)" or "Filling Milled Concrete Rumble Strips (Centerline)." This price is full compensation for surface preparation, priming, equipment, labor, materials, tools, disposal of all materials removed, and incidentals. Trial batches will not be paid for unless they are incorporated into pavement work approved by the Department.

Item 536

Concrete Medians and Directional Islands



1. DESCRIPTION

Construct cast-in-place concrete medians and directional islands.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 420, "Concrete Substructures"
- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"
- Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter"

Use Class A concrete unless otherwise shown on the plans.

Use of fibers meeting the requirements of [DMS-4550](#), "Fibers for Concrete," to replace reinforcing steel in Class A concrete is allowed unless otherwise shown on the plans. Dose fibers in accordance with the Department's MPL of pre-qualified fibers for concrete.

3. CONSTRUCTION

Provide wood or metal forms securely held in place. Properly position and secure reinforcing steel and dowels. Place concrete for each section on the prepared foundation to line, grade, and cross-section in accordance with Item 420. Separate sections from adjacent curbs or adjoining sections using expansion or contraction joints of the type and size specified on the plans. A curb section may be used for the perimeter of the median or island when shown. Construct curbs in accordance with Item 529.

Furnish and place reinforcing steel in accordance with Item 440 unless fiber reinforced concrete is used.

Finish exposed surfaces with a wood or metal float after sufficient concrete set. Round exposed edges as shown on the plans.

Remove forms after concrete has set. Point up exposed surfaces. Provide an ordinary surface finish in accordance with Item 427, "Surface Finishes for Concrete." Use mortar consisting of one part hydraulic cement and two parts fine aggregate to plaster exposed formed surfaces when required. Apply the mortar using a template made to conform to the cross-section shown on the plans.

Cure at least 72 hr. using a method specified in Item 420, "Concrete Substructures."

4. MEASUREMENT

This Item will be measured by the foot or by the square yard to the face of the curb.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Median" or "Concrete Directional Island." This price is full compensation for preparing foundation surfaces; furnishing and operating equipment; curbs

and gutters used as part of the concrete median or directional island; and labor, materials, tools, and incidentals.

Item 538

Right of Way Markers



1. DESCRIPTION

Install cast-in-place concrete right of way markers.

2. MATERIALS

Furnish materials in accordance with the following.

- Item 421, "Hydraulic Cement Concrete"
- Item 440, "Reinforcement for Concrete"

The Department will furnish bronze disks.

Provide Class A concrete. When approved, use fibers meeting the requirements of [DMS-4550](#), "Fibers for Concrete," to replace reinforcing steel in Class A concrete. Dose fibers in accordance with the MPL of pre-qualified fibers for concrete.

3. CONSTRUCTION

Cast and finish right of way markers in accordance with Item 420, "Concrete Substructures," and details shown on the plans. Install right of way markers at designated points to the required horizontal and vertical locations. Center the bronze disk within 1/2 in. of the location shown. Reposition any marker that is outside this tolerance.

The Department will provide a survey crew working under the direction of a registered professional land surveyor, licensed to practice in Texas, to make the final alignment checks on each right of way marker installed and to place the right of way location punch mark on the bronze disk, unless otherwise shown on the plans. Do not disturb or destroy the original points before installing right of way markers using bronze disks or before placing punch marks.

4. MEASUREMENT

This Item will be measured by each marker.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Right of Way Markers." This price includes materials, labor (including work of the registered professional land surveyor when required by the plans), tools, equipment, and incidentals. Removal and disposal of existing right of way markers will not be paid for directly but will be subsidiary to pertinent Items.

Item 540

Metal Beam Guard Fence



1. DESCRIPTION

Furnish, install, replace, or adjust metal beam guard fence consisting of metal beam rail elements, hardware, blocks, and support posts.

2. MATERIALS

Provide samples of metal beam rail elements, terminal sections, bolts, and nuts for compliance testing in accordance with [Tex-708-I](#) and [Tex-713-I](#) to verify physical and chemical properties meet AASHTO M 180 when directed.

Obtain materials at the locations shown on the plans when the plans designate that the Department will furnish materials.

2.1. **Metal Beam Rail Elements.** Furnish new metal beam rail elements, transitions, anchor sections, and terminals that meet the requirements of Table 1 and from a manufacturer on the Department’s MPL of rail element manufacturers.

Type I or Type II is required, unless otherwise shown on the plans. Base metal for metal beam rail elements must not contain more than 0.04% phosphorus or more than 0.05% sulfur.

Warped or deformed rail elements will be rejected.

Table 1
Rail Element Requirements

Specification	AASHTO M 180
Class	A— Base metal nominal thickness 0.105 in. B— Base metal nominal thickness 0.135 in.
Type	I— Zinc-coated 1.80 oz. per square foot minimum single-spot. II— Zinc-coated 3.60 oz. per square foot minimum single-spot. IV— Weathering steel (required when shown on the plans).
Shape	W-Beam Thrie Beam W-Beam to Thrie Beam Transition
Markings	Permanently mark each metal beam rail element (including curved sections) with the information required in AASHTO M 180.

2.2. **Posts.** Furnish new round timber, rectangular timber, or rolled steel section posts as shown on the plans and in conformance with the following requirements.

2.2.1. **Timber Posts.** Meet requirements [DMS-7200](#), “Timber Posts and Blocks for Metal Beam Guard Fence.” Purchase from a manufacturer or supplier on the Department’s MPL of timber treating plants and suppliers.

2.2.2. **Steel Posts.** Provide rolled sections conforming to the material requirements of ASTM A36. Drill or punch posts for standard rail attachment as shown on the plans. Galvanize in accordance with Item 445, “Galvanizing.” Low-fill culvert posts may be fabricated as galvanized “blanks” with the rail hole and the final height field fabricated. Treat all exposed post surfaces caused by the field fabrication in accordance with Section 445.3.4., “Repairs.”

2.3. **Blocks.** Furnish new rectangular timber or composite blocks as shown on the plans and in conformance with the following requirements.

- 2.3.1. **Timber.** Meet the requirements of [DMS-7200](#). Purchase from a manufacturer or supplier on the Department's MPL of timber treating plants and suppliers.
- 2.3.2. **Composite.** Meet the requirements of [DMS-7210](#), "Composite Material Posts and Blocks for Metal Beam Guard Fence." Purchase from a manufacturer on the Department's MPL of composite material blocks and posts.
- 2.4. **Fittings.** Furnish new fittings (e.g., bolts, nuts, and washers) as shown on the plans and galvanized in accordance with Item 445.
- 2.5. **Terminal Connectors.** Furnish new terminal connectors, where required, meeting the material and galvanizing requirements specified for metal beam rail elements.
- 2.6. **Concrete.** Furnish concrete for terminal anchor posts meeting the requirements for Class A concrete in accordance with Item 421, "Hydraulic Cement Concrete."
- 2.7. **Curb.** If indicated in the details, furnish the curb shown with metal beam guard fence transition in accordance with Item 529, "Concrete Curb, Gutter, and Combined Curb and Gutter."
- 2.8. **Driveway Terminal Anchor Posts.** Furnish new terminal anchor posts from steel conforming to the material requirements of ASTM A36. Fabricate posts in accordance with Item 441, "Steel Structures." Galvanize terminal anchor posts after fabrication in accordance with Item 445.
- 2.9. **Downstream Anchor Posts.** Furnish new terminal anchor posts consisting of new rectangular timber and new steel foundation tubes as shown on the plans.
- 2.10. **Downstream Anchor Hardware.** Furnish new hardware (e.g., brackets, plates, struts, and cable) as shown on the plans and galvanized in accordance with Item 445.
- 2.11. **Controlled Released Terminal (CRT) Posts.** Furnish new CRT posts as shown on the plans and conforming to the requirements of [DMS-7200](#). Purchase from a manufacturer or supplier on the Department's MPL of timber treating plants and suppliers.

3. CONSTRUCTION

Install posts and rail elements as shown on the plans.

