

700 Items

Maintenance

Item 700

Pothole Repair



1. DESCRIPTION

Repair potholes, spalled areas, depressions, and raveled or damaged pavement edges in roadway surfaces.

2. MATERIALS

Furnish materials, unless otherwise shown on the plans. Use materials that meet the requirements of the following, as shown on the plans.

- Item 300, "Asphalts, Oils, and Emulsions"
- Item 330, "Limestone Rock Asphalt Pavement"
- Item 334, "Hot-Mix Cold-Laid Asphalt Concrete Pavement"
- Item 341, "Dense-Graded Hot-Mix Asphalt"
- [DMS-9202](#), "Asphaltic Concrete Patching Material (Stockpile Storage or Bagged)"
- [DMS-9203](#), "Rapid-Curing Asphaltic Concrete Patching Material (Containerized)"
- [DMS-9204](#), "Fiber Additives for Bituminous Mixtures"

3. WORK METHODS

Work requests are made on a callout basis. Begin physical repair within 24 hr. of notification, 3 hr. if emergency mobilization is required, unless otherwise shown on the plans. Unless otherwise shown on the plans or directed, dispose of materials removed in accordance with Article 6.11., "Surplus Materials."

- 3.1. **Standard Repair.** Remove loose and foreign materials from the repair area. Remove water, dry, and apply tack coat to surfaces of the repair area unless otherwise directed.

Place repair material in horizontal lifts as directed. Finish to grade and compact to conform to roadway surface. Compact using hand tamp, mechanical tampers, or rollers as directed or approved. Compact to achieve full consolidation.

- 3.2. **Saw-Cut Repair.** Square the sides of the repair area by saw-cutting or other approved methods. Remove loose and foreign material. Clean and dry the repair area. Apply tack coat to surfaces of the repair area unless otherwise directed.

Place repair material in horizontal lifts no more than 3 in. deep. Finish to grade and compact to conform to roadway surface. Compact using hand tamp, mechanical tampers, or rollers as directed or approved. Compact to achieve full consolidation.

- 3.3. **Edge Repair.** Repair pavement edges to the line and grade of original pavement. Clean roadway surface after repair operations. Refer to typical section sheets in the plans for detail.

4. MEASUREMENT

For Contracts with callout work without emergency mobilization, the minimum quantity per callout bid unit, respectively, is 5 sq. yd., 1/2 cu. yd., 1/2 ton, or 150 lb., unless otherwise shown on the plans.

For Contracts using square yard measurements for pothole repair, measurements will be based on the depth range shown for each bid item. However, actual depths of repair necessary at each location will vary.

- 4.1. **Pothole Repair.** Pothole repair will be measured by the square yard of surface area or by the cubic yard, ton, or pound of material used.
- 4.2. **Edge Repair.** Edge repair will be measured by the ton of material used.
- 4.3. **Emergency Mobilization.** Emergency mobilization will be measured by each emergency work request.
- 4.4. **Measurement Methods.**
 - 4.4.1. **Area.** The surface area of repairs will be measured.
 - 4.4.2. **Volume.** Trucks will be measured, and the loose volume in cubic yards will be calculated for legally transported loads. Level the load for measurement before beginning work. Level off the material remaining on the last load for measurement. Material not used at the end of the day will be deducted from the volume.
 - 4.4.3. **Weight (Ton).** Trucks will be weighed on certified scales. Provide weight tickets. Material not used at the end of the day will be deducted from the weight. Measurement will be in accordance with Item 520, "Weighing and Measuring Equipment."
 - 4.4.4. **Weight (Pound).** Materials furnished in a container will be measured by the pound as shown on the container.

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 "Pothole Repair (Standard)" of the depths specified; "Pothole Repair (Saw-Cut)" of the depth specified; "Edge Repair"; and "Emergency Mobilization," if required. The unit price bid for pothole repair and edge repair is full compensation for furnishing materials, unless otherwise shown on the plans; application of the tack coat; removal and disposal of debris and excess material; leveling off or weighing the load for measurement; and equipment, labor, tools, and incidentals.

The unit price bid for emergency mobilization is full compensation for beginning physical work within 3 hr. of notification. Emergency mobilization will be paid for in addition to pothole repair or edge repair.

Item 712

Cleaning and Sealing Joints and Cracks (Asphalt Concrete)



1. DESCRIPTION

Clean and seal joints and cracks in asphalt concrete roadway surfaces.

2. MATERIALS

Furnish materials unless otherwise shown on the plans. Furnish sealant materials as shown on the plans in accordance with Item 300, "Asphalts, Oils, and Emulsions." Furnish fine aggregate in accordance with Section 341.2.1.3., "Fine Aggregate."

3. EQUIPMENT

Furnish equipment, tools, and machinery for proper execution of the work.

- 3.1. **Hot-Applied Sealants.** Heat in a double-jacketed heater using a heat transfer oil so no direct flame contacts the shell of the vessel containing the sealing compound. Provide a heater capable of circulating and agitating the sealant during the heating process to achieve a uniform temperature rise and maintain the desired temperature. Provide gauges to monitor the temperature of the vessel contents and avoid overheating the material. Provide a heater equipped with a gear-driven asphalt pump with adequate pressure to dispense the sealant.
- 3.2. **Cold-Applied Sealants.** Provide equipment with adequate pressure to dispense the sealant in a continuous flow.

4. WORK METHODS

Apply material when the air or pavement temperature is within the manufacturer's recommendations or as approved. Clean and seal joints and cracks that are 1/8 in. or greater in width using Department-approved materials. Fill cracks greater than 1/2 in. with dry sand or as shown on the plans. For cracks 1/8–1-1/2 in. in width, fill with standard crack sealant in conformance with the manufacturer's recommendations or as approved for optimal crack penetration. For cracks wider than 1-1/2 in., fill with material meeting the requirements of Item 721, "Fiber Reinforced Polymer Patching Material." The installation method will be as shown on the plans. Rout joints and cracks to the configuration shown on the plans when required. Clean joints and cracks using air blast cleaning or other acceptable methods to a depth at least twice the joint or crack width. Joints and cracks must be free of moisture before sealing. Dispose of materials removed as directed or approved. Apply sealing material using a pressure nozzle. Completely fill cracks and joints. Squeegee material to no more than 3 in. wide and 1/8 in. above the pavement surface. Prevent tracking with an application of fine aggregate as directed.

5. MEASUREMENT

This Item will be measured by the foot, gallon, pound, or lane mile. Shoulders wider than 6 ft. are considered additional lanes.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Joint and Crack Sealing" of the sealant material specified and "Joint and Crack Routing and Sealing" of the sealant material specified. This price is full compensation for routing, cleaning, and sealing joints and cracks; furnishing and placing materials; and equipment, labor, tools, and incidentals.

If measurement is by the lane mile, shoulders 6 ft. or narrower will not be paid for directly but will be subsidiary to work on the adjacent travel lane.

Item 713

Cleaning and Sealing Joints and Cracks (Concrete Pavement)



1. DESCRIPTION

Clean and seal joints and cracks in concrete pavement.

2. MATERIALS

Furnish sealant, boards, and backer rods in accordance with [DMS-6310](#), "Joint Sealants and Fillers." The sealant must be Type 4, 5, 7, or 8 unless otherwise shown on the plans or in conformance with specifications. Furnish primer when required by the sealant manufacturer.

3. EQUIPMENT

Use equipment in conformance with the sealant manufacturer's recommendations. Furnish equipment capable of placing the sealant, backer rods, and boards as shown on the plans. Furnish equipment capable of removing all foreign material from the concrete joint or the grooved crack. The following equipment is recommended to meet cleaning and sealing requirements:

- power concrete saw,
- sandblasting equipment,
- power router,
- high-pressure air, and
- sealant dispenser.

4. WORK METHODS

Use dimensions for joint details in accordance with Standard Drawing *Concrete Paving Details, Joint Seals*, unless other dimensions are shown on the plans. Make a groove, follow the cracks to be sealed, and rout the groove approximately 1/2 in. deep × 5/8 in. wide, unless otherwise directed or shown on the plans. The Engineer will select joints and cracks to be cleaned and sealed.

Remove all foreign material from the joint or groove reservoir. Clean the joint by sandblasting or other approved methods. If directed, saw joint sides to remove embedded foreign material in the concrete that sandblasting will not remove. Do not place sealant when the concrete pavement is below 55°F or above 90°F. Do not place sealant in a wet or damp joint or groove. Use approved drying method if joints or grooves are sealed within 24 hr. of rain. Apply primer when required by the sealant manufacturer. Blow out joint or groove by high pressure air or other approved methods before placing sealant. Remove and replace sealant when placed flush with or above the pavement surface. The various types of joints and cracks are shown in Table 1.

**Table 1
Types of Joints and Cracks Requirements**

Joint or Crack Type	Requirement
Transverse contraction joints	Backer rods and sealants
Longitudinal contraction joint	Sealant
Longitudinal construction joint	Sealant
Expansion joints	Boards, backer rods, and sealant
Cracks in concrete pavement	Sealant

5. MEASUREMENT

Joint cleaning and sealing will be measured by the foot of joint cleaned and sealed. Crack cleaning and sealing will be measured by the foot of crack cleaned and sealed.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Joint Sealing and Cleaning" of the type specified, or "Crack Cleaning and Sealing."

Item 720

Repair of Spalling in Concrete Pavement



1. DESCRIPTION

Repair spalling and up to half-depth failures in concrete pavement.

2. MATERIALS

Furnish either rapid-set concrete or polymer concrete patching material unless otherwise shown on the plans.

- 2.1. **Rapid-Set Concrete.** Provide materials meeting the requirements of [DMS-4655](#), "Concrete Repair Materials," Type A or Type B, and listed on the MPL for "Concrete Repair Materials."
- 2.2. **Polymer Concrete Patching Material.** Provide polymer concrete patching materials meeting [DMS-6170](#), "Polymeric Materials for Patching Spalls in Concrete Pavement," and listed on the MPL for "Polymeric Materials for Patching Spalls in Concrete Pavement."

3. EQUIPMENT

Furnish equipment in accordance with Item 429, "Concrete Structure Repair," or as approved.

4. WORK METHODS

Repair areas as shown on the plans or as directed. Dispose of debris off the right of way in conformance with federal, state, and local regulations.

Repair boundaries should be square or rectangular with a minimum length and width of 12 in. Saw at least 1-1/2 in. deep around repair area before concrete removal, unless otherwise directed by the manufacturer of the repair material being used, providing a vertical face around the perimeter of the repair area. Do not saw-cut longitudinal or transverse steel. If the longitudinal steel is cut or damaged, a full-depth repair may be required as directed without additional compensation. Protect and reuse existing reinforcing steel if encountered, unless otherwise directed. Remove concrete to a depth of at least 1-1/2 in. or the depth of deteriorated concrete, whichever is greater. Use chipping hammers not heavier than the nominal 15-lb. class or hydrodemolition equipment for the removal of concrete below 1-1/2 in. depth. Dry and abrasive blast the repair area to ensure it is free of moisture, dirt, grease, oil, or other foreign material that may reduce the bond. Remove dust from the abrasive blasting operation.

