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 considered part of mobilization.

2. MEASUREMENT

This Item will be measured by the lump sum as the work progresses.

3. PAYMENT

Partial payments of the lump sum bid for mobilization will be as follows. The adjusted Contract amount for construction Items as used below is defined as the total Contract amount less the lump sum for mobilization.

- 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, 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.
Item 502
Barricades, Signs, and Traffic Handling

1. DESCRIPTION

Provide, install, move, replace, maintain, clean, and remove upon completion of work all barricades, signs, cones, lights, and other traffic control devices used for traffic handling as indicated on the plans and as directed.

2. CONSTRUCTION

Implement the traffic control plan (TCP) developed for this project.

2.1. Traffic Control Plan (TCP). Provide traffic control devices that conform to details shown on the plans, the TMUTCD, and the Compliant Work Zone Traffic Control Device List (CWZTCDL) maintained by the Traffic Operations Division.

Designate in writing, before beginning work, a Contractor’s Responsible Person (CRP) and alternate to be the representative of the Contractor who is responsible for taking or directing corrective measures of installation and maintenance deficiencies as soon as possible. The CRP, or designated alternate, must be accessible by phone 24 hr. per day and able to respond to emergencies when notified. The CRP shall be trained as a traffic control supervisor through Department-approved training. See the Department’s MPL for approved training. Provide a current certificate indicating training completion.

Follow the TCP and install traffic control devices as shown on the plans and as directed. Install traffic control devices straight and plumb. Make changes to traffic control only as approved by the Engineer. Minor adjustments to meet field conditions (constructability and visibility) are allowed.

Submit Contractor-proposed TCP changes, signed and sealed by a licensed professional engineer, to the 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 CWZTCDL.

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

2.2. Flaggers. Provide a Contractor representative who has current certification as a flagging instructor through Department-approved courses. See the Department’s MPL for approved training providers. Provide the certificate indicating course completion. This representative serves as a flagging supervisor and is responsible for training and assuring that all flaggers are qualified to perform flagging duties.

A qualified flagger must be independently certified by completing a Department-approved course or be trained by the Contractor’s certified flagging instructor. Provide the Engineer with a current list of qualified flaggers before beginning flagging activities. Use only flaggers on the qualified list. Furnish documentation that the flagger is qualified when requested.

Flaggers must be courteous and able to effectively communicate with the public. When directing traffic, flaggers shall dress appropriately, wear high-visibility safety apparel, use flags, signs, stop-slow paddles, and other hand-signaling devices, and follow the flagging procedures set forth in the TMUTCD.
2.3. **Removal.** Remove all barricades, signs, cones, lights, and other traffic control devices used for work zone traffic handling upon completion of work unless otherwise shown on the plans.

2.4. **Law Enforcement Officers.** Uniformed officers providing work zone traffic service shall be trained for the service which they must perform through Department-approved training. See Department’s MPL for approved training. Provide a current certificate indicating training completion.

2.5. **Work Zone Traffic Control Personnel.** Workers responsible for temporary traffic control shall be trained through Department-approved training. See the Department’s MPL for approved training. Provide a current certificate indicating training completion.

3. **MEASUREMENT**

This Item will be measured by the month.

4. **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 "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 under pertinent Items.

4.1. **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 and construction has begun. Installation of the project limit advance warning signs alone is not considered the beginning of construction.

4.2. **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 time frame 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.

4.3. **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.” However, when all work is complete for all project locations, except for work for vegetative establishment and maintenance periods and performance and test periods, the 10% of the total Contract amount may be exceeded. The remaining balance will be paid in accordance with Section 502.4.5., “Balance Due.”

4.4. **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 by Section 502.4.2., “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; nor delays caused directly or indirectly by requirements of the Contract.

4.5. **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.”
4.6. **Law Enforcement.** Law enforcement required by the Engineer will be paid in accordance with Article 9.7., "Force Account."
Item 504
Field Office and Laboratory

1. DESCRIPTION

Provide field offices and laboratories for exclusive use of the Engineer and inspection staff.

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 a location acceptable to the Engineer. If desired, use permanent buildings or rental space meeting the requirements for field offices instead of portable buildings only if approved. Maintain the field office until the Department accepts the project. Furnish other equipment as required.

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.

2.1.1. Parking and Fencing. Provide an all-weather parking area for the sole use of at least 2 State-owned vehicles unless otherwise shown on the plans. Situate the area near the field office or laboratory at a location acceptable to the Engineer. Maintain the parking area until the project is completed and restore the area to a condition acceptable to the Engineer upon project completion.

Enclose the field office or laboratory and the parking area with a 6-ft. chain-link fence, a top-mounted 3-strand barbed wire, and a 12-ft. gate when shown on the plans.

2.1.2. Buildings.

2.1.2.1. Field Office. Provide field offices with roof, floor, doors, and screened windows. Ensure the floor is strong enough to support testing equipment and has an impervious floor covering. Ensure that the field office is tied down, weatherproof, piped for water and fuel, and electrically wired by personnel meeting the requirements of Article 7.15., “Electrical Requirements.”

Furnish and install adequate equipment, outlets, lighting, air-conditioning, heating, and ventilation. Provide a partitioned restroom furnished with restroom supplies, a lavatory, and a flush toilet connected to a sewer or septic tank. If desired, furnish a portable toilet only when approved.

Provide secured and controlled access to the field office or laboratory through security measures such as bars, alarms, or security fencing. Furnish steps to the structures if directed.

2.1.2.2. Laboratory. Provide laboratories with all of the requirements described in Section 504.2.1.2.1., “Field Office.” In addition, provide the following items unless otherwise directed:
- a 10 lb. ABC fire extinguisher with up-to-date inspection tag and a working smoke detector;
- laboratory equipment necessary for testing when shown on the plans;
- water (for testing purposes) from an approved source;
- an exhaust fan for concrete curing, asphalt, or other operations to meet Department and OSHA requirements (Vent all exhaust to the outside of the structure);
- a work platform at least 18 in. long and 12 in. wide, mounted on a lumber post at least 6 × 6 in. extending through the floor and firmly fixed in the ground (The work platform support can be provided by other methods as shown on the plans or as directed);
- a minimum of 20 ft. of total work counter length at least 3 ft. wide and 3 ft. above the floor and strong enough to support required testing equipment; and
- a laboratory sink measuring 24 × 30 in. and 12 in. deep.

2.1.3. **Field Office and Laboratory Appurtenances.** Provide workbenches and tables at least 3 ft. wide and 6 ft. long, chairs, and filing cabinets in the quantity acceptable to the Engineer. Provide solar screens, blinds, or shades if directed. Provide potable water, electricity, collection and disposal of trash, and janitorial services acceptable to the Engineer.

Provide internet connectivity, a printer/fax/scan/copier, and telephone if shown on the plans.