- 3.1. **Posts.** Install posts by either drilling or driving.
- 3.1.1. **Drilling.** Drill holes and set posts plumb and firm to the line and grade shown. Backfill posts by thoroughly compacting material to the density of adjacent undisturbed material.
- 3.1.2. **Driving.** Drive posts plumb using approved power hammers (e.g., steam, compressed air, vibratory, or diesel) or gravity hammers to the line and grade shown while preventing damage to the post. Use pilot holes when required and approved. Determine the size and depth of pilot holes based on results of the first few posts driven. Thoroughly tamp loosened soil around the post, fill voids with suitable material, and thoroughly compact to the density of adjacent undisturbed material.
- 3.2. **Rail Elements.** Erect metal beam rail elements to produce a smooth, continuous rail paralleling the line and grade of the roadway surface or as shown on the plans. Bolt rail elements end-to-end and lap splices in the direction of traffic. Field-drill or punch holes in rail elements for special details, only when approved.
- 3.3. **Short Radius.** Special rail fabrication with a required radius must be as shown on the plans.

- 3.4. **Galvanizing Repair.** Repair all parts of galvanized steel posts, washers, bolts, and rail elements after erection where galvanizing has become scratched, chipped, or otherwise damaged. Repair in accordance with Section 445.3.4., "Repairs."
- 3.5. **Guardrail Adjustment.** Work includes vertical adjustment, horizontal shift, and overlap of the rail element as shown on the plans.
- 3.6. **Curb.** If indicated in the details, construct the curb shown with metal beam guard fence transition in accordance with Item 529.
- 3.7. **Driveway Terminal Anchor Posts.** Embed terminal anchor posts in concrete, unless otherwise shown on the plans.

4. MEASUREMENT

- 4.1. **Guard Fence.** Measurement will be by the foot of fence. Fence will be measured on the face of the rail in place, from center-to-center of end splice locations.
- 4.2. **Transitions.** Transitions for rail connection will be measured by each transition.
- 4.3. **Short Radius.** Measurement will be by the foot to the nearest whole foot along the face of the rail in place, from beginning of radius (first CRT post) to the end of radius.
- 4.4. **Driveway Terminal Anchor Section.** Measurement will be by each section, complete in place, consisting of a driveway terminal anchor post and one 6-ft. section of rail element.
- 4.5. **Downstream Anchor Terminal.** Measurement will be by each section, complete in place, consisting of one W-Beam end section, two downstream anchor posts, and one rail section.
- 4.6. **Long Span System.** Measurement will be by each long span system, complete in place. Each long span system will be from the first CRT to the last CRT in the system.

5. PAYMENT

The work performed and material furnished in accordance with this Item and measured as provided under "Measurement" will be paid at the unit price bid for "Metal W-Beam Guard Fence" of the post type specified; "Metal Thrie Beam Guard Fence" of the post type specified, "Metal Beam Guard Fence Transition" of the type specified, "Metal W-Beam Guard Fence Adjustment," "Metal Thrie Beam Guard Fence Adjustment," "Transition Adjustment," "Short Radius," "Driveway Terminal Anchor Section," "Downstream Anchor Terminal," or "Metal Beam Guard Fence (Long Span System)." When weathering steel is required, Type IV will be specified.

Samples furnished to the Department for testing purposes, special backfill materials, and concrete curbs will not be paid for directly, but will be subsidiary to this Item.

- 5.1. **Guard Fence.** The unit price bid for "Metal W-Beam Guard Fence" or "Metal Thrie Beam Guard Fence" is full compensation for materials, hauling, erection, setting posts in concrete, blocks, driving posts, excavating, backfilling, equipment, labor, tools, and incidentals.
- 5.2. **Transition.** The unit price bid for "Metal Beam Guard Fence Transition" is full compensation for furnishing nested sections of Thrie Beam; nested sections of W-Beam; Thrie Beam to W-Beam transitional rail piece, posts, concrete, curb, and connections to W-Beam guard fence and bridge rails; Thrie Beam terminal connectors; excavation and backfilling; and equipment, labor, tools, and incidentals.
- 5.3. **Guardrail Adjustment.** The unit price bid for "Metal W-Beam Guard Fence Adjustment," "Metal Thrie Beam Guard Fence Adjustment," "Terminal Anchor Section Adjustment," and "Transition Adjustment" is full

compensation for furnishing materials not supplied by the Department, drilling holes in posts, hauling, erection, blocks, excavation, backfill, cleaning, salvaging materials, setting rail element anchor assembly and terminal anchor post, removal of rail element, concrete, curb, equipment, labor, tools, and incidentals.

- 5.4. **Short Radius.** The unit price bid for “Short Radius” is full compensation for furnishing special rail fabricated metal beam guard fence, CRT posts, steel posts, sand barrels, end terminal, cable anchor, materials, hauling, erection, blocks, driving posts, excavating, backfilling, equipment, labor, tools, and incidentals.
- 5.5. **Driveway Terminal Anchor Section.** The unit price bid for “Driveway Terminal Anchor Section” is full compensation for furnishing the rail element, driveway anchor assembly, driveway terminal anchor post, and foundations; installing the rail element anchor assembly and the driveway terminal anchor post and foundations; excavation and backfilling; and equipment, labor, tools, and incidentals.
- 5.6. **Downstream Anchor Terminal.** The unit price bid for “Downstream Anchor Terminal” is full compensation for furnishing the rail element, W-Beam end section, guardrail anchor bracket, shelf angle bracket, channel strut, downstream anchor posts, breakaway cable terminal (BCT) cable anchor assembly, and foundations; installing the BCT cable anchor assembly and the downstream anchor post and foundations; excavation and backfilling; and equipment, labor, tools, and incidentals.
- 5.7. **Long Span System.** The unit price bid for “Metal Beam Guard Fence (Long Span System)” is full compensation for furnishing the rail element, CRT posts, materials, hauling, erection, blocks, driving posts, excavating, backfilling, equipment, labor, tools, and incidentals.

Item 542

Removing Metal Beam Guard Fence



1. DESCRIPTION

Remove existing metal beam guard fence and store at locations shown on the plans or as directed.

2. CONSTRUCTION

Remove rail elements in original lengths. Remove fittings from the posts and the metal rail and then pull the posts. Do not mar or damage salvageable materials during removal.

Completely remove posts and any concrete or grout backfill surrounding the posts. Furnish backfill material and backfill the hole with material equal in composition and density to the surrounding soil unless otherwise directed.

Cut off or bend down deadman eyebolts to an elevation at least 1 ft. below the new subgrade elevation and leave in place along with the deadman.

Neatly stack salvaged materials to be retained by the Department at designated sites shown on the plans. Properly dispose of unsalvageable materials in conformance with federal, state, and local regulations. Repair or replace Contractor-damaged salvageable material at the Contractor's expense.

3. MEASUREMENT

This Item will be measured by the foot for "Remove Metal Beam Guard Fence" in its original position. Measurement will be made along the face of the rail, in place, including metal beam guard fence transitions, from center-to-center of end posts and from terminal points shown on the plans.

When "Remove Terminal Anchor Section" is specified as a separate bid item, measurement will be made for each removed section. A terminal anchor section consists of one post, one 25-ft. rail element, and associated hardware.

When "Remove Downstream Anchor Terminal" is specified as a separate bid item, measurement will be made for each removed section. Downstream anchor terminal consists of two posts, one section, and associated hardware.

4. PAYMENT

The work performed and measured as provided under "Measurement" will be paid for at the unit price bid for "Remove Metal Beam Guard Fence," "Remove Terminal Anchor Section," and "Remove Downstream Anchor Terminal." This price is full compensation for removing materials; loading, hauling, unloading, and storing or disposal; furnishing backfill material; backfilling postholes; and equipment, labor, tools, and incidentals.

Removal of mow strips or riprap will be paid for separately under the pertinent Items.

Removal of curb associated with the metal beam guard fence transitions will not be paid for directly, but will be subsidiary to this Item.

Item 543

Cable Barrier System



1. DESCRIPTION

Furnish and install, relocate, or remove cable barrier systems and cable barrier terminal sections at the locations shown on the plans.

2. MATERIALS

Furnish new cable barrier systems and cable barrier terminal sections in accordance with the details shown on the plans and in conformance with the manufacturer's shop drawings, or equal as approved. Cable barrier systems approved for use have passed NCHRP Report 350 or MASH of the test level specified (e.g., TL-3 or TL-4). The post spacing and resulting deflection characteristics of the system will be such that contact with obstructions within the project site will be avoided when the system is impacted.