- 4.1. **Hydraulic Cement Concrete Material.** Prepare the surface in conformance with manufacturer's recommendation. Mix, place, and cure repair material in conformance with manufacturer's recommendations. Place repair material when the air temperature is 40°F or above. Screed repair material to conform to roadway surface. Provide a rough broom finish.
- 4.2. **Polymer Concrete Patching Material.** Submit for approval a statement from the manufacturer identifying the recommended equipment and installation procedures. Limit repair area depths to no more than 2 in. when using polymer concrete patching materials. Apply primer to the repair area in conformance with manufacturer's recommendations. Reapply primer if conditions change before placing patching material. Mix, place, and cure in conformance with manufacturer's recommendations. Begin placement of material at the

lower end of sloped areas. Screed polymer concrete patching material to conform to the roadway surface. Provide a non-skid finish using a notched trowel unless otherwise directed by product manufacturer.

5. MEASUREMENT

This Item will be measured as follows.

- 5.1. **Hydraulic Cement Concrete Material.** By the cubic foot of concrete repair material placed.
- 5.2. **Polymer Concrete Patching Material.** By the gallon of polymer concrete patching material placed.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Spalling Repair" of the type ("Hydraulic Cement Concrete"; "Polymer, Flexible"; or "Polymer, Semirigid") specified. This price is full compensation for sawing, chipping, milling, cleaning, abrasive blasting, repairing spalled concrete pavement, disposal of materials, materials, equipment, labor, tools, and incidentals.

Item 721

Fiber Reinforced Polymer Patching Material



1. DESCRIPTION

Repair spalled areas, potholes, and joints on concrete and asphalt pavements using a fiber reinforced polymer patching material, bulking aggregates, and finishing aggregates as specified below.

2. DEFINITIONS

For the purposes of this Specification, the following definitions apply.

- **Binder.** The thermal setting material that is the basis of the patching material, and to which any fillers, fibers, or other components are added.
- **Patching Material.** The binder and other additives, mixed, and in the form that will be applied to the patch, not including bulking aggregate or final surface aggregate.
- **Bulking Aggregate.** Additional aggregate mixed with the patching material when used for repairs deeper than 1 in.; and
- **Finishing Aggregate.** Additional aggregate applied to the patch after the patching material has been applied.

3. MATERIALS

Provide a hot-applied patching material consisting of a combination of binder, polymers, graded fillers, aggregates, fibers, and rubber that once heated provides an impermeable, voidless solid mass at ambient temperatures. Pre-approved fiber reinforced polymer patching materials are listed on the MPL for "Fiber Reinforced Polymer Patching Material," or are as shown on the plans. Formulate the patching material according to climatic conditions to provide a durable pavement repair with good fluidity at process temperature, low temperature flexibility, and ambient temperature flow resistance.

The binder may be liquid asphalt or polymer based, unless otherwise shown on the plans, and may be provided separately or premixed with the other components of the patching material. The patching material must meet the requirements shown in Table 1.

Table 1
Patching Material Properties

Property	Test Method	Requirement
Resilience	Tex-547-C	50% Min
Tensile strain to failure	Tex-548-C	20% Min
Max tensile stress	Tex-548-C	50 psi Min
Cone flow	Tex-549-C	12% Max (asphalt based) 4% Max (polymer based)
Flexibility	Tex-550-C	pass ¹
Settlement	Tex-551-C	3 mm, Max

1. No evidence of cracking of the sample.

- 3.1. **Sampling and Testing.** Provide material that has been preapproved by the Department in accordance with [Tex-538-C](#). Submit blended samples of patching material for preapproval or field evaluation when requested.

- 3.2. **Bulking Aggregate.** Provide single-sized bulking aggregate consisting of a crushed, double-washed, and dried Type A, Grade 1, aggregate in accordance with Item 302, "Aggregates for Surface Treatments," or equivalent.

Note—Patching material may be supplied with the bulking aggregate premixed, when shown on the plans. The Engineer may sample the material to determine the percentage by weight of bulking aggregate included.

- 3.3. **Final Surface Aggregate.** Provide final surface aggregate consisting of a crushed, double-washed, and dried Type A, Grade 5 aggregate in accordance with Item 302.

4. WORK METHODS

Install the patching material to fill the damaged or spalled areas as shown on the plans, with adjustments to the depth and width of the repairs as directed.

Use an applicator certified by the material manufacturer.

Remove all loose and damaged material from the repair area, either by saw-cutting around the area and using a jackhammer to remove material, or a milling machine, as approved. Remove material from the repair area to a depth and width necessary to provide sound pavement that will allow proper seating of the patching material, as follows.

- Use an approved jackhammer capable of performing the required removal of the existing material without further damaging the surrounding pavement. Use a jackhammer no larger than 30 lb. unless otherwise approved; or
- Operate the milling machine in the longitudinal direction to provide a tapered edge in the direction of travel.

Thoroughly clean and dry substrate faces using a hot-compressed air lance.

Prime the area for concrete pavement using a primer determined by the manufacturer to prevent moisture intrusion.

Mix and heat the patching material onsite in a horizontal mixing unit equipped with electronically controlled thermostats. Heat the bulking and final surface aggregates until dry and free of dust, using a vented barrel mixer or other approved method, to 300°F.

Apply patching material to the repair area. If the repair area is deeper than 1 in., add bulking aggregate at a rate of 15–30% by volume as directed. Install patching material in lifts to ensure uniform application for materials with the bulking aggregate premixed.

Install additional patching material and bulking aggregate in 1-in. lifts until the repair is level with the existing pavement.

Apply a final coat of the heated patching material to level the repair area.

Dress the surface of the patch with heated surface aggregate. Perform this operation while the patch is still hot.

Sweep the area and remove all debris from the site. Ensure the material has cooled to where it does not permanently deform under pressure, as recommended by the manufacturer or as directed, before opening to traffic.

5. MEASUREMENT

This Item will be measured as follows.

- 5.1. **Patching Material.** Patching material will be measured by the pound of patching material installed. If the bulking aggregate is supplied premixed with the patching material, discount the gross weight of material by the weight percentage of bulking aggregate included.
- 5.2. **Bulking Aggregate.** Bulking aggregate will be measured by the pound of bulking material installed. If the bulking aggregate is supplied premixed with the patching material, discount the gross weight of material by the weight percentage of patching material included.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Fiber Reinforced Polymer Patching Material" and for "Bulking Aggregate." These prices are full compensation for furnishing materials, including bulking and final surface aggregates, patching material binder, and primer; heating and mixing; removal and disposal of existing pavement material; placing and finishing; and labor, equipment, tools, and incidentals.

Item 730

Roadside Mowing



1. DESCRIPTION

Mow roadside vegetation.

2. EQUIPMENT

- 2.1. **Mowers.** Provide either rigid-frame mowers with a maximum cutting width of 9 ft. or batwing rotary mowers equipped with sharp blades to cleanly cut vegetation using deflection devices to prevent flying debris ejected by the mowers, unless otherwise shown on the plans.
- 2.2. **Emblems.** Provide slow-moving vehicle emblem affixed to rear of mowers.
- 2.3. **Warning Lights.** Provide highly visible omnidirectional amber flashing warning lights on tractors and work trucks.
- 2.4. **Trimmers.** Provide trimmers for hand trimming.
- 2.5. **Portable Pressure Washer.** Provide a portable pressure washer with a minimum operating pressure of 1,500 psi to wash mowing equipment when shown on the plans.

3. WORK METHODS

- 3.1. **Requirements.** Set mower cutting height 5–7 in. or as directed.
- Perform mowing sequence as directed or approved.
- Ensure wet ground is not mowed when rutting can occur, unless otherwise approved.
- Do not mow designated non-mow areas.
- Remove debris ejected onto the roadway immediately. Remove mowed grass from roadway when determined to be a hazard.
- Hand-trim around fixed objects within mowed area. Complete hand trimming on each roadway within 24 hr. of mowing. Ensure trees and shrubs are not damaged.
- Restore appurtenances damaged by mowing operations in accordance with Article 7.17., “Contractor’s Responsibility for Work.”
- Ensure stands of wildflowers are not mowed before seeds have matured, unless otherwise directed.
- 3.2. **Mowing Types.**
- 3.2.1. **Strip Mowing.** Mow a strip of vegetation along edge of pavement or unpaved shoulder shown on the plans.
- Mow to provide sight distance at horizontal curves, intersections, driveways, and ramps.
- Mow to right of way line where specified.

Mow around appurtenances within the strip width.

Mow entire right of way under bridges and in drainage channels.

Provide a 6:1 transition between the strip width and other areas requiring a different width.

Mow the entire width of medians and outer separations (e.g., areas between mainlanes, ramps, and frontage roads), except for non-mow areas.

- 3.2.2. **Full-Width Mowing.** Mow vegetation in the entire right of way, except for non-mow areas.
- 3.2.3. **Spot Mowing.** Work requests are made on a callout basis. Begin mowing designated areas within 48 hr. of notification unless otherwise shown on the plans.
- 3.3. **Washing Mowing Equipment.** Pressure wash mowing equipment before the equipment enters or leaves designated areas shown on the plans. Notify the Inspector before washing the equipment. The Inspector must approve the washing locations so seed and plant material is contained.
- 3.4. **Mowing Season.** The Engineer may adjust the listed dates and timelines as needed.
- 3.4.1. **Spring.** Delaying spring mowing allows wildflowers to set seed for repopulation.
- 3.4.2. **Fall.** Delaying fall mowing until October 15 allows full use of the Department's herbicide program.

4. MEASUREMENT

This Item will be measured by the cycle or acre.

- 4.1. **Strip and Full-Width Mowing.** "Strip Mowing" and "Full-Width Mowing" will be measured by the cycle, or the acre as shown on the plans. These are plans quantity measurement Items. The quantity to be paid is the quantity shown on the plans, unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required. The Engineer will quantify and provide acreage on the plans for informational purposes when using by the cycle measurement.
- 4.2. **Spot Mowing.** "Spot Mowing" will be measured by the acre mowed. The minimum quantity per callout is 3 acres, unless otherwise shown on the plans.

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 "Strip Mowing," "Full-Width Mowing," or "Spot Mowing." This price is full compensation for furnishing and operating equipment; pressure washing; and materials, tools, and incidentals.

Item 731

Herbicide Treatment



1. DESCRIPTION

Apply herbicide to control undesirable vegetation within the highway right of way.

2. MATERIALS

Furnish herbicide materials in conformance with the Department herbicide operations program, as shown on the plans, or otherwise approved. Furnish surfactant, drift control, and blue indicator dye that are aquatic approved. Materials furnished by the Department will be shown on the plans. All use of materials must be in conformance with the product label and federal and state laws and regulations. All mixing and applications must be in conformance with the Department herbicide operations program.