Provide a closet within the facility for Contracts that require a nuclear gauge for moisture or density determination, or a separate structure for storage of the gauge located as far as possible from normal office work. Provide internal keyed deadbolt locks and hinges with pins on the inside of the storage area for all doors allowing access to the nuclear gauge.

2.2. **Structure Types.**

2.2.1. **Type A Structure (Field Laboratory).** Provide at least 200 sq. ft. of gross floor area in rooms 8 ft. high. Partition the building into at least 2 rooms, each furnished with an exterior door and at least 2 windows.

2.2.2. **Type B Structure (Field Office and Laboratory).** Provide at least 600 sq. ft. of gross floor area in rooms 8 ft. high. Partition the floor area into at least 3 interconnected rooms with doors, 2 exterior doors, and at least 2 windows in each room.

2.2.3. **Type C Structure (Field Office).** Provide at least 400 sq. ft. of gross floor area in rooms 8 ft. high. Partition the floor area into at least 2 interconnected rooms with doors, 2 exterior doors, and at least 2 windows in each room.

2.2.4. **Type D Structure (Asphalt Mix Control Laboratory).** Provide at least 700 sq. ft. of gross floor area in rooms 8 ft. high. Partition the floor area into at least 2 interconnected rooms with doors, 2 exterior doors, and at least 2 windows in each room.

2.2.4.1. **Asphalt Content by Ignition Method.** Provide enough power ventilation for the room, a NEMA 6-50R (208/240 V, 50 A) outlet within 3 ft. of the ignition oven location, and an independent exhaust outlet no farther than 8 ft. from the oven when asphalt content is determined by the ignition method. 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.

Vent the ignition oven to the outside.

2.2.5. **Type E Structure.** Provide building as shown on plans.

3. **MEASUREMENT AND PAYMENT**

The work performed, materials furnished, utilities and utility service (including phone if required), appurtenances (including office equipment and Internet service), testing equipment, labor, tools, and incidentals will not be measured or paid for directly but will be subsidiary to pertinent Items.
1. DESCRIPTION

Install, maintain, and remove erosion, sedimentation, and environmental control measures to prevent or reduce the discharge of pollutants in accordance with the Storm Water Pollution Prevention Plan (SWP3) in the plans and the Texas Pollutant Discharge Elimination System (TPDES) General Permit TXR150000. Control measures are defined as Best Management Practices used to prevent or reduce the discharge of pollutants. 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” or “Sediment Control Approved Products” lists. Perform work in a manner to prevent degradation of receiving waters, facilitate project construction, and comply with applicable federal, state, and local regulations. Ensure the installation and maintenance of control measures is performed in accordance with the manufacturer’s or designer’s specifications.

Provide the Contractor Certification of Compliance to the Engineer before performing SWP3 or soil disturbing activities. By signing the Contractor Certification of Compliance, the Contractor certifies they have read and understand the requirements applicable to this project pertaining to the SWP3, the plans, and the TPDES General Permit TXR150000. The Contractor is responsible for any penalties associated with non-performance of installation or maintenance activities required for compliance. Ensure the most current version of the certificate is executed for this project.

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 hardness, durability, cleanliness, and resistance to crumbling, flaking, and eroding acceptable to the Engineer. Provide the following:

- Types 1, 2, and 4 Rock Filter Dams. Use 3 to 6 in. aggregate.
- Type 3 Rock Filter Dams. Use 4 to 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 in. × 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 that conform to the plans. Recycled and other materials meeting these requirements are allowed if approved.

Furnish concrete in accordance with Item 432, "Riprap."

2.3. **Temporary Paved Flumes.** Furnish asphalt concrete, hydraulic cement concrete, or other comparable non-erodible material that conforms to 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 that meet the details shown on the plans and 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 from adherent coatings such as salt, alkali, dirt, clay, loam, shale, soft or flaky materials, and organic and injurious matter. Use 4- to 8-in. aggregate for Type 1. Use 2- to 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 with 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, "Pipe Underdrains," and details 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 0.5 lb. per foot.

2.7.2. **Fence.** Provide orange construction fencing as approved.

2.7.3. **Fence Wire.** Provide 11 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 stability exceeding 70%.

Use natural coarse sand or manufactured sand meeting the gradation given in Table 1 to fill sandbags. Filled sandbags must be 24 to 30 in. long, 16 to 18 in. wide, and 6 to 8 in. thick.
Table 1
Sand Gradation

<table>
<thead>
<tr>
<th>Sieve #</th>
<th>Retained (% by Weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Maximum 3%</td>
</tr>
<tr>
<td>100</td>
<td>Minimum 80%</td>
</tr>
<tr>
<td>200</td>
<td>Minimum 95%</td>
</tr>
</tbody>
</table>

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

2.9. **Temporary Sediment Control Fence.** Provide a net-reinforced fence using woven geo-textile 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 1.3 lb. per foot.

2.9.3. **Net Reinforcement.** Provide net reinforcement of at least 12-1/2 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 called out on the plans. Permit no more than 5% of the material to escape from the containment mesh. Furnish compost meeting the requirements of Item 161, “Compost.”

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 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 who has overall responsibility for the storm water management program. The CRPE will implement storm water and erosion control practices; will oversee and observe storm water control measure monitoring and management; will 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 General Permit TXR1500000. 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 to the Engineer on how to
improve the effectiveness of control measures. Attend the Department’s preconstruction conference for the project. Ensure training is completed as identified in Section 506.3.3., "Training," by all applicable personnel before employees work on the project. Document and submit a list, signed by the CRPE, to the Engineer of all applicable Contractor and subcontractor employees who have completed the training. Include the employee’s name, the training course name, and date the employee completed the training. Provide the most current list to the Engineer at the preconstruction conference or before SWP3 or soil disturbing activities. Update the list as needed and provide the updated list to the Engineer when updated.

3.2. **Contractor Superintendent Qualifications and Responsibilities.** Provide a superintendent that is competent, has experience with and knowledge of storm water management, and is knowledgeable of the requirements and the conditions of the TPDES General Permit 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 storm water management at the project site; represent and act on behalf of the Contractor; and attend the Department’s preconstruction conference for the project.

3.3. **Training.** All Contractor and subcontractor employees involved in soil disturbing activities, small or large structures and, SWP3 (storm water control measures, soil retention blankets, seeding, sodding, etc.) activities must complete the following training before performing soil disturbing or SWP3 activities on the project. Training is provided by the Department at no cost to the Contractor and is valid for 3 yr. from the date of completion. The Engineer may require training at a frequency less than 3 yr. based on environmental needs.

- “Environmental Management System: Awareness Training for the Contractor (English and Spanish) (Approximate running time 20 min.)”
- “Storm Water: Environmental Requirements During Construction (English and Spanish) (Approximate running time 20 min.)”