Furnish pre-stretched cable.

Furnish Class A concrete in accordance with Item 421, "Hydraulic Cement Concrete."

Furnish delineators as shown on the plans and in accordance with Item 658, "Delineator and Object Marker Assemblies."

Salvage approved material when shown on the plans. When specified, construct cable barrier systems and cable barrier terminal sections using salvaged materials removed within the project site. Incidentals and material necessary to replace unsalvageable materials needed to relocate a cable barrier system or cable barrier terminal section as shown on the plans and in conformance with manufacturer's recommendations will be furnished by the Contractor.

3. CONSTRUCTION

Perform work in accordance with the details, dimensions, and requirements shown on the plans and in accordance with manufacturer's recommendations. Place posts into steel sleeves in a concrete foundation unless otherwise shown on the plans. Locate terminal sections at locations as shown on the plans. Repair or replace damaged parts immediately. Provide an installation and repair manual specific to the cable barrier system and cable barrier terminal sections.

Locate barrier delineators at a maximum spacing of 100 ft. and in accordance with the TMUTCD or as shown on the plans. Install barrier delineators in conformance with manufacturer's recommendations.

3.1. **Install.** Provide and install new cable barrier system and terminal section components.

3.2. **Relocate.** As shown on the plans, remove existing cable barrier system and cable barrier terminal sections and install at another location. Completely remove posts and any concrete surrounding the posts. Furnish new foundation concrete. Furnish backfill material and backfill holes with material equal in composition and density to the surrounding soil unless otherwise directed. Repair or replace Contractor damaged material at the Contractor's expense as directed.

3.3. **Remove.** Remove existing cable barrier systems and cable barrier terminal sections from the project site. Properly dispose of unsalvageable materials in conformance with federal, state, and local regulations. Completely remove posts and any concrete surrounding the posts. Furnish backfill material and backfill the holes with material equal in composition and density to the surrounding soil unless otherwise directed.

As shown on the plans, salvage cable, posts, terminal sections, and hardware to be retained by the Department. Neatly stack salvaged materials and deliver to designated sites shown on the plans. Concrete foundations and steel post inserts will be considered unsalvageable material. Repair or replace Contractor damaged salvageable material at the Contractor's expense. Do not mar or damage salvageable materials during removal.

4. MEASUREMENT

- 4.1. **Install.** Measurement will be by the foot of cable barrier system and by each cable barrier terminal system installed.
- 4.2. **Relocate.** Measurement will be by the foot of cable barrier system and by each cable barrier terminal system relocated.
- 4.3. **Remove.** Measurement will be by the foot of cable barrier system and by each cable barrier terminal system removed.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid under this Article. Delineators attached to the cable barrier will not be measured or paid for directly but will be subsidiary to this Item.

- 5.1. **Install.** Payment will be made for the unit price bid for "Install Cable Barrier System" of the test level specified (e.g., TL-3 or TL-4), "Install Cable Barrier System" of the test level specified (e.g., TL-3 or TL-4) and post spacing specified, and "Install Cable Barrier Terminal Section" of the test level specified (e.g., TL-3 or TL-4). The unit price bid for "Cable Barrier System (Install)" and "Cable Barrier Terminal Section (Install)" is full compensation for furnishing cable barrier system, cable barrier terminal section, concrete foundations (excluding mow strips), delineators, equipment, labor, tools, and incidentals.
- 5.2. **Relocate.** Payment will be made for the unit price bid for "Relocate Cable Barrier System" of the test level specified (e.g., TL-3 or TL-4), "Relocate Cable Barrier System" of the test level specified (e.g., TL-3 or TL-4) and post spacing specified, and "Relocate Cable Barrier Terminal Section" of the test level specified (e.g., TL-3 or TL-4). The unit price bid for "Cable Barrier System (Relocate)" and "Cable Barrier Terminal Section (Relocate)" is full compensation for relocating existing cable barrier system and cable barrier terminal sections on the project site from one location to another (including disassembly and reassembly costs), moving material to a temporary storage area (including disassembly costs), and moving and installing cable barrier system and cable barrier terminal section material from a temporary storage area to an installation site on the project. This price includes furnishing steel post inserts, concrete foundations (excluding mow strips), delineators, backfilling holes, equipment, tools, and incidentals.
- 5.3. **Remove.** Payment will be made for the unit price bid for "Remove Cable Barrier System" and "Remove Cable Barrier Terminal Section." The unit price bid for "Cable Barrier System (Remove)" and "Cable Barrier Terminal Section (Remove)" is full compensation for salvaging or removing and disposing of cable barrier system, cable barrier terminal sections, concrete foundations (excluding mow strips), delineators, backfilling holes, equipment, labor, tools, and incidentals.

Item 544

Guardrail End Treatments



1. DESCRIPTION

Furnish and install, move, or remove guardrail end treatments.

2. MATERIALS

Furnish new materials from the MPL of rail element manufacturers. Obtain materials at the location shown on the plans when furnished by the Department.

3. CONSTRUCTION

Install guardrail end treatments in conformance with manufacturer's assembly and installation requirements and the details shown on the plans. Provide the Engineer with manufacturer's installation and repair manuals specific to the guardrail end treatment.

Move or remove guardrail end treatments as shown on the plans and as directed. Deliver salvageable materials as shown on the plans or as directed. Dispose of unsalvageable materials in conformance with federal, state, and local regulations.

4. MEASUREMENT

This Item will be measured by each guardrail end treatment.

5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Guardrail End Treatment (Install)" of the post and type specified where applicable, "Guardrail End Treatment (Move and Reset)," or "Guardrail End Treatment (Remove)." This price is full compensation for foundations, materials, stockpiling, disposal of unsalvageable materials, equipment, labor, tools, and incidentals.

Payment for "Guardrail End Treatment (Move and Reset)" will include each guardrail end treatment removed from a stockpile or from an existing location and reset in a new location as shown on the plans or as directed.

Payment for "Guardrail End Treatment (Remove)" will include each guardrail end treatment removed from an existing location and stockpiled at the location shown on the plans, or disposed of, or as otherwise directed.

Item 545

Crash Cushion Attenuators



1. DESCRIPTION

For permanent placement or temporary work zone locations, furnish and install, move and reset, or remove crash cushion attenuators.

2. MATERIALS

- 2.1. **Permanent Crash Cushion Attenuators.** Furnish new crash cushion attenuators in accordance with the details shown on the plans and in conformance with the manufacturer's shop drawings. Obtain crash cushion attenuators at the location shown on the plans when furnished by the Department. New crash cushion attenuators that are furnished for the project may be used in temporary installation locations if they meet the design requirements for the temporary installation location and the final placement location, and if the attenuators are fully functional.
- 2.2. **Work Zone Crash Cushion Attenuators.** Furnish new or used crash cushion attenuators in accordance with Item 502, "Barricades, Signs, and Traffic Handling," and as shown on the plans. Sacrificial water-filled crash cushion attenuators (which are designated for exclusive use in temporary work zone locations) may be reused for the applicable payment items as long as the crash cushions are undamaged, all parts from the appropriate installation manual are supplied, and the devices are not older than 7 yr. from the manufacture date. If the 7-yr. manufacture date occurs during project construction, the device may be used to the termination of the project up to 10 yr. from the manufacture date.
- 2.3. **Concrete.** Furnish concrete for pads in accordance with Item 421, "Hydraulic Cement Concrete," and the foundation requirements as shown on the plans.

3. CONSTRUCTION

Perform the following as shown on the plans.

- 3.1. **Installation.** Assemble and install crash cushion attenuators in accordance with the details shown on the plans and in conformance with manufacturer recommendations. Obtain assembly and installation information for the crash cushion attenuators from the manufacturer and provide the Engineer with an installation and repair manual specific to the crash cushion attenuators.
- 3.2. **Moving and Resetting.** Remove crash cushion attenuators from a stockpile or from an existing location and reset in a new location as shown on the plans or as directed. Install crash cushion attenuators in conformance with pertinent standards and manufacturer recommendations. Provide additional materials to complete the installation as needed. Dispose of unsalvageable materials in conformance with federal, state, and local regulations. New cushions that are initially placed in temporary work zone applications and later moved to a permanent location will be paid for under "Move and Reset."
- 3.3. **Removal.** Retain and remove Contractor-furnished temporary work zone attenuators from the right of way when no longer in use. Existing attenuators salvaged from the project, meeting the above requirements, may be reused for temporary work zone installations unless otherwise shown on the plans. Retain and remove existing attenuators unless otherwise shown on the plans. For existing attenuators designated as salvageable, remove the crash cushion attenuators, clean, and stockpile in the area shown on the plans. Dispose of unsalvageable materials in conformance with federal, state, and local regulations.