3. LICENSE REQUIREMENTS

Possess a commercial pesticide applicator's license with the Vegetation Management (5) category, or a structural pest control services commercial business license with the Weed Control category, issued from the Texas Department of Agriculture. A Department Direct Supervision Affidavit must be completed for unlicensed employees working under a licensed commercial pesticide applicator. Provide the Department with documentation of licenses, Department Direct Supervision Affidavits, and verifiable training records. The Engineer may conduct on-site supervision of all mixing, transporting, handling, spraying, and disposal of materials. The Engineer at any time may request documentation of licensure and Direct Supervision Affidavits, verifiable training records, application records, and equipment calibration. The Engineer may at any time request review of Department herbicide operations, program knowledge, and policy and procedures with any employee making applications for the Department. The Engineer reserves the right to determine that applications are being made in conformance with the Department's herbicide operations program and may stop noncompliant applications immediately.

4. RECORDS

Document work in conformance with all federal, state, and local laws and regulations. The Department's Herbicide Records or other approved format will be used to document all applications for the Department. Submit a copy of the herbicide records on the next business day following the application. Submit a copy of application records upon request by the Engineer. Submit final copy of all herbicide application records upon completion of the Contract.

5. SEASON

Spray herbicide during active growing periods unless otherwise approved.

6. EQUIPMENT

Furnish all equipment. Equipment must be functional and in conformance with all federal, state, and local laws and regulations. Provide the Engineer with documented calibration rates or equipment that is to be calibrated in the Engineer's presence.

- 6.1. **Broadcast Application.** Furnish self-propelled equipment and tractor mounted or pulled spray rigs with a low center of gravity that allows a safe traverse on a maximum 3:1 slope. Provide equipment capable of making uniform broadcast applications calibrated between 20 gal. and 40 gal. per acre.

- 6.2. **Pavement Edges and Structures.** Provide spray equipment capable of spraying a pattern that will cover cracks and expansion joints in the entire pavement shoulder and a continuous band along the pavement's edge. Provide additional booms or nozzles capable of spraying under guardrails and around sign posts, luminaire poles, or other structures within 10 ft. of the pavement edge. Provide equipment capable of making uniform broadcast applications calibrated at a rate between 20 gal. per acre and 40 gal. per acre.
- 6.3. **Handgun Applications.** Provide equipment with a handgun and enough hose to reach all fixtures on the right of way and capable of making applicable applications.
- 6.4. **Basil Bark and Cut Tree Applications.** Furnish sprayers with low volume spray tips (Spray Systems 5500 Adjustable Spray Tip X-2 or approved equivalent).
- 6.5. **Wiper Applications.** Furnish equipment capable of performing a uniform herbicide application while safely traversing a 3:1 slope and performing applications in variable heights ranging from 12–30 in. Use double coverage applications in opposite directions. Outfit equipment with components necessary to provide an adjustable, consistent flow of herbicide, but prevent undesired leakage of materials while storing, transporting, and making applications.
- 6.6. **Storage and Nurse Tanks.** Outfit equipment with components necessary to prevent undesired leakage of materials while transporting, storing, or making applications.
- 6.7. **All-Terrain Vehicles (ATVs) or Four-Wheel Utility Vehicles (FWUVs).** Use ATVs and FWUVs to expedite the work as approved. Operate ATVs and FWUVs on the right of way roadside in conformance with all state laws and regulations.
- 6.8. **Personal Protective Equipment.** Follow the manufacturer's label requirements for personal protection of employees.

7. WORK METHODS

Apply approved herbicide in conformance with the manufacturer's label recommendations, as shown on the plans or as approved. Add surfactant and blue dye marker at the manufacturer's recommended rate unless otherwise approved. Prepare herbicide solution to the rates shown on the plans using procedures on the herbicide container label. Mix herbicide solution under the direct supervision of Department personnel. Return any unused, Department-furnished herbicide to the Department. Dispose of empty containers and unused chemical mixtures in conformance with label directions and local, state, and federal regulations. **Cease spraying operations immediately when wind or other environmental conditions cause off target spray drift, leaves are wet, or rainfall is imminent.** An inspection of the treated areas will be made not less than 14 days and no later than 30 days after the application. Re-treat areas in which the undesirable vegetation has not been controlled for no additional compensation. All applications made after October 1 will be inspected in May of the following year to determine whether any re-treatment is required. Repair and replace any damaged desirable vegetation or erosion from negligent applications.

- 7.1. **Broadcast Application.** Spray undesirable vegetation by broadcasting using spray nozzles at the desired rate. Spray from the pavement or roadside to reach the vegetation being controlled as approved. Ensure nozzles spray consistently across the area being covered.
- 7.2. **Pavement Edges, Structures, and Fixtures.** Apply herbicide to eliminate all grass and weeds encroaching into or on pavement mainlane, shoulder edges, riprap, and structures including retaining walls, sidewalks, islands, traffic barriers, raised medians, curbs, mow strips, and any other concrete or asphalt structure as shown on the plans, or as directed.
- 7.2.1. **Pavement.** Spray a band of herbicide on and along the outside edge of pavement surfaces and curbs wide enough to spray vegetation growing in the pavement or curbs and approximately 6 in. of vegetation off the pavement edge or behind the curb. Do not treat roadways adjacent to highly maintained or manicured landscapes, such as residential yards or parks, with herbicides.

- 7.2.2. **Guardrails and Cable Barriers.** Spray a band of herbicide approximately 18 in. wide under guardrails and cable barriers.
- 7.2.3. **Appurtenances (e.g., Retaining Walls, Sidewalks, Islands, Traffic Barriers, Mow Strips, and Attenuators).** Spray a band of herbicide on and along the outside edge of appurtenances and approximately 6 in. of vegetation along or around the fixture.
- 7.2.4. **Supports (e.g., Sign Supports, Luminaire Poles, and Mail Box Supports).** Spray a 12 in. wide band around and on all sides of the base of sign posts, luminaire poles, mailbox supports, or other roadside hardware within 10 ft. of the pavement edge.
- 7.2.5. **Handgun Applications.** Use a handgun to spray structures inaccessible to spray using boom mechanized spray equipment.
- 7.3. **Basal Bark Treatment.** Apply herbicide solution using a low-volume, low-pressure sprayer that thoroughly wets the lower 12–15 in. of stems on all sides, including the root collar area, but not to the point of runoff. Perform applications anytime throughout the year, except when stems or stumps are wet from rainfall or dew, or snow prevents spraying to the base of plants.
- 7.4. **Cut-Stump Treatment.** Cut plants parallel to the ground, not to exceed 2 in. above the ground line. Apply the herbicide solution using a low-volume, low-pressure sprayer that thoroughly wets the area adjacent to the cambium and bark around the entire circumference of the stump. Thoroughly wet the sides of the stump, but not to the point of runoff. Make the herbicide application within 1 hr. from the time each plant is cut. Dispose of removed materials and debris at locations off the right of way in conformance with local, state, and federal requirements.
- 7.5. **Wick Application.** Apply herbicide to targeted vegetation within the full width of right of way, excluding areas as shown on the plans, by wiping the rope wick applicator across the vegetation at a constant rate in a smooth manner. Adjust wick height to achieve the control of only the targeted weeds. Apply herbicide only to target weed species as shown on the plans, or as directed. Replace any desirable trees, shrubs, wildflowers, or grasses damaged by negligent applications. Re-treat all target weeds not controlled after 15 days until weeds are controlled.

Pressure-wash all herbicide application equipment before beginning work and again before leaving the jobsite to remove any weed seed on equipment. Notify the Inspector before washing the equipment, and wash equipment in an approved area.

8. MEASUREMENT

This Item will be measured by the lump sum, centerline mile, or acre.

9. 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 "Broadcast Application" "Pavement Edges, Structures and Fixtures," "Basal Bark Herbicide Treatment," "Basal Bark Herbicide Treatment (Cut Stump)," or "Wick Application of Herbicide." A partial payment of 50% of the unit price bid will be paid after the initial application is performed. The final 50% of the unit price bid will be paid after the inspection and required re-treatments have been completed and accepted. This price is full compensation for herbicide application and furnishing equipment, materials, labor, tools, re-treatment, and incidentals.

Item 734

Litter Removal



1. DESCRIPTION

Remove and dispose of litter, including objects not part of the highway facility, such as trash, garbage, scrap metal, paper, wood, plastic, glass products, animal remains, rubber products, tires, auto parts, furniture, mattresses, household appliances, and large bulky items.

2. MATERIALS

Furnish bags and containers.

3. EQUIPMENT

Provide equipment and tools. Provide highly visible omni-directional amber flashing warning lights on work vehicles. Provide equipment that prevents the accumulated debris from being strewn along the roadway during transport.

4. WORK METHODS

Remove bagged litter on the same day it is collected. Notify the Department for removal of dead animals larger than 150 lb. or hazardous materials. Dispose of litter off the right of way in accordance with federal, state, and local regulations. Perform litter removal and disposal according to the following types.

- 4.1. **Litter.** Remove and dispose of litter from the right of way, including shoulders but excluding the traveled lanes and shoulders next to barriers, to the limits shown on the plans.
- 4.2. **Spot Litter.** Work requests are made on a callout basis. Begin removing litter within 48 hr. of notification, unless otherwise shown on the plans.

5. MEASUREMENT

This Item will be measured as follows.

- 5.1. **Litter.** By the cycle or acre.
- 5.2. **Spot Litter.** By the acre. The minimum quantity per callout is 3 acres, unless otherwise shown on the plans.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Litter Removal" or "Litter Removal (Spot)." This price is full compensation for collecting, hauling, and disposing of litter, and for equipment, labor, materials, tools, and incidentals.

Item 735

Debris Removal



1. DESCRIPTION

Remove and dispose of debris discarded or deposited on or adjacent to the pavement. Debris includes all objects not part of the highway facility, such as dead animals, tires, tire fragments, wood, furniture, mattresses, household appliances, scrap metal, and driftwood. Unless otherwise shown on the plans or directed, remove and dispose of debris in accordance with Article 6.11., "Surplus Materials."

2. EQUIPMENT

Furnish all equipment, labor, and incidentals necessary to achieve acceptable work. Equipment may include but is not limited to dragline, front-end loader, backhoe, hydraulic excavator, and dump trucks.

All heavy equipment operating on or within 30 ft. of the outside edge of the traveled lane must have an amber rotary flashing light or strobe light mounted on the highest point of the machine to ensure 360° visibility. Provide equipment that prevents the accumulated debris from being strewn along the roadway during transport.

3. WORK METHODS

Remove debris at locations shown on the plans. Notify the Department for removal of hazardous materials. Dispose of debris off the right of way in conformance with applicable federal, state, and local regulations.