The CRPE, alternate CRPE designated for emergencies, Contractor’s superintendent, and Contractor and subcontractor lead personnel involved in soil disturbing or SWP3 activities must enroll and complete the training listed below and provide the Certification of Completion to the Engineer before performing soil disturbing or SWP3 activities on the project. Training is provided by a third party and is valid for 3 yr. from the date shown on the Certificate of Completion. Coordinate enrollment through the third party and pay associated fees for the following training:

- “Revegetation During Construction,”
- “Construction General Permit Compliance,” and
- “Construction Stage Gate Checklist (CSGC).”

Training may take place at a location at the discretion of the Contractor. Training and associated fees will not be measured or paid for directly but are considered subsidiary to this Item.

4. **CONSTRUCTION**

4.1. **Contractor Responsibilities.** Implement the SWP3 for the project site in accordance with the plans and specifications, TPDES General Permit TXR150000, and as directed. Coordinate storm water management with all other work on the project. Develop and implement an SWP3 for project-specific material supply plants within and outside of the Department’s right of way in accordance with the specific or general storm water permit requirements. Prevent water pollution from storm water 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 an alternate, must be accessible by phone and able to respond to project-related storm water management or other environmental emergencies 24 hr. per day.

4.2.1. **Commencement.** Implement the SWP3 as shown and as directed. Contractor-proposed recommendations for changes will be allowed as approved. Conform to the established guidelines in the TPDES General Permit TXR150000 to make changes. Do not implement changes until approval has been received and
changes have been incorporated into the plans by the Engineer. Minor adjustments to meet field conditions are allowed and will be recorded by the Engineer 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 the TPDES General Permit 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 utilize another stabilization practice in accordance with the TPDES General Permit TXR150000.

4.3.3. **Finished Work.** Remove and dispose of all temporary control measures upon the Engineer's 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 the TPDES General Permit TXR150000. An exception will be allowed in arid areas as defined in the TPDES General Permit TXR150000.

4.3.4. **Restricted Activities and Required Precautions.** Do not discharge onto the ground or surface waters any pollutants such as chemicals, raw sewage, fuels, lubricants, coolants, hydraulic fluids, bitumens, or any other petroleum product. Operate and maintain equipment on-site to prevent actual or potential water pollution. Manage, control, and dispose of litter on-site 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 the TPDES General Permit TXR150000. Utilize 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). 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, according to manufacturers’ guidelines, and in accordance with the TPDES General Permit 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 determined by the Engineer.

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 with the time frame specified is when site conditions are "Too Wet to Work." Take immediate action if a correction is deemed critical by the Engineer. When corrections are not made within the established time frame, 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 of the SWP3, plans, or TPDES General Permit TXR150000.

The Engineer may limit the disturbed area if, in the opinion of the Engineer, 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 the permit, 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 with wire ties, or hog rings for Types 2 and 3, or as directed. Place rock filter dams perpendicular to the flow of the stream or channel unless otherwise directed. Construct filter dams according to the following criteria unless otherwise shown on the plans:

4.4.1.1. Type 1 (Non-reinforced).

4.4.1.1.1. Height. At least 18 in. measured vertically from existing ground to top of filter dam.

4.4.1.1.2. Top Width. At least 2 ft.


4.4.1.2. Type 2 (Reinforced).

4.4.1.2.1. Height. At least 18 in. measured vertically from existing ground to top of filter dam.

4.4.1.2.2. Top Width. At least 2 ft.

4.4.1.2.3. Slopes. No steeper than 2:1.

4.4.1.3. Type 3 (Reinforced).

4.4.1.3.1. Height. At least 36 in. measured vertically from existing ground to top of filter dam.

4.4.1.3.2. Top Width. At least 2 ft.

4.4.1.3.3. 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- to 5-in. spacing for vertical filling. Pull the end lacing rod at one end until tight, wrap around the end, and twist 4 times. Fill with stone at the filling end, pull the rod tight, cut the wire with approximately 6 in. remaining, and twist wires 4 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 a maximum of 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, “Riprap,” when designated 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 to 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 storm water 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, as specified in 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 to 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 to 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 with staples, or to steel posts with T-clips, in at least 4 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 by 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 6 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 1 patch every 15 to 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 in plans or as directed.

Secure biodegradable erosion control logs in a method adequate to prevent displacement as a result of normal rain events, prevent damage to the logs, and to the satisfaction of the Engineer such that flow is not allowed under the logs. Temporarily removing and replacing biodegradable erosion logs as 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 a minimum of 12 in. long × 2 to 4 in. wide × 1/2 to 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 on a daily basis as long as there are BMPs in place and/or soil disturbing activities are evident to ensure compliance with the SWP3 and TPDES General Permit 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 as described in 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, 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 to the Engineer within 7 days. Together, the CRPE and an Engineer’s representative will complete the Construction Stage Gate Checklist on a periodic basis as determined by the Engineer.

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 that 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 is considered subsidiary to this Item.

6. **PAYMENT**

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

- erosion-control measures for Contractor project-specific locations (PSLs) inside and outside the right of way (such as 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.

Furnishing and installing pipe for outfalls associated with sediment traps and ponds will not be paid for directly but is 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 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 is 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, “Riprap.”

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 are 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 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 is 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 is 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 is 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 is considered subsidiary to this Item.
Item 508
Constructing Detours

1. DESCRIPTION

Construct and maintain detours. Remove detours when required.

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 in accordance with details 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 so that it is not acceptable in accordance 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 accordance 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 accordance with pertinent Items. Maintain detours for public travel in a safe and passable condition. Public traffic safety and convenience is essential. Maintain detours in accordance with Article 4.5., "Maintenance of Traffic"; Article 7.7., "Public Safety and Convenience"; Article 7.14., "Contractor's Responsibility for Work"; 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 accordance with federal, state, and local requirements. If desired, dispose of materials by spreading along the adjacent roadway slopes if allowed. Salvage or stockpile in accordance 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) is used when embankment, base, and surface are paid for separately.

The price bid 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 accordance with other pertinent Items.

Maintenance of detours constructed will not be paid for directly, but will be subsidiary to this Item. Maintenance of pavement on detours that use existing pavement will be paid for in accordance with Article 7.14., “Contractor’s Responsibility for Work.”

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 accordance 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 the requirements of Item 502, “Barricades, Signs, and Traffic Handling,” at all entry points to the work zone, to stop traffic. Furnish a Stop/Slow paddle that meets the requirements of 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 on each approach to the activity area to control traffic. Provide Stop/Slow paddles and signs that meet the requirements of 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. A list of approved units can be found in 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 flaggers and pilot vehicle.

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 will be full compensation for the units, set up, relocating, removing, replacing parts, batteries, fuel, oil, and incidentals.
Item 512
Portable Concrete Traffic Barrier

1. DESCRIPTION

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

2. MATERIALS

Barrier sections will be furnished by the Department when shown on the plans. Furnish new barrier 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”

Furnish the class of concrete shown on the plans.

When portable barrier is to be furnished and retained by the Contractor, products from nonapproved sources or previously used product 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, and
- the general condition of both the barrier sections and their connectors is acceptable.