4. MEASUREMENT

This item will be measured by each crash cushion attenuator.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided for under "Measurement" will be paid for at the unit price bid for "Crash Cushion Attenuator (Furnish and Install, Designated Source, Move and Reset, Stockpile, or Remove)" of the category, width (N or W), and test level, and for work zones the width, test level, and designation "Work Zone." This price is full compensation for foundations, materials, stockpiling, moving and removing, hauling, installing and resetting, disposal of unsalvageable materials, equipment, labor, tools, and incidentals. Incidental maintenance and incident repair and replacement will be paid for in accordance with Article 7.17., "Contractor's Responsibility for Work," and Article 9.7., "Payment for Extra Work and Force Account Method."

- 5.1. **Furnish and Install.** This price is full compensation for furnishing and installing crash cushion attenuator.
- 5.2. **Designated Source.** This price is full compensation for delivering and installing Department-furnished crash cushion attenuator from a designated source.
- 5.3. **Move and Reset.** This price is full compensation for moving crash cushion attenuator installations on the project site from one location to another (including disassembly and reassembly costs), moving crash cushion attenuator from an installation on the project site to a temporary storage area (including disassembly costs), and moving crash cushion attenuator from a temporary storage area to an installation site (including assembly costs).
- 5.4. **Stockpile.** This price is full compensation for removing crash cushion attenuator from the project site and delivering to the Department stockpile area shown on the plans or as directed.
- 5.5. **Remove.** This price is full compensation for removing an existing or Contractor-furnished crash cushion attenuator from the project site and retention by the Contractor.

Item 550

Chain Link Fence



1. DESCRIPTION

Furnish, install, remove, repair, or replace chain link fence and gates.

2. MATERIALS

Furnish certification from the chain link fence materials manufacturer stating that all fencing materials comply with the requirements of this Item before installation of the fence. Use only new materials.

2.1. **General.** Furnish materials in accordance with the following.

- Item 421, "Hydraulic Cement Concrete," Class B
- Item 445, "Galvanizing"

2.2. **Wire Fabric.** Provide wire fabric with:

- 9-gauge (0.148-in. diameter) steel wire with a minimum breaking strength of 1,290 lb. meeting ASTM A392 Class I or ASTM A491;
- mesh size of 2 in. \pm 1/8 in. between parallel wires with at least seven meshes in a vertical dimension of 23 in. along the diagonals of the openings; and
- knuckled selvages at the top and bottom edge of the fabric, unless otherwise shown on the plans.

2.3. **Posts.** Provide posts of the size and weight shown on the plans. Do not provide rerolled or open-seam posts. Use material for all posts meeting ASTM F1043 Group 1A Regular Grade or Group 1C High Strength.

2.4. **Post Caps.** Provide malleable iron post caps designed to exclude all moisture. Furnish barbed wire support arms integral with the post caps if barbed wire is shown on the plans. Furnish post caps with an opening for the top rail if top rail is shown on the plans. Post caps must have a 2-in. skirt.

2.5. **Gates.** Provide gates fabricated from round sections of pipe of the size and weight shown on the plans. Use material for all gate pipes meeting ASTM F1043 Group 1A Regular Grade or Group 1C High Strength. For each gate, include:

- corner and tee fittings of malleable iron or pressed steel with means for attaching diagonal bracing members;
- hinges of malleable iron allowing a full 180° swing, easily operated by one person;
- ball-and-socket type bottom hinges that do not twist or turn from the action of the gate and prevent the closed gate from being lifted off the hinges;
- a positive stop that prevents any portion of the gate from swinging over an adjacent traffic lane;
- malleable iron pulley systems for roll-type gate (only when required);
- diagonal braces consisting of 3/8-in. diameter cable with turnbuckles, two to each gate frame, and, for vehicle gates, a vertical pipe brace of the size and weight shown on the plans at the center of each gate leaf;
- latches of malleable iron or steel for single gates with a single-fork latch and padlock eye that will keep the gate closed;
- two fork latches mounted on a center plunger rod with a padlock eye for double-leaf gates;
- holdbacks for each leaf of vehicular gates, with a semi-automatic holdback catch anchored at least 12 in. into a 12-in. diameter \times 24-in. deep concrete footing; and

- a malleable iron center rest, designed to receive the plunger rod anchored as shown on the plans for all double-leaf gates.
- 2.6. **Top Rail.** Use material meeting ASTM F1043 Group 1A or Group 1C for all top rail pipes. Provide 1.660-in. outside diameter (OD) top rail manufactured from Group 1A standard weight (Schedule 40) steel pipe weighing 2.27 lb. per foot, or from Group 1C high-strength pipe weighing 1.84 lb. per foot when shown on the plans. Provide pipe in sections at least 18 ft. long joined with outside steel sleeve couplings at least 6 in. long with a minimum wall thickness of 0.70 in. Use couplings designed to allow for expansion of the top rail.
- 2.7. **Tension Wire.** Use 7-gauge (0.177-in.) carbon steel wire with a minimum breaking strength of 1,950 lb. for the bottom edge of all fence fabric, and for the top edge of fence fabric when a top rail is not specified.
- 2.8. **Truss Bracing.** Provide truss bracing as shown on the plans.
- 2.9. **Cables.** Provide seven-wire strand cables manufactured of galvanized annealed steel at least 3/8 in. in diameter.
- 2.10. **Barbed Wire.** Provide three strands of twisted 12.5-gauge barbed wire with two-point, 14-gauge barbs spaced approximately 5 in. apart conforming to ASTM A121 or ASTM A585 when shown on the plans.
- 2.11. **Barbed Wire Support Arms.** Provide support arms at an angle of 45° from vertical, with clips for attaching three strands of barbed wire to each support arm and sufficient strength to support a 200-lb. weight applied at the outer strand when barbed wire is shown on the plans.
- 2.12. **Stretcher Bars.** Provide stretcher bars made of flat steel at least 3/16 × 3/4 in. and not more than 2 in. shorter than the fabric height. Provide one stretcher bar for each gate and end post and two stretcher bars for each corner and pull post.
- 2.13. **Grounds.** Provide copper-clad steel rods 8 ft. long with a minimum diameter of 5/8 in., or other UL-listed ground rods.
- 2.14. **Miscellaneous Fittings and Fasteners.** Furnish enough fittings and fasteners to erect all fencing materials in a proper manner. Furnish fittings for posts from pressed or rolled steel, forged steel, malleable iron, or wrought iron of good commercial quality spaced as shown on the plans.
- 2.15. **Coatings.** Hot-dip galvanize all materials unless specified otherwise in this Item or as shown on the plans. Fabric, tension wire, and barbed wire may be aluminum-coated or alloy-coated if approved. Additionally, coat all material except bolts, nuts, washers, and pipe material with thermally fused polyvinyl chloride (PVC) in accordance with ASTM F668, Class 2b, meeting the specified color when shown on the plans.
- 2.15.1. **Fabric.**
- 2.15.1.1. **Galvanizing.** Hot-dip galvanize in accordance with ASTM A392, Class I.
- 2.15.1.2. **Aluminum Coating.** Aluminum-coat in accordance with ASTM A491.
- 2.15.1.3. **Alloy Coating.** Coat with zinc-5% aluminum-mischmetal alloy (Zn-5Al-MM) in accordance with ASTM F1345, Class I.
- 2.15.2. **Posts, Braces, and Gates.**
- 2.15.2.1. **Standard Weight (Schedule 40) Pipe.** Hot-dip galvanize inside and outside in accordance with ASTM F1043 (1.8 oz. per square foot galvanized zinc weight).