- 3.1. **Center Medians and Mainlanes.** Remove and dispose of debris from the main travel lanes, paved medians, paved shoulders, and an additional 5 ft. adjacent to the pavement, unless otherwise shown on the plans.
- 3.2. **Frontage Roads.** Remove and dispose of debris from frontage roads, shoulders, U-turn lanes, and intersecting streets to the right of way, including turn lanes, underpasses and overpasses, and an additional 5 ft. adjacent to the pavement, unless otherwise shown on the plans.
- 3.3. **Entrance and Exit Ramps.** Remove and dispose of debris from ramps, shoulders, and an additional 5 ft. adjacent to the pavement, unless otherwise shown on the plans.
- 3.4. **High-Occupancy Vehicle (HOV) Lane.** Remove and dispose of debris from HOV lanes including HOV ramps. HOV lanes are defined as follows.
 - 3.4.1. **Barrier-Separated Contraflow Lane.** A barrier-separated contraflow lane is defined as a lane enclosed by two physical barriers.
 - 3.4.2. **Buffer-Separated Concurrent Flow Lane.** A buffer-separated concurrent flow lane is separated from general purpose lanes by a striped buffer zone and is defined as the left most or inner most lane identified by signing and diamond symbols on the pavement.
- 3.5. **Direct Connector Ramp Debris Removal.** Remove and dispose of debris from the shoulders and paved gutters of direct connector ramp.
- 3.6. **Spot Debris Removal.** Work requests are made on a callout basis. Remove and dispose of debris as directed. Begin removing debris within 3 hr. of notification, unless otherwise shown on the plans.

- 3.7. **Driftwood Removal.** Remove driftwood from channels, bridge abutments, bridge caps, and other areas located within the limits shown on the plans.

Cut driftwood as required, and load, haul, and dispose of driftwood and debris off the right of way in conformance with federal, state, and local regulations. Small items of brush and limbs may be chipped onsite and then hauled to a suitable place of disposal at the expense of the Contractor.

Temporary stockpiling of debris under bridges is not allowed.

No dumping of driftwood or debris within 500 ft. of the highway right of way.

No burning of driftwood or debris permitted within the limits of the highway right of way.

At locations where driftwood is behind guard fence and no access is available, the Contractor may, with approval, remove enough guard fence to allow access to the work area. Reinstall the guard fence at the end of each workday.

Remove all debris and trash from the worksite, smooth all areas of the right of way that are damaged, and leave the site in a neat uniform appearance as much as practical.

4. MEASUREMENT

This Item will be measured as follows.

- 4.1. **Center Medians and Mainlanes, Frontage Roads, and Entrance and Exit Ramps.** By the cycle or right of way centerline mile. A right of way centerline mile is defined as the distance from beginning reference marker location to ending reference marker location, regardless of the number of roadbeds.
- 4.2. **High-Occupancy Vehicle (HOV) Lane Debris Removal.** By the cycle or HOV lane centerline miles. HOV lane centerline mile is defined as the distance measured along each HOV lane regardless of the number of lanes.
- 4.3. **Direct Connector Ramp Debris Removal.** By the cycle or direct connector ramp centerline mile. A direct connector centerline mile is defined as the distance measured along each direct connector regardless of the number of lanes.
- 4.4. **Spot Debris Removal.** By the roadbed mile. The minimum quantity per callout is 1 roadbed mile, unless otherwise shown on the plans.
- 4.5. **Driftwood Removal.** This Item will be measured by the lump sum or cubic yard or by lump sum for sites as shown on the plans.

5. PAYMENT

- 5.1. **Debris Removal.** 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 "Debris Removal" of the type and cycle location specified. This price is full compensation for collecting, hauling, and disposing of debris, and for equipment, labor, materials, tools, and incidentals. Traffic control will not be paid for directly but will be subsidiary to this Item, unless otherwise shown on the plans.

Debris removal in buffer-separated concurrent flow lanes will be subsidiary to debris removal in center medians and mainlanes, unless otherwise shown on the plans.

Debris removal required for work orders issued under Item 734, "Litter Removal," or Item 738, "Cleaning and Sweeping Highways," will be subsidiary to that Item unless otherwise shown on the plans.

- 5.2. **Driftwood Removal.** This price is full compensation for cutting up, loading, hauling, and disposing of driftwood, smoothing the right of way at each location as shown on the plans, and all manipulation, labor, equipment, appliances, tools, and incidentals necessary to complete the work. Traffic control will not be paid for directly but will be subsidiary to this Item, unless otherwise shown on the plans.

Item 738

Cleaning and Sweeping Highways



1. DESCRIPTION

Clean and sweep highway facilities.

2. EQUIPMENT

Furnish equipment and tools capable of dislodging crusted debris from road surfaces, removing, and collecting materials from roadway. Provide highly visible omni-directional flashing warning lights on work vehicles. Furnish equipment with a water tank and adequate spray assemblies for dust control, and a dirt hopper with enough capacity to allow progress with minimum interference to traffic. Provide other types of cleaning and sweeping equipment, including hand tools, when required.

3. WORK METHODS

Completely remove debris from pavement surfaces and other areas shown on the plans, such as all sides of raised pavement markers, barrier drain slots, slotted drains, inlet openings, attenuators, and guardrails. Notify the Department for removal of hazardous materials. Debris is defined as dirt and other objects not part of the highway facility including dead animals, tires, tire fragments, wood, furniture, mattresses, household appliances, and scrap metal. Unless otherwise shown on the plans or directed, remove and dispose of debris in accordance with Article 6.11., "Surplus Materials." Ensure debris is not swept or blown onto traffic lanes. The types of cleaning and sweeping are as follows.

- 3.1. **Center Median Cleaning and Sweeping.** Clean and sweep the paved center medians or left-paved shoulders and left-paved gutters.
- 3.2. **Outside Mainlane Cleaning and Sweeping.** Clean and sweep the outside lanes or right-paved shoulders and right-paved gutters. Clean and sweep intersecting streets to the right of way line.
- 3.3. **Frontage Road Cleaning and Sweeping.** Clean and sweep the right- and left-paved shoulders and paved gutters on all frontage roads. Clean and sweep U-turn lanes and intersecting streets to the right of way line, including turn lanes, underpasses, and overpasses.
- 3.4. **Entrance and Exit Ramp Cleaning and Sweeping.** Clean and sweep right- and left-paved shoulders and paved gutters of ramps.
- 3.5. **Direct Connector Cleaning and Sweeping.** Clean and sweep the right- and left-paved shoulders and paved gutters of direct connectors.
- 3.6. **High-Occupancy Vehicle (HOV) Lane Cleaning and Sweeping.** Clean and sweep HOV lanes, bridges, and ramps.
- 3.7. **Aggregate Removal.** Clean and remove aggregate from designated areas following adverse weather conditions.
- 3.8. **Spot Sweeping.** Work requests are made on a callout basis. Clean and sweep roadways in designated areas. Begin sweeping within 3 hr. of notification, unless otherwise shown on the plans.

- 3.9. **Handwork.** Clean sides of raised pavement markers, barrier drain slots, slotted drains, inlet openings, attenuators, and guardrails within the limits shown on the plans.

4. MEASUREMENT

Right of way centerline mile is defined as the distance measured from the beginning point to the ending point shown on the plans and is measured once regardless of the number of lanes or roadbeds.

Ramp centerline mile is defined as the distance measured along each ramp regardless of the number of lanes. Roadbed mile is defined as the distance along each roadbed regardless of the number of lanes.

HOV lane centerline mile is defined as the distance measured along each HOV lane regardless of the number of lanes. Direct connector centerline mile is defined as the distance measured along each direct connector regardless of the number of lanes.

Work areas that cannot be accessed by mechanical sweepers will be measured separately under Section 738.4.9, "Handwork." Types of cleaning and sweeping will be measured as follows.

- 4.1. **Center Median.** By the cycle or right of way centerline mile.
- 4.2. **Outside Mainlane.** By the cycle or right of way centerline mile.
- 4.3. **Frontage Road.** By the cycle or right of way centerline mile.
- 4.4. **Entrance and Exit Ramp.** By the cycle or ramp centerline mile.
- 4.5. **High-Occupancy Vehicle (HOV) Lane Cleaning and Sweeping.** By the cycle or HOV lane centerline mile.
- 4.6. **Direct Connector Cleaning and Sweeping.** By the cycle or direct connector centerline mile.
- 4.7. **Aggregate Removal.** By the roadbed mile.
- 4.8. **Spot.** By the roadbed mile. The minimum quantity per callout is 1 roadbed mile, unless otherwise shown on the plans.
- 4.9. **Handwork.** By the square yard.

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 "Cleaning and Sweeping" of the type and cycle location specified. This price is full compensation for cleaning, sweeping, collecting, hauling, and disposing of debris, and for equipment, labor, materials, tools, and incidentals.

When work requests include multiple bid items and overlap occurs, the measurement and payment priority will be determined by the order shown under "Measurement."

Item 740

Graffiti Removal and Anti-Graffiti Coating



1. DESCRIPTION

Remove graffiti or apply anti-graffiti coating on concrete or steel.

2. MATERIALS

Furnish acrylic latex paint meeting the requirements of Item 446, "Field Cleaning and Painting Steel," for steel structures. Furnish concrete paint or opaque sealer in accordance with Item 427, "Surface Finishes for Concrete," for concrete structures unless otherwise shown on the plans. Furnish anti-graffiti coating of the type specified, in accordance with [DMS-8111](#), "Anti-Graffiti Coatings." Furnish graffiti removal chemicals as approved.

3. WORK METHODS

Graffiti is defined as inscriptions or drawings placed on fixtures, structures, and riprap. Remove graffiti from signs as directed.

Work requests are made on a callout basis. Begin graffiti removal within 24 hr. of notification, unless otherwise shown on the plans.

Shape treated area to a rectangular configuration. Control dust or water to prevent hazard to traffic. Ensure treated areas exhibit a uniform clean appearance upon completion. Follow the manufacturer's recommendations and use a low-pressure (less than 1,000 psi) water wash when using a chemical cleaning method.

Verify whether an anti-graffiti coating is present before performing any maintenance activity. If construction records are not available for the structure, perform a methyl ethyl ketone (MEK) rub test on the existing coating by rubbing the coating with a rag soaked in MEK or an anti-graffiti cleaner. If the MEK or anti-graffiti cleaner removes or damages the coating, then the coating is not an anti-graffiti coating.

To determine whether an anti-graffiti coating is Type II or Type III, clean a portion of the graffiti using a liquid detergent and water. If the graffiti can be removed by the soap and water, then the coating is a Type III anti-graffiti coating, and a low-pressure water blast may be used to remove the graffiti.

3.1. **Graffiti Removal.** Remove graffiti by any of the following methods as specified.

3.1.1. **Surfaces Without Anti-Graffiti Coating.**

3.1.1.1. **Concrete Structures.** Remove graffiti by any of the following methods.

- **Blast Cleaning.** Use abrasive blasting, water blasting, or steam cleaning.
- **Chemical Cleaning.** Follow the manufacturer's recommendations.
- **Painting.** Prepare surface by approved methods before painting. Paint over the graffiti on concrete in accordance with Item 427. Match the color of the existing surface.

3.1.1.2. **Metal Surfaces.** Remove graffiti by either of the following methods.