Department-furnished barrier sections will be at a stockpile location or an existing concrete traffic barrier installation shown on the plans.

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, “Precast Concrete Structural Members (Fabrication),” 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, “Concrete Substructures,” to the dimensions and cross-sections shown on the plans. Provide forms and cure concrete in accordance with Item 424, “Precast Concrete Structural Members (Fabrication).”

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.

Remove formwork after the concrete has reached sufficient strength to prevent physical damage to the member. Move barrier sections to a storage area and place them on blocking to prevent damage when they have attained sufficient strength to permit handling without causing visible damage.

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

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
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</tr>
<tr>
<td>Insert Placement</td>
<td>±1/2 in.</td>
</tr>
<tr>
<td>Horizontal Alignment</td>
<td>±1/8 in. per 10 feet of length</td>
</tr>
<tr>
<td>Deviation of Ends:</td>
<td></td>
</tr>
<tr>
<td>Horizontal Skew</td>
<td>±1/4 in.</td>
</tr>
<tr>
<td>Vertical Batter</td>
<td>±1/8 in. per foot of depth</td>
</tr>
</tbody>
</table>

Install the barrier sections in accordance with the details shown on the plans or as directed.

After use, stockpile portable barriers and connection hardware that are to be retained by the Department at the location shown on the plans or as otherwise directed.

Repair or replace all concrete 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 at the Contractor’s expense.

4. **MEASUREMENT**

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

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 Concrete 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 (1, 2, 3, etc.) of barrier specified. This price includes equipment, labor, tools, and incidentals.

5.1. **Furnish and Install.** This price is full compensation for furnishing and installing barrier and connection hardware.

5.2. **Designated Source.** This price is full compensation for delivering and installing Department-furnished barrier and connection hardware from a designated source.

5.3. **Move.** This price is full compensation for moving barrier installations on the project from one location to another (including disassembly and reassembly costs), moving barrier from an installation on the project to a temporary storage area (including disassembly costs), and moving barrier 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 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 and retained by the Contractor.
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, “Reinforcement for Concrete.” 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, “Precast Concrete Structural Members (Fabrication)” 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, “Precast Concrete Structural Members (Fabrication)”) 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, “Drilled Shaft Foundations,” when required.

Construct barrier in accordance with Item 420, “Concrete for Substructures.” 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, “Precast Concrete Structures (Fabrication).”

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 ±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 of Table 1 unless otherwise shown on the plans.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>±1 in.</td>
</tr>
<tr>
<td>Insert Placement</td>
<td>±1/2 in.</td>
</tr>
<tr>
<td>Horizontal Alignment</td>
<td>±1/8 in. per 10 feet of length</td>
</tr>
<tr>
<td>Deviation of Ends:</td>
<td></td>
</tr>
<tr>
<td>Horizontal Skew</td>
<td>±1/4 in.</td>
</tr>
<tr>
<td>Vertical Batter</td>
<td>±1/8 in. per foot of depth</td>
</tr>
</tbody>
</table>

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 (1, 2, 3, etc.), 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 to the satisfaction of the Engineer. Check all weighing and measuring equipment after each move and at least once each 6 mo. or when requested.

Calibrate all scales using weights certified by the Texas Department of Agriculture (TDA) or an equivalent agency approved by the Engineer. Provide a written calibration report from a scale mechanic for all 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 on a daily basis where payment is determined by weight. Each loading ticket must show the ticket number, truck number, gross weight, tare weight, and net weight.

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 by the Engineer.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Example Spreadsheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totals</td>
<td>Totals</td>
</tr>
</tbody>
</table>

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 3 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 (such as hydrated lime or mineral filler) and slurries (such as 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 528**  
Colored Textured Concrete and Landscape Pavers

<table>
<thead>
<tr>
<th>1. DESCRIPTION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1. <strong>Colored Textured Concrete.</strong> Furnish and place colored textured concrete.</td>
<td></td>
</tr>
<tr>
<td>1.2. <strong>Landscape Pavers.</strong> Furnish and install landscape pavers.</td>
<td></td>
</tr>
<tr>
<td>1.3. <strong>Landscape Pavers (Furnished).</strong> Landscape pavers will be furnished by the Department. Load and transport from the location shown on the plans to the project, and install.</td>
<td></td>
</tr>
<tr>
<td>1.4. <strong>Remove, Store, and Relay Landscape Pavers.</strong> Remove, store, and relay landscape pavers as shown on the plans or as directed. Furnish and lay replacement pavers.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. MATERIALS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1. <strong>Colored Textured Concrete.</strong> Furnish materials in accordance with the following:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Item 420, “Concrete Substructures”</td>
</tr>
<tr>
<td></td>
<td>Item 421, “Hydraulic Cement Concrete”</td>
</tr>
<tr>
<td></td>
<td>Item 440, “Reinforcement for Concrete”</td>
</tr>
<tr>
<td>Use Class A concrete unless otherwise shown on the plans.</td>
<td></td>
</tr>
<tr>
<td>When allowed by the Engineer, 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 Department’s MPL of pre-qualified fibers for concrete.</td>
<td></td>
</tr>
<tr>
<td>Use approved dry-shake color hardener or integral concrete colorant shown on the plans. Provide colored wax as a curing membrane meeting the requirements of ASTM C309 or as shown on the plans.</td>
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</tr>
<tr>
<td>2.2. <strong>Landscape Pavers.</strong> Furnish materials in accordance with the details shown on the plans and the following:</td>
<td></td>
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<tr>
<td></td>
<td>Item 132, “Embankment”</td>
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<td></td>
<td>Item 247, “Flexible Base”</td>
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<td></td>
<td>Item 275, “Cement Treatment (Road Mixed)”</td>
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<tr>
<td></td>
<td>Item 401, “Flowable Backfill”</td>
</tr>
<tr>
<td></td>
<td>Item 421, “Hydraulic Cement Concrete”</td>
</tr>
<tr>
<td>2.2.1. <strong>Pavers.</strong> Furnish pavers meeting the requirements of ASTM C936; made using normal-weight aggregates conforming to ASTM C33; and conforming to the shape, color, laying pattern, and dimensions shown on the plans. 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.</td>
<td></td>
</tr>
<tr>
<td>2.2.2. <strong>Bedding Sand.</strong> Furnish fine aggregate as specified in Item 421, “Hydraulic Cement Concrete,” with the gradation given in Table 1.</td>
<td></td>
</tr>
</tbody>
</table>
Table 1

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 in.</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>85–100</td>
</tr>
<tr>
<td>No. 100</td>
<td>10–30</td>
</tr>
</tbody>
</table>

Spread the sand at a uniform moisture content of 3% to 7%. Protect the sand against rain if it is stockpiled on-site before spreading.