- 2.15.2.2. **High Strength Pipe.** Hot-dip galvanize before or after forming pipe in accordance with ASTM F1043 Group 1C and as follows.
 - **Outside.** Minimum 0.9 oz. per square foot galvanized zinc weight with a verifiable polymer overcoat.
 - **Inside.** Minimum 0.9 oz. per square foot galvanized zinc weight before forming, or minimum 0.3 mils zinc-based coating after forming containing a minimum 90% zinc dust, by weight.
- 2.15.2.3. **Optional Additional Coating.** Additionally, coat all pipe material with 10 mils minimum thermally fused PVC in accordance with ASTM F1043, meeting the specified color when shown on the plans.
- 2.15.3. **Fittings, Bolts, and Other Miscellaneous Hardware.** Galvanize all fittings, bolts, and miscellaneous hardware in accordance with Item 445.
- 2.15.4. **Tension Wire.** Zinc-coat tension wire with a minimum coating of 0.80 oz. per square foot, or aluminum-coat with a minimum coating of 0.30 oz. per square foot.
- 2.15.5. **Barbed Wire.** Zinc-coat barbed wire in accordance with ASTM A121 (0.80 oz. per square foot), or aluminum-coat in accordance with ASTM A585 (0.30 oz. per square foot).
- 2.15.6. **Pull Cable.** Zinc-coat pull cable with a minimum coating of 0.80 oz. per square foot of individual-wire surface when tested in accordance with ASTM A116.

3. CONSTRUCTION

Erect the chain link fence to the lines and grades established on the plans. Overall height of the fence when erected is the height above the grade shown.

Repair or replace damaged fence or gates. Remove and replace the post and foundation if posts cannot be repaired by straightening. Return all salvageable material to the location shown on the plans when a fence installation is to be removed in its entirety and not replaced. Backfill all postholes with suitable material. Return the salvaged fence fabric in secured rolls not more than 50 ft. long. Dispose of unsalvageable material.

- 3.1. **Clearing and Grading.** Clear all brush, rocks, and debris necessary for the installation of this fencing.

Stake the locations for corner posts and terminal posts unless otherwise shown on the plans. Follow the finished ground elevations for fencing panels between corner and terminal posts. Level off minor irregularities in the path of the fencing.

- 3.2. **Erection of Posts.** Install posts as shown on the plans. Plumb and permanently position posts with anchorages firmly set before fabric is placed. Brace corner and pull posts as shown on the plans.

- 3.2.1. **Post Spacing.** Space posts as shown in Table 1.

**Table 1
Post Spacing and Placement**

Post Type	Required Spacing or Placement
Line posts	No more than 10 ft. apart
Pull posts	No more than 500 ft. apart and at each change in direction exceeding 20° vertically
Corner posts	At each horizontal angle point

Install cables on all terminal posts and extend to adjacent posts. Install cables on each side of corner and pull posts using a 3/8-in. drop-forged eye-and-eye or eye-and-clevis turnbuckle unless otherwise shown on the plans.

- 3.2.2. **Postholes.** Drill holes for concrete footings for all posts to provide footings of the dimensions shown on the plans.

Penetrate solid rock by at least 12 in. (18 in. for end, corner, gate, and pull posts) or to plan depth where the rock is encountered before reaching plan depth. Drill holes in the solid rock with a diameter at least 1 in. greater than the OD of the post.

Fill the hole in the solid rock with grout consisting of one part hydraulic cement and three parts clean, well-graded sand after the posts are set and plumbed. If desired, other grouting materials may be used only if approved. Thoroughly work the grout into the hole, leaving no voids. Construct concrete footings from the solid rock to the top of the ground.

- 3.2.3. **Gate Posts.** Align the tops of all gate frames with the fencing top tension wire or top rail. Provide vehicular gates that are greater in overall height than the adjacent fencing by the height necessary to extend to within 2 in. of the pavement between the curbs if curbs are shown on the plans.

- 3.2.4. **Concrete Footings.** Center posts in their footings. Place concrete and compact by tamping or other approved methods. Machine mix all batches of concrete more than 1/2 cu. yd. Hand mixing concrete is allowed on batches less than 1/2 cu. yd.

Use forms for footings where the ground cannot be satisfactorily excavated to neat lines. Crown the concrete or grout (for solid rock) to carry water from the post. Keep the forms in place for at least 24 hr. Backfill the footing with moistened material as soon as each form is removed, and thoroughly tamp. Cover concrete with at least 4 in. of loose moist material, free of clods and gravel, immediately after placing concrete. No other curing is required.

Spread all excess excavated and loose material used for curing neatly and uniformly. Remove excess concrete and other construction debris from the site.

- 3.3. **Erection of Fabric.** Place the fabric with the cables drawn taut with the turnbuckles after all posts have been permanently positioned and anchorages firmly set. Secure one end and apply enough tension to the other end to remove all slack before making attachments. Cut the fabric, independently attach each span at all corner posts, and pull posts unless otherwise shown on the plans.

Follow the finished contour of the site with the bottom edge of fabric located approximately 2 in. above the grade. Grade uneven areas so the maximum distance between the bottom of fabric and ground is 6 in. or less.

Fasten fabric at 12-in. intervals to the top and bottom tension wires between posts. Fasten the fabric in the same manner when top rail is shown on the plans. Fasten the fabric on gate frames to the top and bottom of the frame at 12-in. intervals. Use steel wire fabric ties of 9-gauge steel or larger. Fasten fabric to terminal posts using steel stretcher bars and stretcher bar bands fitted with carriage bolts and nuts of the size and spacing shown on the plans. Use stretcher bars to fasten end posts, pull posts, corner posts, and gateposts with stretcher bar bands at intervals of no more than 15 in. Attach stretcher bars to terminal posts using 1 × 1/8-in. flat steel bands with 3/8-in. carriage bolts at intervals up to 15 in.

- 3.4. **Electrical Grounds.** Provide at least one electrical ground for each 1,000 ft. of fence, located near the center of the run. Provide additional grounds directly under the point where power lines pass over the fence. For fence placed on bridge structures, install grounds as shown on the plans.

Vertically drive or drill in the grounding rod until the top of the rod is approximately 6 in. below the top of the ground. Connect a No. 6 solid copper conductor to the rod and to the fence by a UL-listed method so that each element of the fence is grounded.

- 3.5. **Repair of Coatings.** Repair damaged zinc coating in accordance with Section 445.3.4., "Repairs."

4. MEASUREMENT

Chain link fence will be measured by the foot of fence installed, repaired, replaced, or removed, measured at the bottom of the fabric along the centerline of the fence from center to center of posts, excluding gates.

Gates will be measured as each gate installed, repaired, replaced, or removed.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Chain Link Fence (Install)" or "Chain Link Fence (Repair)" of the height specified, or "Chain Link Fence (Remove)" and "Gate (Install)" or "Gate (Repair)" of the type, height, and width of opening specified, or "Gate (Remove)." Clearing and grading for fencing and gates will not be paid for directly, but will be subsidiary to this Item.

- 5.1. **Chain Link Fence (Install).** This price is full compensation for furnishing and installing fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus material; and equipment, labor, tools, and incidentals.
- 5.2. **Chain Link Fence (Repair).** This price is full compensation for furnishing materials; repairing or replacing fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus or damaged material; and equipment, labor, tools, and incidentals.
- 5.3. **Chain Link Fence (Remove).** This price is full compensation for removing all fencing, except gates; cleaning, grading, and backfilling; removing and disposing of surplus material; and equipment, labor, tools, and incidentals.
- 5.4. **Gate (Install).** This price is full compensation for installing gate and for providing materials, center anchorages, equipment, labor, tools, and incidentals.
- 5.5. **Gate (Repair).** This price is full compensation for repairing or replacing gate and for furnishing materials; removing and disposing of damaged materials; and equipment, labor, tools, and incidentals.
- 5.6. **Gate (Remove).** This price is full compensation for removing gate and for materials, equipment, labor, tools, and incidentals.

Item 552

Wire Fence



1. DESCRIPTION

Furnish and construct fence of barbed wire or a combination of woven fence fabric and barbed wire, supported on metal or wood posts.

2. MATERIALS

Furnish materials as shown on the plans and in accordance with this Article.