- **Painted Surfaces.** Prepare surface as approved. Paint over the graffiti on metal in accordance with Item 446. Match the color of the existing surface.
- **Galvanized or Unpainted Surfaces.** Use chemical cleaning.

3.1.2. **Surfaces with Anti-Graffiti Coating.** Fully remove graffiti as described below without damaging the anti-graffiti coating. Repair any damage to the anti-graffiti coating without additional cost to the Department.

- **Anti-Graffiti Coating, Type II (Solvent-Cleanable).** Use solvents or chemical cleaning to fully remove graffiti without damaging the anti-graffiti coating. Use a low-pressure water rinse as desired for a final wash of the cleaned surface.
- **Anti-Graffiti Coating, Type III (Water-Cleanable).** Use water and scrubbing or a low-pressure water wash (less than 1,500 psi at the surface) to fully remove graffiti without damaging the anti-graffiti coating.

Note—Overly high pressures or overly hard brushes will damage the anti-graffiti coating.

3.2. **Application of Anti-Graffiti Coating.** Blast clean all concrete surfaces in accordance with Item 427 to remove old coatings, laitance, curing compound, dirt, grime, and other contaminants.

Apply a primer, when required by the manufacturer, in conformance with the manufacturer's recommendations.

Apply anti-graffiti coatings on surfaces specified on the plans. Anti-graffiti coatings require a dry surface. Apply anti-graffiti coatings when the temperature of the atmosphere, substrate surface, and material is 50°F or above. Ensure anti-graffiti coatings are not applied when impending weather conditions might result in damage to the fresh coating. Ensure anti-graffiti coatings are not applied over any existing appearance coating unless otherwise shown on the plans.

Apply anti-graffiti coatings by spray, roller, or brush at the application rates recommended by the manufacturer. Ensure the anti-graffiti coating is not thinned without prior approval. Replace anti-graffiti coatings not meeting an MEK rub test when tested in accordance with ASTM D4752.

4. MEASUREMENT

This Item will be measured by the square foot. The minimum quantity per callout is 50 sq. ft. unless otherwise shown on the plans.

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 "Graffiti Removal (Blast Cleaning)," "Graffiti Removal (Painting)," "Graffiti Removal (Chemical Cleaning)," "Anti-Graffiti Coating (Permanent—Type II)," and "Anti-Graffiti Coating Permanent—Type III)." This price is full compensation for cleaning, painting, equipment, labor, materials, tools, and incidentals.

Item 745

Picnic Area Maintenance



1. DESCRIPTION

Perform janitorial and grounds maintenance at picnic areas.

2. MATERIALS

Furnish materials and supplies unless otherwise shown on the plans. Obtain approval of materials before use.

3. WORK METHODS

The number and location of picnic areas, workdays, frequency of maintenance, and other scheduled work items will be as shown on the plans, or as directed.

Report any needed repairs or vandalism when discovered. Secure lost-and-found items and report items found daily. Ensure tips or other gratuities are not accepted.

3.1. **Janitorial Maintenance.** Perform the following work on Mondays, Wednesdays, and Fridays for picnic areas unless otherwise shown on the plans.

- Clean tables, benches, concrete pads, arbors, barbecue pits, fire boxes, and other outdoor appurtenances.
- Clean soiled or stained items using an approved cleaner or disinfectant. Rinse thoroughly with clean water. Apply disinfectant to tables or benches only when surfaces can be rinsed immediately. Ensure brushes or cloths used to clean restrooms are not used to clean tables or benches.
- Remove graffiti immediately in accordance with Item 740, "Graffiti Removal and Anti-Graffiti Coating," except for measurement and payment. Display "Caution Wet Paint" signs if graffiti is painted over.
- Remove spider webs and wasp nests.
- Clean slabs, walks, and driveways.
- Keep sidewalks and grounds free of litter including, but not limited to trash, garbage, scrap metal, paper, wood, plastic, glass products, bottle caps, ring-pull tabs, cigarette butts, chewing gum, feces, and animal remains.
- Empty trash receptacles and replace liners. Clean trash receptacles periodically as directed. Obtain approval for onsite temporary storage of collected trash. Dispose of collected trash off the right of way in conformance with federal, state, and local regulations.
- Clean signs within the picnic area location. Report missing, damaged, or faded signs.

3.2. **Grounds Maintenance.** Perform grounds maintenance at the frequency shown on the plans, or as directed. Follow any federal, state, and local regulations.

3.2.1. **Mowing, Edging, and Trimming.** Pick up litter before mowing. Mow areas shown on the plans as directed. Set mower cutting height at 2–3 in. or as directed. Use push-type lawn mowers or hand-held trimmers around trees, arbor units, and other appurtenances when required. Use tractor-driven mowers in other areas, if approved. Ensure trees or other vegetation are not damaged. Replace vegetation damaged by improper operations. Edge sidewalks, arbor units, curbs, and concrete pavement. Trim around buildings, trees, shrubs, light poles, trash receptacles, signposts, guard posts, delineator posts, culvert headwalls, ground lights, plant

beds, and other appurtenances. Remove all dirt and trimmed vegetation from curbs, walks, slabs, and parking areas. Remove weeds, grass, and other undesirable growth from plant beds and shrubs. Remove and dispose of clippings, cutting windrows, and piles as directed.

- 3.2.2. **Watering.** Water grass, trees, and shrubs during the early morning hours at the frequency shown on the plans or as directed.
- 3.2.3. **Tree Pruning and Leaf Removal.** Prune dead and undesirable growth from trees and shrubs, as needed or directed. Remove and dispose of tree clippings, limbs, leaves, and pine needles as shown on the plans or as directed.
- 3.2.4. **Fertilizing.** Fertilize as shown on the plans.

4. MEASUREMENT

- 4.1. **Janitorial Maintenance.**
- 4.1.1. **Picnic Areas.** By the month or by the cycle.
- 4.2. **Grounds Maintenance.**
- 4.2.1. **Mowing and Trimming.** By the cycle or acre.
- 4.2.2. **Tree Pruning and Leaf Removal.** By the cycle.

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 "Janitorial Maintenance (Picnic Areas)," "Grounds Maintenance (Mowing and Trimming)," and "Grounds Maintenance (Tree Pruning and Leaf Removal)." Site numbers will be specified corresponding to the detail location description as shown on the plans when multiple sites are bid separately. This price is full compensation for furnishing and operating equipment; removal and disposal of pruning, limbs, clippings, leaves, and trash; and labor, materials, tools, and incidentals.

Watering and fertilizing will not be paid for directly but will be subsidiary to the grounds maintenance mowing work.

Graffiti removal and anti-graffiti coating will not be paid for directly but will be subsidiary to the janitorial maintenance Item.

If payment is by the month, for any day when janitorial maintenance services are not satisfactorily completed, 1 day's pay will be deducted from the Contractor's monthly payment. One day's pay will be determined by dividing the monthly bid price by 30 days.

Item 751

Landscape Maintenance



1. DESCRIPTION

Perform landscape maintenance, litter pickup, mowing and edging, and irrigation repair of landscaped areas.

2. MATERIALS

Furnish materials in accordance with Article 193.2., "Materials"; Article 166.2., "Materials"; Article 170.2., "Materials"; and Article 168.2., "Materials," unless otherwise shown on the plans.

Use proper materials in conformance with the manufacturer's directions. Furnish Safety Data Sheets on products supplied by the Contractor.

3. WORK METHODS

Perform landscape maintenance as follows in designated areas at the frequency shown on the plans, or as directed. Unless otherwise shown on the plans or directed, remove and dispose of debris in accordance with Article 6.11., "Surplus Materials."

- 3.1. **Landscape Maintenance.** Maintain a weekly log of activities performed. Submit completed log to the Department at the end of each month for payment. At minimum, provide:
- a listing and description of landscape maintenance work activities,
 - the date work is performed,
 - a listing of materials used, and
 - rates of application.
- 3.1.1. **Fertilizer Application.** Apply fertilizer at the specified locations, at the analysis, times, and rate of application shown on the plans. If no rate of application is shown on the plans, apply in accordance with Article 166.3., "Construction."
- 3.1.2. **Herbicide Application.** Comply with license requirements in Section 193.3.1., "Plant Maintenance." Control undesirable vegetation in riprap areas, plant beds, tree areas, and other locations by application of herbicide using manufacturers' recommendations, as directed. Remove dead plant debris.
- 3.1.3. **Irrigation System Operation and Repair.** Perform irrigation system work under the supervision of a person possessing an irrigator's license issued by TCEQ and provide documentation of this license. Repair deficiencies as shown on the plans. Perform backflow preventer testing as necessary or as directed. Ensure all zones are functioning properly and providing adequate moisture to maintain healthy plants using an approved watering schedule. Winterize the system to prevent freeze damage when shown on the plans. Repair system using replacement parts of the same type and manufacturer as originally installed or approved equal. Provide plant irrigation by an approved alternate method at no cost to the Department if the system fails due to the Contractor's actions or neglect.
- 3.1.4. **Leaf Removal.** Remove and dispose of tree clippings, limbs, leaves, and pine needles as shown on the plans or as directed.
- 3.1.5. **Litter Pickup.** Pick up litter in accordance with Item 734, "Litter Removal."

- 3.1.6. **Mowing, Trimming, and Edging.** Mow and trim in accordance with Section 745.3.2., "Grounds Maintenance," and Item 730, "Roadside Mowing," as approved.
- 3.1.7. **Mulching and Reshaping of Plant Beds.** Reshape plant basins and beds. Apply and maintain mulch to a minimum depth of 2 in., unless otherwise shown on the plans. Areas and species to be mulched are as shown on the plans.
- 3.1.8. **Pavement Sweeping.** Sweep or use a blower to remove all debris on paved areas.
- 3.1.9. **Plant Bed Maintenance.** Physically remove weeds and undesirable grasses, including their root systems, from within plant beds. Trim ground covers and perform additional maintenance to plants within plant beds as required on the plans.
- 3.1.10. **Plant Installation.** Place plant material to new or existing beds as directed in the spring and fall. The Department will provide plant material. Remove weeds and grass and till or turn the ground before plant installation. Maintain plant material until it becomes established. Replace dead and stressed plants.
- 3.1.11. **Pruning.** Prune and trim shrubs, bushes, and trees in accordance with ANSI A300.
- 3.1.12. **Shrub Planting and Removal.** Place shrubs provided by the Department as directed. Backfill plant pits with planting soil mix provided by the Department. Use soil removed from plant pits to form watering basins. Dispose of excess soil as directed. Remove all plants and shrubs as directed. Plants and shrubs that are removed become the property of the Contractor and are disposed of off Department property.
- 3.1.13. **Vegetative Watering.** Water areas not containing irrigation systems, as shown on the plans. Provide adequate moisture to maintain healthy plants. Haul water to locations where there is no municipal supply or well. Water areas in accordance with Article 168.3. "Construction."

4. MEASUREMENT

This Item will be measured as follows if all Items will be subsidiary to "Landscape Maintenance."