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

Table 2

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4</td>
<td>100</td>
</tr>
<tr>
<td>No. 8</td>
<td>90–100</td>
</tr>
<tr>
<td>No. 16</td>
<td>60–100</td>
</tr>
<tr>
<td>No. 30</td>
<td>25–70</td>
</tr>
<tr>
<td>No. 50</td>
<td>10–30</td>
</tr>
<tr>
<td>No. 100</td>
<td>2–15</td>
</tr>
<tr>
<td>No. 200</td>
<td>Less than 10</td>
</tr>
</tbody>
</table>

3. **CONSTRUCTION**

3.1. **Colored Textured Concrete.** 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 in accordance with the plans and pertinent Items. Place and screed concrete to the proper grade and wood-float to a uniform surface, in accordance with Item 420, "Concrete Substructures."

Apply colorant in accordance with the manufacturer’s recommendations. Apply dry-shake color hardener, if used, evenly to the plastic surface, following the manufacturer’s directions. Use at least 65 lb. per 12 square yard. Apply in 2 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. Use a brick pattern if no texture is specified. Apply colored curing and finishing compound in accordance with the manufacturer’s directions.

3.2. **Landscape Pavers.**

3.2.1. **Removing and Relaying Existing Pavers.** Exercise care when removing existing pavers, making an effort to remove the 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 during storage. Safeguard the pavers from theft and/or vandalism while the Contract is in progress. Deliver salvageable excess pavers to a stockpile location on the project unless otherwise shown on the plans. Dispose of unsalvageable pavers in accordance 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 with pavers of equivalent size, shape, and color.

3.2.2. **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 accordance 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.
3.2.3. **Bedding Sand Installation.** Screed a layer of uncompacted sand to a depth of 1 to 1-1/2 in. over the compacted base. Do not use bedding sand for leveling.

Maintain the spread sand in a loose condition and protect against precompaction 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.

3.2.4. **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 1 part hydraulic cement to 2 parts concrete sand. Use cement and sand that meet Item 421, “Hydraulic Cement Concrete.”

Do not allow construction traffic on pavers during installation and compaction.

3.2.5. **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- to 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 2 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 work day.

Spread joint-filling sand as soon as practical after compaction but in all cases before the termination of each work day, 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 with a single 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**

Excavation, embankment, and base will not be paid for directly but will be subsidiary to this Item unless otherwise shown on the plans.

5.1. **Colored Textured Concrete.** 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 considered subsidiary to this Item. Base under colored textured concrete will be paid for under pertinent Items unless otherwise shown on the plans.
5.2. **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.

5.3. **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.

5.4. **Removing and Relaying Existing Pavers.** The work performed and measured as provided under “Measurement” will be paid for at the unit price bid for in accordance with “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.

5.4.1. **Remove and Relay Pavers.** Removing and relaying pavers will be paid for at the unit price 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.

5.4.2. **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 conforming to:
- 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 allowed by the Engineer, 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 Department’s MPL of pre-qualified fibers for concrete.

3. **CONSTRUCTION**

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

Furnish and place reinforcing steel in accordance with Item 440, "Reinforcement for Concrete."

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 2 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 to 3/8 in. less than the dimensions of the finished curb unless otherwise approved. After initial set, plaster surface with mortar consisting of 1 part hydraulic cement and 2 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.** Hand-tamp and sprinkle subgrade or foundation material 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 with 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.

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 to be 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 263, “Lime Treatment (Plant-Mixed)”
- Item 275, “Cement Treatment (Road-Mixed)”
- Item 276, “Cement Treatment (Plant-Mixed)”
- Item 292, “Asphalt Treatment (Plant-Mixed)”
- Item 316, “Surface Treatments”
- Item 330, “Limestone Rock Asphalt Pavement”
- Item 334, “Hot-Mix Cold-Laid Asphalt Concrete Pavement”
- Item 340, “Dense-Graded Hot-Mix Asphalt (Small Quantity)”
- 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 accordance 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.
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 accordance with the pertinent bid Items.
Item 531
Sidewalks

1. DESCRIPTION

Construct hydraulic cement concrete sidewalks.

2. MATERIALS

Furnish materials conforming to 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 other concrete as specified. Use Grade 8 course aggregate for extruded Class A concrete. Use other grades if approved.

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.

Mix and place concrete in accordance 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. Ensure that the sidewalk depth and reinforcement are not less than the driveway cross-sectional details shown on the plans where a sidewalk crosses a concrete driveway.

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

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 required 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, adjacent flares or side curb, and detectable warning surface as shown on the plans.
**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 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 connect to concrete driveways or turnouts will be measured and paid for in accordance with Item 530, “Intersections, Driveways, and Turnouts.”
Item 533
Milled Rumble Strips

1. DESCRIPTION

Construct milled rumble strips.

2. EQUIPMENT

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. CONSTRUCTION

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, 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.

Remove and dispose of debris by vacuuming or sweeping before opening the adjacent lane to traffic as directed.

4. MEASUREMENT

Rumble strips will be measured longitudinally by the foot. Measurement will only include the actual work performed. Measurement will not include interruptions across ramps, acceleration or deceleration lanes, crossovers, gore areas, or intersections with other roadways.

5. PAYMENT

The work performed in accordance with this Item and as provided for under “Measurement” will be paid for at the unit price bid for “Rumble Strips (Shoulder) and Rumble Strips (Centerline).” This price is full compensation for equipment, labor, materials, tools, and incidentals.
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.

When allowed by the Engineer, 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 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, “Concrete Substructures.” 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 conformance with Item 529, “Concrete Curb, Gutter, and Combined Curb and Gutter.”

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 1 part hydraulic cement and 2 parts fine aggregate to plaster exposed formed surfaces when required. Apply the mortar with 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 allowed by the Engineer, 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 Department’s 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 with 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 is 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 according to 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 are from a manufacturer on the Department’s MPL of rail element manufacturers.

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

Warped or deformed rail elements will be rejected.

2.2. Posts. Furnish new round timber, rectangular timber, or rolled steel section posts in accordance with details shown in the plans and the following requirements:

2.2.1. Timber Posts. Meet the requirements of 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 according to Item 445, “Galvanizing.”

<table>
<thead>
<tr>
<th>Specification</th>
<th>AASHTO M 180</th>
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</thead>
<tbody>
<tr>
<td>Class</td>
<td></td>
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<tr>
<td>A – Base metal nominal thickness 0.105 in.</td>
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<tr>
<td>B – Base metal nominal thickness 0.135 in.</td>
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<tr>
<td>Type</td>
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<tr>
<td>I – Zinc-coated 1.80 oz. per square foot minimum single-spot.</td>
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<tr>
<td>II – Zinc-coated 3.60 oz. per square foot minimum single-spot.</td>
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<tr>
<td>IV – Weathering Steel (required when shown on the plans).</td>
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<tr>
<td>Shape</td>
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<tr>
<td>W-Beam</td>
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<tr>
<td>Thrie Beam</td>
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<tr>
<td>W-Beam to Thrie Beam Transition</td>
<td></td>
</tr>
<tr>
<td>Markings</td>
<td></td>
</tr>
<tr>
<td>Permanently mark each metal beam rail element with the information required in AASHTO M 180. In addition, permanently mark all curved sections of metal beam rail element with the radius of the curved section in the format “R=XX ft.” Markings must be on the back of the metal beam rail section away from traffic and visible after erection.</td>
<td></td>
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</tbody>
</table>
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 445.3.5, “Repairs.”