- 2.1. **Metal Posts and Braces.** Furnish steel pipe in accordance with ASTM A53 if used for posts and braces. Use steel in accordance with ASTM A702 for T-posts. Use only new steel. Do not use rerolled or open-seam material. Furnish galvanized steel sections in accordance with Item 445, "Galvanizing." Use an approved anticorrosive coating when painting is specified. Spot-coat damaged areas with the same paint color after installation of painted posts and braces. Use paint with at least the same anticorrosive properties as the original paint. Use the size, weight, and area of posts, braces, and anchor plates shown on the plans.
- 2.2. **Wood Posts and Braces.**
- 2.2.1. **Untreated Wood.** Provide cedar or juniper timber.
- 2.2.2. **Treated Wood.** Provide pine timber treated in accordance with Item 492, "Timber Preservative and Treatment." Remove outer bark and all inner cambium bark on treated posts; occasional strips of bark may remain if not more than 1/2 in. wide or more than 3 in. long.
- Use sound timber that is free of decay, shakes, splits, or other defects that would weaken the posts or braces or otherwise make them structurally unsuitable for the purposes intended. Knots that are sound, tight, trimmed flush, and not in clusters are allowed, provided they do not exceed 1/3 of the small diameter or the least dimension of the posts and braces. Remove spurs and splinters, cutting the ends square.
- 2.3. **Gates and Gateposts.** Furnish materials to the dimensions shown on the plans or as directed.
- 2.4. **Barbed Wire.** Furnish barbed wire in accordance with ASTM A121 and as shown on the plans.
- 2.5. **Wire Mesh.** Furnish wire mesh fabric in accordance with ASTM A116 and as shown on the plans.
- 2.6. **Miscellaneous.** Furnish galvanized bolts, nuts, washers, braces, straps, and suitable devices for holding barbed wire and wire mesh firmly to metal posts. Use material of good commercial quality and design. Provide galvanized staples at least 1-1/2 in. long.

3. CONSTRUCTION

Space fence posts as shown on the plans. Set fence posts plumb and firm at the intervals, depth, and grade shown on the plans. Brace corner and pull posts in two directions. Brace end posts and gateposts in one direction. Install a corner post where the alignment changes 30° or more. Brace the angle post to the adjacent line posts with diagonal tension wires at alignment angles between 15° and 30°.

Snub or guy fencing at the critical point of grade depressions and fence sags, where stresses tend to pull posts out of the ground, with a double 9-gauge galvanized wire. Connect the wire to the top horizontal line of

the barbed wire or to the top and bottom wire or wire mesh fabric, and to a deadman weighing at least 100 lb. Stretch the fence before guying and snubbing.

Install corner, end, pull, or angle post assembly before stretching the wire between posts. Connect existing cross fences to the new fences and corner posts at junctions with existing fences. Fasten to posts using galvanized ties or staples while drawing barbed wire and wire fabric taut, or as shown on the plans. Install pull post assemblies at 500-ft. intervals for steel posts and at 1,000-ft. intervals for wood posts. Metal line posts may be driven provided driving does not damage the posts. Metal corners, ends, pull posts, and braces must be set in concrete footings crowned at the top to shed water. Thoroughly tamp backfill in 4-in. layers. Notch timber posts as shown on the plans.

Unless otherwise directed, T-posts, steel pipe brace posts, steel pipe gate posts, steel pipe post assemblies, and water gap posts must remain in place.

Posts removed for the convenience of the Contractor due to brush removal or other issues will be replaced at the Contractor's expense.

Remove brush and trees from fence areas where work is performed. Dispose of debris off the right of way, in conformance with federal, state, and local regulations unless otherwise approved. When approved, chip debris and spread in a thin layer on the right of way.

Install water gaps at locations as shown on the plans.

4. MEASUREMENT

Fencing will be measured by the foot of wire fence, excluding gates and water gaps. Gates will be measured as each gate. Water gaps will be measured by the foot as the distance between fence ends.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Wire Fence," "Water Gap," or "Gate." This price is full compensation for furnishing, preparing, hauling, and installing fence, water gap, and gate materials; excavation, backfilling, and disposal of surplus material; removing and trimming of brush and tree limbs; and equipment, labor, tools, and incidentals.

Unless otherwise shown on the plans, removal of existing fence will not be paid for directly but will be subsidiary to pertinent Items.

Item 556

Pipe Underdrains



1. DESCRIPTION

Install pipe underdrains.

2. MATERIALS

2.1. **Pipe.** Furnish the types and sizes of pipe shown on the plans. Use only one type of pipe for any underdrain system on the project. Use perforated pipe in areas to be drained and use non-perforated pipe between the perforated pipe and the outfall.

2.1.1. **Type 1.** Corrugated steel pipe (CSP) conforming to any type specified in AASHTO M 36, fabricated from corrugated galvanized sheet.

2.1.2. **Type 2.** Corrugated aluminum pipe conforming to AASHTO M 196, Type I or Type IA, fabricated from corrugated sheet.

2.1.3. **Type 3.** Bituminous-coated CSP conforming to the requirements of Type 1 and uniformly coated inside and out with a minimum thickness of 0.05 in. of bituminous material meeting the requirements shown in Table 1 when tested in accordance with ASTM A849 Material Class A or Material Class PA.

Table 1
Requirements of Bituminous Material

Test	Requirements
Solubility, % by wt., in trichloroethylene	99.5 Min
Brittleness	Pass
Flow, in.	0.25 Max

2.1.4. **Type 4.** Bituminous-coated corrugated aluminum pipe conforming to the requirements of Type 2 and uniformly coated inside and out with a minimum thickness of 0.05 in. of bituminous material meeting the requirements shown in Table 1 when tested in accordance with ASTM A849 Material Class A or Material Class PA.

2.1.5. **Type 6.** Corrugated polyethylene plastic tubing conforming to AASHTO M 252.

2.1.6. **Type 7.** Corrugated polyvinyl chloride (PVC) pipe conforming to ASTM F949.

2.1.7. **Type 8.** Smooth-wall PVC pipe conforming to AASHTO M 278 Class PS 46.

2.1.8. **Type 9.** As shown on the plans.

2.2. **Filter Material.** Furnish hard, durable, and clean sand, gravel, crushed stone, or crushed shell meeting the gradation by percent weight shown in Table 2 unless otherwise shown on the plans. Filter material must be free of clay balls or other organic or deleterious matter as determined by in accordance with [Tex-413-A](#). Use of crushed limestone is allowed unless otherwise shown on the plans. Use only one type of filter material for any underdrain system on a project.

Table 2
Acceptable Gradations for Filter Material

Sieve Size	Type B	Type C	Type E	Type F	Type G
	% Retained on Sieve (Tex-401-A)				
1-1/2"	–	0–10	Grade 2 Coarse Aggregate ²	Grade 3 Coarse Aggregate ²	Grade 4 (57) Coarse Aggregate ²
3/4"	0–10	20–40			
3/8"	15–35	–			
#4	35–55	40–60			
#20	35–65 ¹	35–65 ¹			
#50	75–100 ¹	75–100 ¹			

1. Of the portion finer than No. 4 sieve.
2. Refer to Table 4 in Item 421, "Hydraulic Cement Concrete."

Loss by decantation as determined by in accordance with [Tex-406-A](#) must not exceed 1% of the material retained on a No. 4 sieve or 4% of the material passing a No. 4 sieve. Use Type G filter material around the underdrains unless otherwise shown on the plans.

- 2.3. **Filter Fabric.** Meet [DMS-6200](#), "Filter Fabric," Type 1.
- 2.4. **Riprap.** Provide concrete riprap in accordance with Item 432, "Riprap," when required.

3. CONSTRUCTION

Begin excavation of the trench at the outfall and proceed toward its upper end, following the lines and grades shown on the plans or as directed. Hold the minimum horizontal limits of excavation for filter material to the dimensions shown in Table 3 or as shown on the plans.

Table 3
Minimum Horizontal Limits of Excavation for Filler Material

Depth of Trench (ft.)	Distance Outside Neat Lines of Pipe Underdrains (ft.)
0–6	1.00
>6–10	1.50
>10–15	2.00
>15	2.50

Place filter fabric in the bottom and sides of the trench in areas to be drained before placing pipe or filter material, as shown in Figure 1. Provide enough width of fabric to overlap on top of the filter material. Center perforated pipe in the excavated ditch with the perforations below the horizontal axis. Join the pipe with appropriate couplers if required. Join plastic pipe in conformance with the manufacturer's recommendations. Do not use tarpaper strips. Obtain approval for pipe placement before placing filter material.