- 4.1. **Landscape Maintenance.** By the month.
- When Items are specified as a separate pay Item, they will be measured as follows.
- 4.2. **Fertilizer Application.** By the cycle.
- 4.3. **Herbicide Application.** By the cycle.
- 4.4. **Irrigation System Operation and Repair.** By the month.
- 4.5. **Leaf Removal.** By the cycle.
- 4.6. **Litter Pickup.** By the acre or by the cycle.
- 4.7. **Mowing, Trimming, and Edging.** By the acre or by the cycle.
- 4.8. **Mulching and Reshaping of Plant Beds.** By the cycle.
- 4.9. **Pavement Sweeping.** By the cycle.
- 4.10. **Plant Bed Maintenance.** By the cycle.
- 4.11. **Plant Installation.** By the each or cycle.

- 4.12. **Pruning.** By the cycle.
- 4.13. **Shrub Planting and Removal.** By the each.
- 4.14. **Vegetative Watering.** By the 1,000 gal. (TGL) of water as applied or by the month.

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 "Landscape Maintenance," "Fertilizer Application," "Herbicide Application," "Irrigation System Operation and Repair," "Leaf Removal," "Litter Pickup," "Mowing, Trimming, and Edging," "Mulching and Reshaping of Plant Beds," "Pavement Sweeping," "Plant Bed Maintenance," "Plant Installation," "Pruning," "Shrub Planting and Removal," and "Vegetative Watering" at locations specified.

This price is full compensation for equipment, labor, materials, tools, and incidentals.

Disposal of debris, leaves, dead plants, and trees will not be paid for directly but will be subsidiary to pertinent Items.

Item 752

Tree and Brush Removal



1. DESCRIPTION

Remove and dispose of trees, brush, shrubs, and vines. Trim trees and shrubs. Remove stumps.

2. MATERIALS

Furnish commercially available pruning paint.

3. EQUIPMENT

Provide equipment necessary to complete the work.

4. WORK METHODS

Perform tree and brush removal and trimming from right of way line to right of way line or other widths and locations shown on the plans. Ensure trees, shrubs, and other landscape features that are to remain are not damaged. Dispose of debris within 48 hr. of cutting, off the right of way, in conformance with federal, state, and local regulations unless otherwise approved. When approved, chip debris and spread in a thin layer on the right of way.

4.1. **Tree Removal.** Remove trees of various diameters as shown on the plans, or as directed. Remove tree stumps to at least 12 in. below the surrounding terrain unless otherwise shown on the plans, or as directed. Backfill holes with acceptable material and compact flush with surrounding area.

4.2. **Tree Trimming.** Remove dead tree limbs. Remove tree limbs to the limits shown on the plans. Prune trees in accordance with ANSI A300 Standard Practices for shade trees. Make cuts as close as possible to the trunk or parent limb without cutting into the branch collar or leaving a protruding stub. Remove suckers to the height of the lowest main branch.

When removing limbs 2 in. in diameter or larger:

- undercut 1/3 way through the limb 8–12 in. from the main stem,
- remove limb 4–6 in. outside the first cut,
- remove stub with an even flush cut so that a trace (collar) protrudes approximately 1/2 in.,
- do not allow limb to fall free if it can damage other limbs or items, and
- treat exposed cuts on oak trees with wound dressing within 20 min. of the cut.

Disinfect tools using 70% methyl alcohol, benzalkonium chloride, chlorine solution, or other approved disinfectant when trimming oak trees and when shown on the plans before cutting and sterilize or sanitize again before cutting another tree. Avoid pruning between February 15 and June 15, the period for maximum insect and fungal activity.

4.3. **Brush Removal.** Remove brush including, but not limited to, bushes, small trees, and vines growing within the right of way by cutting parallel to and within 1 in. of the ground and to the limits shown on the plans. Remove brush from under bridges, around culverts, and in channels to the limits shown on the plans.

- 4.4. **Channel Work.** Trim trees and remove brush to the limits shown on the plans, including areas under bridges and easements.
- 4.5. **Stump Removal.** Remove tree stumps at least 12 in. below the surrounding terrain unless otherwise shown on the plans, or as directed. Backfill holes with acceptable material and compact flush with surrounding area.
- 4.6. **Spot Tree Trimming and Brush Removal.** Trim trees in accordance with Section 752.4.2., "Tree Trimming," and remove brush in accordance with Section 752.4.3., "Brush Removal."

5. MEASUREMENT

This Item will be measured as follows.

- 5.1. **Tree Removal.** By each tree of the diameter specified. The diameter will be measured 3 ft. above the ground. Trees less than 4 in. in diameter are considered brush. Trees with multiple trunks at the point of measurement will be measured separately and paid for according to the specified diameter. Removal of the stump will be subsidiary to "Tree Removal."
- 5.2. **Tree Trimming and Brush Removal.** By the centerline mile of the dimension specified. "Centerline mile" is defined as the continuous measurement along the center of the right of way.
- 5.3. **Tree Trimming and Brush Removal for Channels.** By the acre.
- 5.4. **Stump Removal.** By each stump removed. This Item is for stumps where others previously removed the tree.
- 5.5. **Spot Tree Trimming and Brush Removal.** "Brush Removal" will be measured by the foot along the length of the right of way. "Tree Trimming" will be measured by the foot along the length of the right of way to the outer edges of the tree canopy. For areas with tree trimming and brush removal, use the greatest length combination along the right of way.

6. PAYMENT

The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Tree Removal" of the diameter specified, "Tree Trimming" of the dimension specified, "Brush Removal," "Tree Trimming and Brush Removal," "Stump Removal," and "Spot Tree Trimming and Brush Removal." This price is full compensation for removal, trimming, disposal, equipment, traffic control, labor, and incidentals.

When not shown on the plans as a separate pay item, payment for tree trimming and brush removal in channels will be included in payment by the centerline mile. When shown on the plans as a separate pay item, tree trimming and brush removal in channels will be paid for at the unit price bid for "Tree Trimming and Brush Removal (Channels)."

The limits shown on the plans are the limits for pay purposes unless otherwise modified in accordance with Article 4.4., "Changes in the Work."

Item 760

Cleaning and Reshaping Ditches



1. DESCRIPTION

Clean and reshape ditches.

2. WORK METHODS

Excavate and remove excess material from ditches and from around fixtures within the limits of the excavation or reshape by cleaning silt from the ditch and spreading on backslope as approved. Reshape ditches shown on the plans, or as directed. Dispose of excess material in conformance with applicable federal, state, and local regulations, or place on right of way, as directed. Maintain ditch drainage during cleaning and reshaping work.

3. MEASUREMENT

Measurement will be as follows.

- 3.1. **Foot.** By the foot, measured along the centerline of the ditch.
- 3.2. **Cubic Yard in Place.** By the cubic yard in its original position computed by the method of average end areas.
- 3.3. **Cubic Yard in Vehicle.** By the cubic yard in vehicles measured at the point of excavation.

4. PAYMENT

The work performed in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Ditch Reshaping (Foot)," "Ditch Cleaning and Reshaping (Cubic Yard in Place)," or "Ditch Cleaning and Reshaping (Cubic Yard in Vehicle)." This price is full compensation for excavation, disposal of removed materials, reshaping, equipment, labor, tools, and incidentals.

Item 764

Pump Stations and Drainage System Cleaning



1. DESCRIPTION

Perform hydraulic cleaning, vacuum removal and disposal of debris in drain inlets, pump station wells, basket and inlet pipes, downspouts, sumps, storm sewers, and slotted drains. Debris is defined as dirt and other material not part of the drainage system.

2. MATERIALS

Furnish materials unless otherwise shown on the plans. Furnish water that is free of industrial waste and other objectionable material.

3. EQUIPMENT

Provide a vacuum truck that is a self-contained, single-unit vehicle with a high-pressure water pump capable of pumping at least 60 gpm at 2,000 psi with at least 500 ft. of hose and a water storage tank with at least 1,300-gal. capacity, or as approved. Provide a debris storage bin of at least 14-cu. yd. capacity and an air conveying vacuum system capable of cleaning pump station wells up to 55 ft. deep through 8-in. diameter tubing for pump station well, basket, and inlet pipe cleaning, or as required by the plans.

4. WORK METHODS

Remove and dispose of debris and wash water off the right of way in conformance with federal, state, and local regulations.

Perform hydraulic cleaning and vacuum removal as follows.

- 4.1. **Drain Inlet.** Clean the drain inlet, including the top. Drain inlet cleaning includes cleaning curb inlets, grate inlets, catch basins, or manholes.
- 4.2. **Pump Station Well.** Clean the pump well floor, excluding the basket and inlet pipes.
- 4.3. **Basket and Inlet Pipe.** Clean the basket and inlet pipes at the pump station well. Clean inlet pipes for a minimum distance of 10 ft. from inlet pipe entry into the well unless otherwise shown on the plans.
- 4.4. **Downspout.** Clean downspouts from the drain inlet on the bridge deck to the junction box, manhole, storm sewer trunk system, or outfall.
- 4.5. **Sump.** Clean the sump box.
- 4.6. **Storm Sewer.** Clean storm sewer pipe or box culvert, regardless of size or shape, for the distance required.
- 4.7. **Slotted Drain.** Clean the slotted drain, including the drainpipe below the slot. Clean the drainpipe from the downstream end of the slotted drain to the pipe outfall or to the next slotted drain in accordance with Section 764.4.6., "Storm Sewer."

5. MEASUREMENT

This Item will be measured by the each or foot as follows.

- 5.1. **Drain Inlet.** By each drain inlet cleaned.
- 5.2. **Pump Station Well.** By each pump station well cleaned.
- 5.3. **Basket and Inlet Pipe.** By each basket and inlet pipe cleaned.
- 5.4. **Downspout.** By each downspout cleaned.
- 5.5. **Sump.** By each sump cleaned.
- 5.6. **Storm Sewer.** By the foot of storm sewer pipe or box culvert cleaned, as measured by the hose extended into the pipe or culvert.
- 5.7. **Slotted Drain.** By the foot of drain measured along the slot. Cleaning of the drainpipe from the downstream end of the slotted drain to the pipe outfall or to the next slotted drain will be measured by the foot of hose extended into the drainpipe.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Drain Inlet Cleaning," "Pump Station Well Cleaning," "Basket and Inlet Pipe Cleaning," "Downspout Cleaning," "Sump Cleaning," "Storm Sewer Cleaning" of the type and size specified, and "Slotted Drain Cleaning." This price is full compensation for cleaning, removing, and disposing of debris and wash water, and equipment, labor, materials, tools, and incidentals.

Item 770

Guard Fence Repair



1. DESCRIPTION

Repair guard fence elements, posts, terminal anchor sections, single guard fence terminals, and other appurtenances.

2. MATERIALS

Furnish the following materials, unless otherwise shown on the plans:

- rail elements, posts, blockouts, fittings, and anchor concrete in accordance with Item 540, "Metal Beam Guard Fence";
- single guardrail terminal (SGT) in accordance with Item 544, "Guardrail End Treatments";
- steel posts with base plates or terminal anchor posts to match original design, in accordance with ASTM A36 or better;
- paint as required;
- concrete for structural repair in accordance with Item 429, "Concrete Structure Repair";
- grout meeting the requirements of the current metal beam guard fence mow strip standard general notes; and
- backfill material as approved.