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

2.3.1. **Timber.** Meet the requirements of 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.

2.3.2. **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 (bolts, nuts, and washers) according to the details shown on the plans and galvanized according to Item 445, “Galvanizing.”

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 as required in Item 421, “Hydraulic Cement Concrete.”

2.7. **Curb.** If indicated in the details, furnish the curb shown with metal beam guard fence transition as required by Item 529, “Concrete Curb, Gutter, and Combined Curb and Gutter.”

2.8. **Terminal Anchor Posts.** Furnish new terminal anchor posts from steel conforming to the material requirements of ASTM A36. Fabricate posts according to Item 441, “Steel Structures.” Galvanize terminal anchor posts after fabrication according to Item 445, “Galvanizing.”

2.9. **Driveway Terminal Anchor Posts.** Furnish new terminal anchor posts from steel conforming to the material requirements of ASTM A36. Fabricate posts according to Item 441, “Steel Structures.” Galvanize terminal anchor posts after fabrication according to Item 445, “Galvanizing.”

2.10. **Downstream Anchor Posts.** Furnish new terminal anchor posts consisting of new rectangular timber and new steel foundation tubes according to details shown on the plans.

2.11. **Downstream Anchor Hardware.** Furnish new hardware (brackets, plates, struts, cable, etc.) according to the details shown on the plans and galvanized according to Item 445, “Galvanizing.”

2.12. **Controlled Released Terminal (CRT) Posts.** Furnish new CRT posts according to the details shown on the plans and conforming to the requirements of 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.

### 3. CONSTRUCTION

Install posts and rail elements according to details 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 with approved power hammers (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 shall be as shown on the plans. Short radius metal beam guard fence requires the placement of CRT posts of the quantity shown on the plans.

3.4. **Terminal Anchor Posts.** Embed terminal anchor posts in concrete, unless otherwise shown on the plans.

3.5. **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 445.3.5., “Repairs.”

3.6. **Guardrail Adjustment.** Work includes vertical adjustment and horizontal shift of the rail element to meet the detail shown on the plans.

3.7. **Curb.** If indicated in the details, construct the curb shown with metal beam guard fence transition as required by Item 529, “Concrete Curb, Gutter, and Combined Curb and Gutter.”

3.8. **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 posts.

4.2. **Terminal Anchor Sections.** Measurement will be by each section, complete in place, consisting of a terminal anchor post and one 25-ft. section of rail element.

4.3. **Transitions.** Transitions for rail connection will be measured by each transition.

4.4. **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.

4.5. **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.

4.6. **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.

4.7. **Long Span System.** Measurement will be by the foot of fence. Fence shall be measured on the face of the rail, in place, between the first CRT and last CRT posts 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; “Terminal Anchor Section”; “Metal Beam Guard Fence Transition” of the type specified; “Metal W-Beam Guard Fence Adjustment”; “Metal Thrie Beam Guard Fence Adjustment”; “Terminal Anchor Section 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 directly, but are subsidiary to this item.

5.1. **Guard Fence.** The 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. **Terminal Anchor Section.** When a separate bid item is specified, the price bid for “Terminal Anchor Section” is full compensation for furnishing the rail element, anchor assembly, terminal anchor post, and foundations; installing the rail element anchor assembly and the terminal anchor post and foundations; excavation and backfilling; and equipment, labor, tools, and incidentals.

5.3. **Transition.** The 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.

5.4. **Guardrail Adjustment.** The 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.

5.5. **Short Radius.** The price bid for “Short Radius” is full compensation for furnishing special rail fabricated metal beam guard fence, CRT posts, materials, hauling, erection, blocks, driving posts, excavating, backfilling, equipment, labor, tools, and incidentals.

5.6. **Driveway Terminal Anchor Section.** The 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.

5.7. **Downstream Anchor Terminal.** The 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.

5.8. **Long Span System.** The 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 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 accordance 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 at the unit price bid for “Remove Metal Beam Guard Fence,” “Remove Terminal Anchor Section,” and “Remove Downstream Anchor Terminal.” This price will be 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 curb associated with the metal beam guard fence transitions will not be paid directly, but will be subsidiary to this Item.
# Item 544

## Guardrail End Treatments

<table>
<thead>
<tr>
<th></th>
<th>DESCRIPTION</th>
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<tbody>
<tr>
<td>1.</td>
<td>Furnish and install, move, or remove guardrail end treatments.</td>
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<tr>
<th></th>
<th>MATERIALS</th>
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<tbody>
<tr>
<td>2.</td>
<td>Furnish new materials from the Department’s MPL of rail element manufacturers. Obtain Department-furnished materials at the location shown on the plans.</td>
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<tr>
<th></th>
<th>CONSTRUCTION</th>
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</thead>
<tbody>
<tr>
<td>3.</td>
<td>Install guardrail end treatments in accordance 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 in accordance with the plans and as directed. Deliver salvageable materials in accordance with the plans or as directed. Dispose of unsalvageable materials in accordance with federal, state, and local regulations.</td>
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<tr>
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<th>MEASUREMENT</th>
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<tbody>
<tr>
<td>4.</td>
<td>This Item will be measured by each guardrail end treatment.</td>
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<tr>
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<th>PAYMENT</th>
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<tbody>
<tr>
<td>5.</td>
<td>The work performed and the materials furnished in accordance with this Item and measured as provided for 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 detailed 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 designated on the plans, disposed, or as otherwise directed.</td>
</tr>
</tbody>
</table>
Item 545
Crash Cushion Attenuators

1. DESCRIPTION

Furnish and install, move and reset, or remove crash cushion attenuators.

2. MATERIALS

2.1. Crash Cushion Attenuators. Furnish new crash cushion attenuators in accordance with the details shown on the plans and on the manufacturer’s shop drawings. Obtain crash cushion attenuators at the location shown on the plans when furnished by the Department.

2.2. Concrete. Furnish Class S concrete for pads that meets Item 421, “Hydraulic Cement Concrete.”

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 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 accordance with pertinent standards and manufacturer recommendations. Provide additional materials to complete the installation as needed. Dispose of unsalvageable materials in accordance with federal, state, and local regulations.

3.3. Removal. Remove crash cushion attenuators from an existing location and stockpile in the area designated on the plans, as directed, or dispose. Clean and repair salvageable units before inspection by the Engineer and return them to the Department. Dispose of unsalvageable materials in accordance with federal, state, and local regulations.

4. MEASUREMENT

This Item will be measured by each crash cushion attenuator.

5. PAYMENT

The work performed and the 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. 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.