Place filter material at least 12 in. above the bottom of the pipe or as shown on the plans. Do not allow filter material to displace the pipe.

Lap filter fabric over the top of the filter material after placing pipe and filter material in conformance with the manufacturer's recommendation or as shown on the plans.

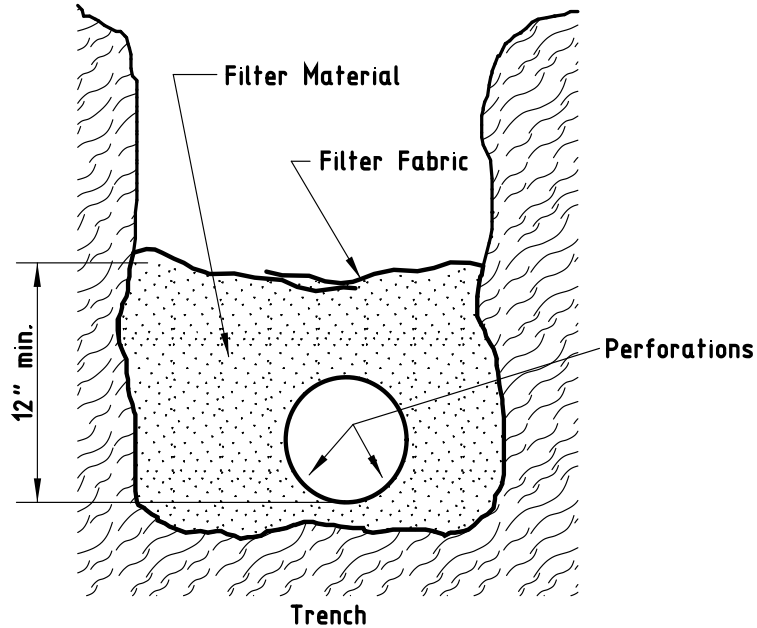


Figure 1
Installation Process

Install non-perforated pipe sections between the perforated pipe and the outfall. The sections of non-perforated pipe do not require filter fabric or filter material.

Place approved plugs in the upper ends of all pipe. Cover exposed outfall ends with 1/2-in. galvanized hardware cloth as directed. Provide Class B concrete riprap, when required, in accordance with Item 432 and as shown on the plans. Place the riprap to the contour and grade of the embankment slope. Cut the pipe to the slope of the riprap.

Backfill the remainder of the trench with suitable material in layers not to exceed 6 in.

4. MEASUREMENT

This Item will be measured by the foot along the top of the pipe and will include the length of elbows, wyes, tees, and other branches.

5. PAYMENT

The work performed and material furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Pipe Underdrains" of the pipe type and size specified. This price is full compensation for pipe, couplers, plugs, screens, filter material, filter fabric, riprap, excavation, backfill, equipment, labor, materials, tools, and incidentals.

Protection methods for excavations deeper than 5 ft. will be measured and paid for in accordance with Item 402, "Trench Excavation Protection."

Item 560

Mailbox Assemblies



1. DESCRIPTION

Install, remove, temporarily relocate, or replace mailbox assemblies of the type specified.

2. MATERIAL

Furnish mailbox assemblies as shown on the plans. An assembly does not include the mailbox unless shown otherwise on the plans. Provide new mailbox assemblies for permanent installations.

3. CONSTRUCTION

Temporarily relocate mailbox assemblies as shown on the plans or as directed. Furnish and install approved mailbox assemblies and mount mailboxes on those assemblies. Maintain mailbox assemblies in a serviceable condition. Furnish and install additional mailbox assemblies as directed. Relocate mailbox and assemblies to permanent locations upon completion of construction work.

4. MEASUREMENT

This Item will be measured by each permanent mailbox assembly installed.

5. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Mailbox Installation (Single)," of the type specified; "Mailbox Installation (Double)," of the type specified; or "Mailbox Installation (Multiple)," of the type specified. This price is full compensation for installing mailboxes and reflectors in permanent locations, materials, equipment, labor, tools, and incidentals. Removing existing or installing and moving temporary mailbox assemblies will not be paid for directly, but will be subsidiary to pertinent Items.

Item 585

Ride Quality for Pavement Surfaces



1. DESCRIPTION

Measure and evaluate the ride quality of pavement surfaces.

2. EQUIPMENT

2.1. **Surface Test Type A.** Provide a 10-ft. straightedge.

2.2. **Surface Test Type B.** Provide a high-speed or lightweight inertial profiler, certified at the Texas A&M Transportation Institute. Provide equipment certification documentation. Display a current decal on the equipment indicating the certification expiration date.

Use a certified profiler operator from the MPL. When requested, furnish documentation for the person certified to operate the profiler.

2.3. **Diamond Grinding and Grooving Equipment.** Provide self-propelled powered grinding and grooving equipment specifically designed to smooth and texture pavements using circular diamond blades when grinding or grooving is required. Provide equipment with automatic grade control capable of grinding at least 3 ft. of width longitudinally in each pass without damaging the pavement. When grooving, configure blades to produce grooves 0.10–0.16 in. wide and 0.19 in. deep with a land area 0.70–0.80 in. between the grooves unless otherwise shown on the plans. Meet the groove tolerances ± 0.02 in. for width and ± 0.06 in. for depth unless otherwise directed.

3. WORK METHODS

Measure and evaluate profiles using Surface Test Type A and Type B on surfaces as described below unless otherwise shown on the plans.

3.1. **Longitudinal Profile.** Measure the longitudinal profile of the surface, including horizontal curves.

3.1.1. **Travel Lanes.** Unless otherwise shown on the plans, use Surface Test Type B on the final riding surface of all travel lanes except as follows.

3.1.1.1. **Service Roads and Ramps.** Use Surface Test Type A on service roads and ramps unless Surface Test Type B is shown on the plans.

3.1.1.2. **Short Projects.** Use Surface Test Type A when project pavement length is less than 2,500 ft. unless otherwise shown on the plans.

3.1.1.3. **Bridge Structures.** Measure the profile in conformance with the pertinent Item or use Surface Test Type A for span type bridge structures, approach slabs, and the 100 ft. leading into and away from such structures.

3.1.1.4. **Leave-Out Sections.** Use Surface Test Type A for leave-out sections and areas between leave-out sections that are less than 400 ft., and 100 ft. leading into and away from leave-out sections.

3.1.1.5. **Ends.** Use Surface Test Type A on the first and last 100 ft. of the project pavement length.

3.1.2. **Shoulders and Other Areas.** Use Surface Test Type A for shoulders and all other areas, including intermediate pavement layers.