Pick up materials furnished by the Department at the locations shown on the plans. Load and deliver furnished material to the project location. Pick up Department-furnished materials during normal business hours.

3. WORK METHODS

Replace guard fence, including thrie beam, curb, and transitions, in accordance with Item 540 and as shown on the plans or as directed. Work requests are made on a callout basis. Begin physical work within 72 hr. of notification, unless otherwise shown on the plans. Replace end treatments in accordance with Item 544 and as shown on the plans or as directed. Weld in accordance with Item 448, "Structural Field Welding." Repair concrete in accordance with Item 429. Remove guard fence in accordance with Item 542, "Removing Metal Beam Guard Fence." Replace rail and posts removed during the same workday, unless otherwise approved.

Protect traffic from exposure to unattached rail elements left overnight, as approved.

Cover or fill post holes at the end of each day.

Place rail to a smooth line and grade, with posts plumb to the correct height, as shown on the plans.

Remove salvageable rail elements in original lengths. Remove fittings from posts and rail elements. Deliver salvageable materials to a designated stockpile site and neatly stack as directed. Reuse salvageable materials in the repair as approved.

Dispose of debris and damaged components in conformance with all federal, state, and local regulations.

- 3.1. **Replace Rail Element.** Remove and replace rail elements as directed. Bolt rail elements end-to-end and lap in the direction of traffic in the lane adjacent to the guard fence. Provide prefabricated curved rail when

needed. Field-drill or punch to create holes for special details. Tighten nuts. Replace bridge end connection when required, in accordance with Item 540.

- 3.2. **Replace Short Radius System (TL-2 or TL-3).** Remove and replace short radius rail systems as directed.
- 3.3. **Replace Timber or Steel Post.** Remove and replace posts as directed. Dispose of any concrete removed. Drill new post holes as needed. Clean post holes free of loose dirt and debris, and thoroughly compact bottom of hole to the correct embedment depth for placement of post. Place post to the correct alignment, elevation, and plumb. Backfill with select material by thoroughly compacting material to the density of adjacent undisturbed material. Replace concrete foundations only as directed. Use grout to fill space between riprap and posts when replacing posts.
- 3.4. **Realign Posts.** Realign existing posts to a smooth line and grade.
- 3.5. **Repair Terminal Anchor Post.** Repair the steel anchor post by straightening or welding to the existing post above the concrete foundation.
- 3.6. **Replace Terminal Anchor Posts.** Remove and replace damaged anchor posts with foundation or install new anchor posts with foundation. Remove anchor and clean existing holes or drill new holes, as approved.
- 3.7. **Remove Obsolete Guardrail End Treatment and Replace with SGT.** Remove damaged guard fence end treatment and replace with complete new SGT.
- 3.8. **Remove Obsolete Guardrail End Treatment.** Remove damaged guard fence end treatment.
- 3.9. **Replace SGT Components.** Remove damaged SGT components and replace with new components. Salvage and reuse components as approved.
- 3.10. **Repair Steel Post with Base Plate.** Replace damaged steel posts with base plates. Drill anchor holes and install new bolts or weld new anchor bolts to existing bolts as directed. Field-weld in accordance with Item 448, or shop-weld in accordance with Item 441, "Steel Structures." Repair damaged galvanized coating in accordance with Section 445.3.4., "Repairs."
- 3.11. **Raise Rail Element.** Raise rail as shown on the plans.
- 3.12. **Replace Blockouts.** Remove and replace damaged or deteriorated blockouts with new blockouts when shown on the plans or as directed.

4. MEASUREMENT

This Item will be measured as follows.

- 4.1. **Replace Rail Element (W-Beam or Thrie-Beam).** By the foot along the face of the rail from center to center of the slotted hole at each end of the rail elements to be replaced, excluding the terminal anchor section, the rail with any bolt hole spacing, and the first two rail elements of the SGT section.
- 4.2. **Replace Rail Element (Thrie-Beam Transition to W-Beam).** By each transition.
- 4.3. **Replace Short Radius System (TL-2 or TL-3).** By each short system radius.
- 4.4. **Replace Timber or Steel Posts (Without Concrete Foundation).** By each post replaced.
- 4.5. **Replace Timber or Steel Posts (with Concrete Foundation).** By each post replaced.
- 4.6. **Realign Posts.** By each post realigned.

- 4.7. **Repair Terminal Anchor Post.** By each post repaired.
- 4.8. **Replace Terminal Anchor Posts.** By each post replaced.
- 4.9. **Remove Obsolete Guardrail End Treatment and Replace with SGT.** By each SGT.
- 4.10. **Remove Obsolete Guardrail End Treatment.** By each end treatment.
- 4.11. **Replace SGT (Impact Head).** By each head.
- 4.12. **Replace SGT (Rail).** By the foot from center to center of posts, two rails.
- 4.13. **Replace SGT (Post).** By each post replaced, including metal sleeves.
- 4.14. **Replace Blockouts.** By each blockout replaced.
- 4.15. **Repair Steel Post with Base Plate.** By each post repaired. Includes top or side mount posts.
- 4.16. **Reset SGT Impact Head.** By each head reset.
- 4.17. **Replace SGT (Object Marker).** By each marker replaced, as directed, including the removal and disposal of the existing rubber bumpers.
- 4.18. **Replace SGT (Cable Anchor).** By each cable anchor replaced.
- 4.19. **Replace SGT (Cable Assembly).** By each cable assembly replaced.
- 4.20. **Replace SGT (Strut).** By each strut replaced.
- 4.21. **Raise Rail.** By the foot along the face of the rail from center to center of the slotted hole at each end of the rail element raised.

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 "Replace Rail Element" of the type specified, "Replace Short Radius System" of the type specified, "Raise Rail" of the type specified, "Replace Post" of the type specified, "Repair Post" of the type specified, "Realign Posts" of the type specified, "Remove Obsolete Guardrail End Treatment and Replace with SGT," "Remove Obsolete Guardrail End Treatment," "Replace SGT" of the type specified, "Reset SGT Impact Head," "Replace Blockouts," and "Repair Steel Post with Base Plate."

This price is full compensation for repairing rail and furnishing equipment, materials, labor, tools, and incidentals. Realignment of existing rail without removing will not be paid for directly but will be subsidiary to realigning posts. Replacement of concrete riprap around posts, removal and replacement of curbs, and bridge end connection will not be paid for directly but will be subsidiary to the various bid items. Replacement of SGT components not mentioned above will not be paid for directly but will be subsidiary to the various bid items. Concrete repair will be paid for in accordance with pertinent Items. Payment for repair of steel posts with base plate includes work performed above the concrete foundation. Any rail removed and replaced to remove and replace posts will not be paid for directly but will be subsidiary to various bid items.

Coring new holes and furnishing new bolts and epoxy for the repair or replacement of posts with base plate will be subsidiary to various bid items.

Item 771

Repair Cable Barrier System



1. DESCRIPTION

Repair cable barrier system and cable barrier terminal sections of the type shown.

2. MATERIALS

Furnish new materials in accordance with Item 543, "Cable Barrier System."

Pick up materials furnished by the Department at the locations shown on the plans.

Salvage materials as directed. Accept ownership of unsalvageable materials and dispose of them in conformance with federal, state, and local regulations.

3. WORK METHODS

Remove and replace cable barrier system components and cable barrier terminal sections in accordance with the details shown on the plans and in conformance with manufacturer's recommendations. Place posts into steel sleeves in a concrete foundation, unless otherwise shown on the plans.

Begin physical repair for Contracts with callout work within 72 hr. of notification, unless otherwise shown on the plans. Repair damaged components such as terminal anchor sections, concrete foundations, cables, posts, and pavement, as necessary to ensure the final installation functions as designed. Replace non-repairable cable. Replace delineators and object markers at terminal ends as needed. Sweep and clean area around cable barrier system.

Provide a tension meter and use it after repair is complete to verify cables in repaired area are properly tensioned. Re-tension the cable barrier system to within manufacturer recommended range as needed. Check cables for proper tensioning when requested and re-tension to within manufacturer recommended range as needed.

Replace post hardware including the high-density polyethylene cable spacers (with reflector when required) and the stainless-steel post strap.

4. MEASUREMENT

This Item will be measured as follows.

- 4.1. **Replace Posts.** By each post replaced.
- 4.2. **Cable Splice and Turnbuckle.** By each cable splice made.
- 4.3. **Repair Concrete Foundation.** By each foundation repaired.
- 4.4. **Repair or Replace Cable Barrier Terminal Section.** By each section repaired or replaced.
- 4.5. **Replace Cable.** By the foot of damaged cable.

- 4.6. **Check and Re-Tension Cables.** By each run checked and re-tensioned. A run is defined as a section of cable barrier system beginning and ending with a terminal section.
- 4.7. **Replace Post Hardware.** By each post.

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 "Replace Posts," "Cable Splice and Turnbuckle," "Repair Concrete Foundation," "Repair or Replace Cable Barrier Terminal Section," "Replace Cable," "Check and Re-Tension Cables," and "Replace Post Hardware," all of the test level specified (e.g., TL-3, TL-4). This price is full compensation for repairing cable barrier system components and cable barrier terminal sections; checking and re-tensioning of a run, furnishing materials; salvage, removal, and disposal; concrete; delineator and object marker replacement; and equipment, labor, tools, and incidentals.

Item 772

Post and Cable Fence



1. DESCRIPTION

Install, repair, or remove post and cable fence.

2. MATERIALS

Furnish materials as follows, unless otherwise shown on the plans.

- 2.1. **Posts.** Furnish timber posts in accordance with [DMS-7200](#), "Timber Posts and Blocks for Metal Beam Guard Fence."
- 2.2. **Cable.** Furnish wire cable in accordance with ASTM A475 and the following requirements.
- 3/8-in. nominal strand diameter
 - Seven-wire strand, common grade
 - Minimum breaking strength of 4,000 lb.
 - 0.30-oz. per square foot minimum weight of zinc coating
- 2.3. **Fittings and Anchors.** Furnish fittings and anchors galvanized in accordance with ASTM A153.
- 2.4. **Concrete.** Furnish concrete in accordance with Item 421, "Hydraulic Cement Concrete," of the class shown on the plans.
- 2.5. **Reflectors.** Furnish reflectors as shown on the plans.
- 2.6. **Backfill.** Furnish backfill material as approved.
- 2.7. **Gate.** Furnish gates as shown on the plans.

3. WORK METHODS

Install, repair, or remove post and cable fence, including reflectors and related items as shown on the plans.