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 from one location to another (including disassembly and reassembly costs), moving crash cushion attenuator from an installation on the project to a temporary storage area (including disassembly costs), and moving crash cushion attenuator 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 crash cushion attenuator 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 crash cushion attenuator from the project and retained 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. ±1/8 in. between parallel wires with at least 7 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, 2 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 by 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 1C for all top rail pipes. Provide 1.660 in. 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 7-wire strand cables manufactured of galvanized annealed steel at least 3/8 in. in diameter.

2.10. **Barbed Wire.** Provide 3 strands of twisted 12.5 gauge barbed wire with 2-point, 14 gauge barbs spaced approximately 5 in. apart conforming to ASTM A121 or ASTM A585 when specified on the plans.

2.11. **Barbed Wire Support Arms.** Provide support arms at an angle of 45° from vertical, with clips for attaching 3 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 specified on the plans.

2.12. **Stretcher Bars.** Provide stretcher bars made of flat steel at least 3/16 in. × 3/4 in. and not more than 2 in. shorter than the fabric height. Provide 1 stretcher bar for each gate and end post and 2 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 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-5A1-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 according to ASTM F1043 (1.8 oz./sq. ft. galvanized zinc weight).

2.15.2.2. **High Strength Pipe.** Hot-dip galvanize before or after forming pipe according to ASTM F1043 Group 1C and as follows:

- Outside – minimum 0.9 oz./sq. ft. galvanized zinc weight with a verifiable polymer overcoat.
2.15.2.3. **Optional Additional Coating.** Additionally coat all pipe material with 10 mils minimum thermally fused PVC according to 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 conformance with [Item 445, “Galvanizing.”](#)

2.15.4. **Tension Wire.** Zinc-coat tension wire with a minimum coating of 0.80 oz./sq. ft. or aluminum-coat with a minimum coating of 0.30 oz./sq. ft.

2.15.5. **Barbed Wire.** Zinc-coat barbed wire in accordance with ASTM A121 (0.80 oz./sq. ft.) or aluminum-coat in accordance with ASTM A585 (0.30 oz./sq. ft.).

2.15.6. **Pull Cable.** Zinc-coat pull cable with a minimum coating of 0.80 oz./sq. ft. of individual-wire surface when tested in conformance 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>
<thead>
<tr>
<th>Post Type</th>
<th>Required Spacing or Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line posts</td>
<td>no more than 10 ft. apart</td>
</tr>
<tr>
<td>Pull posts</td>
<td>no more than 500 ft. apart and at each change in direction exceeding 20° vertically</td>
</tr>
<tr>
<td>Corner posts</td>
<td>at each horizontal angle point</td>
</tr>
</tbody>
</table>

Install cables on all terminal posts and extend to adjacent posts. Install cables on each side of corner and pull posts with 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 outside diameter of the post.

Fill the hole in the solid rock with grout consisting of 1 part hydraulic cement and 3 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 over 1/2 cu. yd. Hand mixing concrete is allowed on batches under 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 and 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 by 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 endposts, pull posts, corner posts, and gateposts with stretcher bar bands at intervals of no more than 15 in. Attach stretcher bars to terminal posts with 1 in. × 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 1 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.

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 445.3.5., “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 is 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 in accordance with details shown on the plans and with the requirements of this Article.

2.1. Metal Posts and Braces. Furnish steel pipe in accordance with ASTM A53 if used for posts and braces. Use steel that meets 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 over 1/2 in. wide or over 3 in. long.

Use sound timber that is free from 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 will be 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, Class 1. Use barbed wire consisting of 2 strands of 12-1/2 gauge wire, twisted with 2-point 14 gauge barbs spaced no more than 5 in. apart, or other barbed wire as directed.

2.5. Wire Mesh. Furnish wire mesh fabric in accordance with ASTM A116, Class 1 to the height and design shown on the plans. Use at least 10 gauge wire for the top and bottom wires and at least 12-1/2 gauge wire for the intermediate wires and vertical stays.

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 2 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 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, 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.

4. MEASUREMENT

Fencing will be measured by the foot of wire fence, excluding gates. Gates will be measured as each gate.

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” or “Gate” of the type specified. This price is full compensation for furnishing, preparing, hauling, and installing fence and gate materials; excavation, backfilling, and disposal of surplus material; removal 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.
1. **DESCRIPTION**

   Install pipe underdrains.

2. **MATERIALS**

   2.1. **Pipe.** Furnish the types and sizes of pipe specified 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 IA, fabricated from corrugated sheet.

   2.1.3. **Type 3.** Bituminous-coated corrugated steel pipe 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 of Table 1 when tested in accordance with ASTM A849, Material Class A or Material Class PA.

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

   2.1.5. **Type 5.** Acrylonitrile-butadiene-styrene (ABS) pipe conforming to ASTM D2751, SDR-35. Perforations must meet the requirements of AASHTO M 278.

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

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

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

   2.1.9. **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 specified 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 Tex-413-A. Do not furnish crushed limestone unless shown on the plans. Use only one type of filter material for any underdrain system on a project.

---

### Table 1

*Requirements of Bituminous Material*

<table>
<thead>
<tr>
<th>Test</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solubility, % by wt., in trichloroethylene</td>
<td>99.5 Min</td>
</tr>
<tr>
<td>Brittleness</td>
<td>Pass</td>
</tr>
<tr>
<td>Flow, in.</td>
<td>0.25 Max</td>
</tr>
</tbody>
</table>

---

---
Table 2

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Type A</th>
<th>Type B</th>
<th>Type C</th>
<th>Type D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2 in.</td>
<td>–</td>
<td>–</td>
<td>0–10</td>
<td>–</td>
</tr>
<tr>
<td>3/4 in.</td>
<td>–</td>
<td>0–10</td>
<td>20–40</td>
<td>–</td>
</tr>
<tr>
<td>3/8 in.</td>
<td>–</td>
<td>15–35</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>No. 4</td>
<td>0–10</td>
<td>35–55</td>
<td>40–60</td>
<td>0–5</td>
</tr>
<tr>
<td>No. 8</td>
<td>–</td>
<td>0–20</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>No.16</td>
<td>15–50</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>No. 20</td>
<td>35–65¹</td>
<td>35–65¹</td>
<td>35–65¹</td>
<td>–</td>
</tr>
<tr>
<td>No. 30</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>40–75</td>
</tr>
<tr>
<td>No. 50</td>
<td>75–100¹</td>
<td>75–100¹</td>
<td>75–100¹</td>
<td>70–90</td>
</tr>
<tr>
<td>No. 100</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>90–100</td>
</tr>
</tbody>
</table>

1. Of the portion finer than No. 4 sieve.

Loss by decantation as determined by 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 B or Type C filter material around the underdrains unless otherwise shown on the plans. Do not place Type A or Type D filter material within 6 in. of perforations.