- 3.2. **Profile Measurements.** Measure the finished surface using Surface Test Type A or Type B in accordance with Section 585.3.1., “Longitudinal Profile,” and the plans.
- 3.2.1. **Surface Test Type A.** Test the surface using a 10-ft. straightedge as directed.
- 3.2.2. **Surface Test Type B.**
- 3.2.2.1. **Quality Control (QC) Testing.** Perform QC tests throughout the duration of the project. Use a 10-ft. straightedge, inertial profiler, profilograph, or any other means to perform QC tests.
- 3.2.2.2. **Quality Assurance (QA) Testing.** Perform QA tests using either a high-speed or lightweight inertial profiler. Coordinate with and obtain authorization from the Engineer before starting QA testing. Perform QA tests on the finished surface of the completed project or at the completion of a major stage of construction, as approved. Perform QA tests within 7 days after receiving authorization.
- The Engineer may require QA testing to be performed at times of off-peak traffic flow. Operate the inertial profiler in a manner that does not unduly disrupt traffic flow as directed. When using a lightweight inertial profiler to measure a surface that is open to traffic, use a moving traffic control plan in accordance with the TMUTCD, Part 6, and the plans.
- In accordance with [Tex-1001-S](#), operate the inertial profiler and deliver test results within 24 hr. of testing. Provide all profile measurements in electronic data files using the format specified in [Tex-1001-S](#).
- 3.2.2.2.1. **Verification Testing.** The Engineer may perform ride quality verification testing within 10 working days after the Contractor’s QA testing is complete for the project or major stage of construction. When the Department’s profiler produces an overall average international roughness index (IRI) value of more than 3.0 in. per mile higher than the value calculated using Contractor data, the Engineer will decide whether to accept the Contractor’s data, use the Department’s data, use an average of both parties’ data, or request a referee test. Referee testing is mandatory if the difference is greater than 6.0 in. per mile.
- 3.2.2.2.2. **Referee Testing.** The Maintenance Division will conduct referee testing, and the results are final. The Maintenance Division may require recertification for the Contractor’s or Department’s inertial profiler when the results between the verification, Contractor, and referee testing are greater than 6.0 in. per mile.
- 3.3. **Acceptance Plan and Payment Adjustments.** The Engineer will evaluate profiles for determining acceptance, payment adjustment, and corrective action.
- 3.3.1. **Surface Test Type A.** Use diamond grinding or other approved work methods to correct surface areas that have more than 1/8-in. variation between any two contacts on a 10-ft. straightedge. For asphalt concrete pavements, when directed, fog seal the aggregate exposed from diamond grinding. The Engineer will waive surface variation requirements for deficiencies resulting from manholes, permanent traffic markings, or other similar appurtenances near the wheel paths. Before performing work, the Engineer will determine whether repair areas or crack sealing may result in reflective defects, and may waive surface variation requirements. Following corrective action, retest the area to verify compliance with this Item.
- 3.3.2. **Surface Test Type B.** The Engineer will use the QA test results to determine payment adjustments for ride quality using Department software. IRI values will be calculated using the average of both wheel paths. When taking corrective actions to improve a deficient 0.1-mi. section, payment adjustments will be based on the data obtained from reprofiling the corrected area.
- 3.3.2.1. **International Roughness Index (IRI) Payment Adjustment for 0.1-mi. Sections.** For asphalt concrete pavements, unless payment adjustment Schedule 1 or Schedule 2 is shown on the plans, Schedule 3 will be used to determine the level of payment adjustment for each 0.1-mi. section on the project. Before performing work, the Engineer will determine whether Surface Test Type A will be used instead of the specified payment adjustment schedule when the following conditions exist in existing travel lanes:
- travel lane is directly adjacent to existing curb and gutter, or
 - travel lane has repair areas or crack sealing that may result in reflective defects.

For concrete pavements, payment adjustment Schedule 5 will be used unless payment adjustment Schedule 4 is shown on the plans.

No positive payment adjustment will be paid for any 0.1-mi. section that contains localized roughness after corrective action is performed.

- 3.3.2.2. **International Roughness Index (IRI) Deficient 0.1-mi. Sections.** Correct any 0.1-mi. section with an average IRI of more than 95.0 in. per mile. The Engineer may apply a \$3,000 penalty if the IRI is greater than 95 instead of requiring corrective action. No corrective action is required for Schedule 3 or Schedule 5. After making corrections, reprofile the pavement section to verify that corrections have produced the required improvements.

The associated payment adjustment shown in Table 1 and Table 2 applies when successful corrective action improves the IRI of a deficient 0.1-mi. section.

If corrective action does not produce the required improvement, the Engineer may require:

- continued corrective action, or
- application of the pertinent payment adjustment in accordance with Table 1 or Table 2.

- 3.3.2.3. **Localized Roughness.** Measure localized roughness using an inertial profiler in accordance with [Tex-1001-S](#). The Engineer will determine areas of localized roughness using the individual profile from each wheel path.

Before performing corrective action, the Engineer and Contractor, together, will use a 10-ft. straightedge to confirm localized roughness identified from inertial profiler results. Correct confirmed areas that have more than 1/8-in. variation between any two contacts on the straightedge.

The Engineer will waive localized roughness requirements for deficiencies resulting from manholes, permanent traffic markings, or other similar appurtenances near the wheel paths.

- 3.3.2.3.1. **Localized Roughness Payment Adjustment.** Instead of corrective action, the Engineer may assess a payment adjustment for each occurrence of confirmed localized roughness. No more than one payment adjustment will be applied for any 5 ft. of longitudinal distance. No payment adjustment will be applied where the Engineer waived localized roughness requirements. For Schedule 1, a localized roughness payment adjustment of \$500 per occurrence will be applied. For Schedule 2 and Schedule 4, a localized roughness payment adjustment of \$250 per occurrence will be applied. For Schedule 3 and Schedule 5, a localized roughness payment adjustment will not be applied; however, corrective action will be required in areas not waived by the Engineer.

Localized roughness payment adjustments will be evaluated within 0.1-mi. sections and applied unless the IRI deficient 0.1-mi. section payment adjustment is greater. When the IRI deficient payment adjustment is greater, the payment adjustment in Table 1 or Table 2 will be applied.

- 3.3.2.4. **Corrective Action.** Use diamond grinding or other approved work methods to correct IRI deficient sections and localized roughness. After corrective action is complete, perform the following.
- For asphalt concrete pavements, when directed, fog seal the aggregate exposed from diamond grinding or other approved work methods allowed.
 - For concrete pavements, when directed, groove the pavement longitudinally after diamond grinding.

4. MEASUREMENT AND PAYMENT

The work performed, materials furnished, certification and recertification, traffic control for all testing, materials and work needed for corrective action, equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items. Sections shorter than 0.1 mi. and longer than 50 ft. will be prorated in accordance with [Tex-1001-S](#).

Table 1
Payment Adjustments for Ride Quality of Asphalt Concrete Pavements

Average IRI for Each 0.10 mi. of Traffic Lane (in./mi.)	Payment Adjustment for \$/0.10 mi. of Traffic Lane		
	Schedule 1	Schedule 2	Schedule 3
≤30	600	600	300
31	580	580	290
32	560	560	280
33	540	540	270
34	520	520	260
35	500	500	250
36	480	480	240
37	460	460	230
38	440	440	220
39	420	420	210
40	400	400	200
41	380	380	190
42	360	360	180
43	340	340	170
44	320	320	160
45	300	300	150
46	280	280	140
47	260	260	130
48	240	240	120
49	220	220	110
50	200	200	100
51	180	180	90
52	160	160	80
53	140	140	70
54	120	120	60
55	100	100	50
56	80	80	40
57	60	60	30
58	40	40	20
59	20	20	10
60-65	0	0	0
66	-20	0	0
67	-40	0	0
68	-60	0	0
69	-80	0	0
70	-100	0	0
71	-120	0	0
72	-140	0	0
73	-160	0	0
74	-180	0	0
75	-200	0	0
76	-220	-20	0
77	-240	-40	0
78	-260	-60	0
79	-280	-80	0
80	-300	-100	0
81	-320	-120	0
82	-340	-140	0
83	-360	-160	0
84	-380	-180	0
85	-400	-200	0
86	-420	-220	0
87	-440	-240	0
88	-460	-260	0
89	-480	-280	0
90	-500	-300	0
91	-520	-320	0
92	-540	-340	0

Average IRI for Each 0.10 mi. of Traffic Lane (in./mi.)	Payment Adjustment for \$/0.10 mi. of Traffic Lane		
	Schedule 1	Schedule 2	Schedule 3
93	-560	-360	0
94	-580	-380	0
95	-600	-400	0
>95	See Section 585.3.3.2.2.		0

Table 2
Payment Adjustments for Ride Quality of Concrete Pavements

Average IRI for Each 0.10 mi. of Traffic Lane (in./mi.)	Payment Adjustment for \$/0.10 mi. of Traffic Lane	
	Schedule 4	Schedule 5
≤30	600	300
31	580	290
32	560	280
33	540	270
34	520	260
35	500	250
36	480	240
37	460	230
38	440	220
39	420	210
40	400	200
41	380	190
42	360	180
43	340	170
44	320	160
45	300	150
46	280	140
47	260	130
48	240	120
49	220	110
50	200	100
51	180	90
52	160	80
53	140	70
54	120	60
55	100	50
56	80	40
57	60	30
58	40	20
59	20	10
60–85	0	0
86	-40	0
87	-80	0
88	-120	0
89	-160	0
90	-200	0
91	-240	0
92	-280	0
93	-320	0
94	-360	0
95	-400	0
>95	See Section 585.3.3.2.2.	