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

<table>
<thead>
<tr>
<th>Depth of Trench (ft.)</th>
<th>Distance Outside Neat Lines of Pipe Underdrains (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 6</td>
<td>1.00</td>
</tr>
<tr>
<td>Over 6 to 10</td>
<td>1.50</td>
</tr>
<tr>
<td>Over 10 to 15</td>
<td>2.00</td>
</tr>
<tr>
<td>Over 15</td>
<td>2.50</td>
</tr>
</tbody>
</table>

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 accordance 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 according to the manufacturer’s recommendation or as shown on the plans.
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 by the Engineer. Provide Class B concrete riprap, when required, in accordance with Item 432, “Riprap,” and details 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, Y’s, T’s, 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**

<table>
<thead>
<tr>
<th></th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Install, remove, temporarily relocate, or replace mailbox assemblies of the type specified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>MATERIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Furnish mailbox assemblies in accordance with the plans. An assembly does not include the mailbox unless shown otherwise on the plans. Provide new mailbox assemblies for permanent installations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>CONSTRUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>MEASUREMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>This Item will be measured by each permanent mailbox assembly installed.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>PAYMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>The work performed, materials furnished, and measured according to “Measurement” will be paid 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 directly, but will be subsidiary to pertinent Items.</td>
</tr>
</tbody>
</table>
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 or where allowed, a high-speed or lightweight inertial profiler, certified at the Texas Transportation Institute.

2.2. **Surface Test Type B.** Provide a high-speed or lightweight inertial profiler, certified at the Texas 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 Department’s approved list. When requested, furnish documentation for the person certified to operate the profiler.

2.3. **Diamond Grinding Equipment.** When grinding is required, provide self-propelled powered grinding equipment specifically designed to smooth and texture pavements using circular diamond blades. Provide equipment with automatic grade control capable of grinding at least 3 ft. of width longitudinally in each pass without damaging the pavement.

3. WORK METHODS

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

3.1. **Transverse Profile.** Measure the transverse profile of the finished riding surface in accordance with Surface Test Type A.

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

3.2.1. **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.

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

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

3.2.1.3. **Bridge Structures.** For span type bridge structures, approach slabs, and the 100 ft. leading into and away from such structures, measure the profile in accordance with the pertinent item or use Surface Test Type A.

3.2.1.4. **Leave-Out Sections.** Use Surface Test Type A for leave-out sections and areas between leave-out sections that are less than 100 ft.

3.2.1.5. **Ends.** Use Surface Test Type A on the first and last 100 ft. of the project pavement length.
3.2.2. **Shoulders and Other Areas.** Use Surface Test Type A for shoulders and all other areas including intermediate pavement layers.

3.3. **Profile Measurements.** Measure the finished surface in accordance with Surface Test Type A or B in accordance with Section 585.3.1., "Transverse Profile"; Section 585.3.2., "Longitudinal Profile"; and the plans.

3.3.1. **Surface Test Type A.** Test the surface with a 10-ft. straightedge as directed. When allowed, use an inertial profiler to measure the surface. The Engineer will use Department software to evaluate the surface.

3.3.2. **Surface Test Type B.**

3.3.2.1. **QC Testing.** Perform QC tests on a daily basis throughout the duration of the project. Use a 10-ft. straightedge, inertial profiler, profilograph, or any other means to perform QC tests.

3.3.2.2. **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 determined by the Engineer. When using a lightweight inertial profiler to measure a surface that is open to traffic, use a moving traffic control plan in accordance with Part 6 of the TMUTCD 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.

3.3.2.2.1. **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 over 3.0 in. per mi. 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 mi.

3.3.2.2.2. **Referee Testing.** The Construction Division will conduct referee testing, and the results are final. The Construction Division may require recertification for the Contractor’s or Department’s inertial profiler.

3.4. **Acceptance Plan and Pay Adjustments.** The Engineer will evaluate profiles for determining acceptance, bonus, penalty, and corrective action.

3.4.1. **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 2 contacts on a 10-ft. straightedge. For asphalt concrete pavements, fog seal the aggregate exposed from diamond grinding. Following corrective action, retest the area to verify compliance with this Item.

3.4.2. **Surface Test Type B.** The Engineer will use the QA test results to determine pay 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, pay adjustments will be based on the data obtained from reprofiling the corrected area.

3.4.2.1. **IRI Pay Adjustment for 0.1-mi. Sections.** Unless pay adjustment Schedule 1 or 2 is shown on the plans, Schedule 3 from Table 1 and Table 2 will be used to determine the level of pay adjustment for each 0.1-mi. section on the project.

No bonus will be paid for any 0.1-mi. section that contains localized roughness.
3.4.2.2. **IRI Deficient 0.1-mi. Sections.** When pay adjustment Schedule 1 or 2 is specified, correct any 0.1-mi. section with an average IRI over 95.0 in. per mi. Correct the deficient section to an IRI of 65 in. per mi. or less when Schedule 1 is specified or correct to an IRI of 75 in. per mi. or less when Schedule 2 is specified. No corrective action is required for Schedule 3. After making corrections, reprofile the pavement section to verify that corrections have produced the required improvements.

The associated bonus shown in Table 1 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
- apply the pertinent schedule penalty shown in Table 2 if the reprofiled IRI is greater than 65 in. per mi.

3.4.2.2.1. **Corrective Action.** Use diamond grinding or other approved work methods to correct any deficient 0.1-mi. section. For asphalt concrete pavements, fog seal the aggregate exposed from diamond grinding or other approved work methods allowed.

3.4.2.3. **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.

When Schedule 3 is specified, use a 10-ft. straightedge, when allowed, to locate areas that have more than 1/8-in. variation between any 2 contacts on the straightedge.

The Engineer may waive localized roughness requirements for deficiencies resulting from manholes or other similar appurtenances near the wheel paths.

3.4.2.3.1. **Corrective Action.** Use diamond grinding or other approved work methods to correct localized roughness. For asphalt concrete pavements, fog seal the aggregate exposed from diamond grinding or other approved work methods allowed. Reprofile the corrected area, and provide results that show the corrective action was successful. If the corrective action is not successful, the Engineer will require continued corrective action or apply a localized roughness penalty.

3.4.2.3.2. **Localized Roughness Penalty.** Instead of continued corrective action, the Engineer may assess a penalty for each occurrence of localized roughness. No more than 1 penalty will be applied for any 5 ft. of longitudinal distance. For Schedule 1, a localized roughness penalty of $500 per occurrence will be applied. For Schedule 2, a localized roughness penalty of $250 per occurrence will be applied. For Schedule 3, localized roughness penalties will not be applied.

Localized roughness penalties will be evaluated within 0.1-mi. sections and applied unless the IRI deficient 0.1-mi. section penalty is greater. When the IRI deficient penalty is greater, the pay adjustment in Table 2 will be applied.

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

**Bonus Pay Adjustments for Ride Quality**

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<tr>
<th>Average IRI for each 0.10 mi. of Traffic Lane (in./mi.)</th>
<th>Pay Adjustment $/0.10 mi. of Traffic Lane</th>
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