- 3.1. **Removal.** Remove concrete anchors, posts, and cable. Backfill and thoroughly compact post and anchor holes. Accept ownership of removed materials, unless otherwise shown on the plans. Dispose of removed materials in conformance with federal, state, and local regulations.
- 3.2. **Installation.** Place new anchors, posts, and cable as shown on the plans. Set posts on firm foundation and plumb to the required lines and grades. Thoroughly compact backfill in 4-in. layers. Space pull posts as shown on the plans. Lengthen or shorten one pull post space per continuous section if necessary to accommodate site conditions. Cover or fill open holes at the end of each workday.

Maintain current pull post spacing of existing installations if approved. Straighten undamaged posts that are more than 1 in. out of plumb. Stretch cable to remove sag between posts. One cable splice will be allowed between posts, adjacent to the post, but no more than two splices in any 100 ft. of cable. Painting is not required, unless otherwise shown on the plans.

- 3.3. **Repair.** Plumb and realign post in a vertical and horizontal position. Stretch cable to remove sag between posts. One cable splice will be allowed between posts, adjacent to the post, but no more than two splices in any 100 ft. of cable. Removal and replacement of posts, anchors, or cable will be paid for under the appropriate bid item.

4. MEASUREMENT

This Item will be measured as follows.

- 4.1. **Post and Cable Fence Removal.** By the foot from center to center of pull posts.
- 4.2. **Concrete Anchor Removal.** By each anchor removed.
- 4.3. **New Installation of Post and Cable Fence.** By the foot of fence from center to center of pull posts for each continuous section installed.
- 4.4. **New Concrete Anchor.** By each anchor installed.
- 4.5. **Replace Posts.** By each post removed and replaced.
- 4.6. **Replace Concrete Anchors.** By each anchor removed and replaced.
- 4.7. **Replace Cable.** By the foot of cable removed and replaced.
- 4.8. **New Installation of Post and Cable Fence (Gate).** By each gate installed.
- 4.9. **Repair.** By the foot of fence from center to center of pull posts for each repair.

5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Post and Cable Fence (Removal)," "Post and Cable Fence (Remove Concrete Anchor)," "Post and Cable Fence (New Installation)," "Post and Cable Fence (New Concrete Anchor)," "Post and Cable Fence (Replace Posts)," "Post and Cable Fence (Replace Concrete Anchors)," "Post and Cable Fence (Replace Cable)," "Post and Cable Fence (Gate) (New Installation)," or "Post and Cable Fence (Repair)." This price is full compensation for cable splices, straightening posts, realignments of posts, tightening cable, backfilling posts and anchor holes, installation of reflectors, bollards, foundations, backfilling, gate and hardware, paint, materials, equipment, labor, tools, and incidentals.

Item 774

Attenuator Repair



1. DESCRIPTION

Repair or replace damaged attenuators or crash cushions.

2. MATERIALS

Furnish materials in accordance with details shown on the plans.

3. WORK METHODS

Repair or replace attenuators as approved. Begin physical repair for Contracts with callout work within 72 hr. of notification, unless otherwise shown on the plans. Repair damaged components, such as foundation, concrete, anchors, and pavement, as necessary to ensure the final installation functions as designed. Sweep and clean area around attenuator. Dispose of debris and damaged components in conformance with federal, state, and local regulations. Weld in accordance with Item 448, "Structural Field Welding," as directed or approved. Salvage materials as directed.

3.1. **Remove.** Remove existing system shown on the plans or as directed.

3.2. **Replacement.** Remove existing attenuator and replace with a MASH-compliant system shown on the plans or as directed.

3.3. **Repair.** Remove and replace damaged elements of attenuators and repair to meet the installation requirements of the system shown on the plans and in conformance with the specifications that pertain to that appropriate system.

4. MEASUREMENT

4.1. **Remove.** When removing a complete unit, measurement will be by each unit.

4.2. **Replacement.** When replacing a complete unit, measurement will be by each unit.

4.3. **Repair.** Repair will be measured by the each for the component specified or by the foot.

5. PAYMENT

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Remove," "Replace," or "Repair" of the type or component specified. This price is full compensation for repairing or replacing attenuators; furnishing materials; salvage and disposal; and equipment, labor, tools, and incidentals.

Item 776

Metal Rail Repair



1. DESCRIPTION

Repair or replace damaged metal traffic or pedestrian railing on bridges, culverts, parapet walls, retaining walls, or other structures as shown on the plans and as directed.

2. MATERIALS

Furnish metal rail elements in accordance with Item 450, "Railing," and details shown on the plans.

3. WORK METHODS

Remove damaged steel or aluminum rail and repair to match the original or details shown on the plans. Replace steel or aluminum rail to match the original or details shown on the plans if the damaged rail is beyond repair as determined by the Engineer. Begin physical repair for Contracts with callout work within 72 hr. of notification, unless otherwise shown on the plans. Repair damaged components and anchors as necessary to ensure the final installation functions as originally constructed. Drill anchor holes and install new bolts or weld new anchor bolts to existing bolts as directed. Weld in accordance with Item 441, "Steel Structures," or Item 448, "Structural Field Welding." Repair damaged galvanized coating in accordance with Section 445.3.4., "Repairs." Paint repaired areas of painted rail to match existing color in accordance with Item 446, "Field Cleaning and Painting Steel." Repair railing removed for repair during the same workday unless otherwise approved. Deliver salvageable materials to a designated stockpile site and dispose of debris and damaged components in conformance with federal, state, and local regulations.

4. MEASUREMENT

Rail repair will be measured by the foot between centers of the first undamaged post on each side of the repair, or to the end of the rail. Repairing metal post with base plate will be measured by each post repaired. Rail replacement will be measured by the foot between centers of the first undamaged post on each side of the replacement or to the end of the rail.

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 "Repair" of the type specified, "Repair Metal Post with Base Plate" of the type specified, and "Replacement" of the type specified. This price is full compensation for removing and repairing rail; salvage and disposal; and materials, tools, equipment, labor, and incidentals. Concrete repair will be paid for in accordance with Item 429, "Concrete Structure Repair."

Item 777

Permanent Concrete Traffic Barrier Repair



1. DESCRIPTION

Repair or replace damaged permanent concrete traffic barrier as shown on the plans and as directed.

2. MATERIALS

Provide materials in accordance with the following Items, except as shown on the plans.

- Item 427 "Surface Finishes for Concrete"
- Item 429, "Concrete Structure Repair"
- Item 514, "Permanent Concrete Traffic Barrier"

Submit information regarding pre-packaged repair materials, epoxy anchorage systems, and concrete mix design at least 10 calendar days before beginning work.

3. EQUIPMENT

Provide equipment in accordance with Item 429.

4. WORK METHODS

Obtain approval for all materials and work methods at least 10 calendar days before beginning work.

Repair or replace damaged permanent concrete traffic barrier as shown on the plans. Perform the work in accordance with Item 429 and Item 514, as directed.

Remove and replace full height of permanent concrete traffic barrier if damage exceeds half of the barrier height, except as shown on the plans and as directed.

Saw-cut perimeter of concrete repair region 1/2 in. deep. Remove concrete to limits shown on the plans and as directed to remove spalled and delaminated areas. Increase repair length to remove the cracked concrete as directed where cracks associated with impact damage remain outside the specified repair area.

Repair permanent concrete traffic barrier supporting structure (e.g., traffic rail foundation and footing) when damaged in conformance with additional Items of work as shown on the plans and as directed. Include new permanent concrete traffic barrier anchorage reinforcing steel in supporting structure as required.

Drill into undamaged base concrete and add epoxy anchored reinforcing steel to restore severed or damaged permanent concrete traffic barrier anchorage reinforcing steel. Provide epoxy anchorage system rated to obtain yield strength of bar being anchored in conformance with the product literature for the epoxy and steel anchor being used. Use 60-ksi reinforcing steel. Clean and extend existing reinforcing steel and replace any damaged steel or add additional steel as shown on the plans. Restore shape of permanent concrete traffic barrier to match original.

Provide surface finish to match original.

Provide and apply paint in accordance with Item 427 to match color of existing barrier if the damaged barrier was previously painted. This work will be subsidiary to this Item.

5. MEASUREMENT

This Item will be measured by the foot of permanent concrete traffic barrier repaired or replaced as measured along the face of concrete traffic barrier repaired or replaced.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Permanent Concrete Traffic Barrier Repair" and "Permanent Concrete Traffic Barrier Replacement," of the type identified. This price is full compensation for breaking back and restoring permanent concrete traffic barrier; furnishing and placing all materials (including painting where applicable); salvaging and reinstalling existing expansion joints; and all labor, tools, equipment, and incidentals necessary to complete the work.

Item 778

Concrete Rail Repair



1. DESCRIPTION

Repair or replace damaged concrete railing on bridges, culverts, parapet walls, retaining walls, or other structures as shown on the plans and as directed.

2. MATERIALS

Provide materials in accordance with the following Items except as shown on the plans.

- Item 427, "Surface Finishes for Concrete"
- Item 429, "Concrete Structure Repair"
- Item 450, "Railing"
- Item 776, "Metal Rail Repair"

Submit information regarding pre-packaged repair materials, epoxy anchorage systems, and concrete mix design at least 10 calendar days before beginning work.

3. EQUIPMENT

Provide equipment in accordance with Item 429.

4. WORK METHODS

Obtain approval for all materials and work methods at least 10 calendar days before beginning work.

Repair or replace damaged concrete rail as shown on the plans. Perform the work in accordance with Item 429 and Item 450, as directed.

Contain concrete during removal to prevent falling onto lower roadway or into waterway.

Remove and replace full height of rail if damage exceeds half of the rail height, except as shown on the plans and as directed.

Remove existing metal rail components and attachments, and salvage for reuse when undamaged or repairable.

Saw-cut perimeter of concrete repair region 1/2 in. deep. Remove concrete to limits shown on the plans and as directed to remove spalled and delaminated areas. Increase repair length to remove the cracked concrete as directed where cracks associated with impact damage remain outside the specified repair area.

Repair rail supporting structure (e.g., bridge deck and wingwall) when damaged in conformance with additional Items of work as shown on the plans and as directed. Include new rail anchorage reinforcing steel in supporting structure as required.

Drill into undamaged base concrete and add epoxy anchored reinforcing steel to restore severed or damaged rail anchorage reinforcing steel. Provide epoxy anchorage system rated to obtain yield strength of bar being anchored based on the product literature for the epoxy and steel anchor being used. Use 60-ksi

reinforcing steel. Clean and extend existing reinforcing steel and replace any damaged steel or add additional steel as shown on the plans. Restore shape of rail to match original.

Provide surface finish to match original.

Provide and apply paint in accordance with Item 427 to match color of existing rail if the existing rail was previously painted.

Reinstall metal rail components and attachments where previously present.

Salvage and reinstall metal components of expansion joint and joint seal to match existing conditions when repair and replacement occur at an expansion joint. This work will be subsidiary to this Item.

5. MEASUREMENT

This Item will be measured by the foot of rail repaired or replaced and by each rail post repaired or replaced.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Concrete Rail Repair," "Concrete Rail Replacement," "Concrete Post Repair," and "Concrete Post Replacement" of the type identified. This price is full compensation for removing and reinstalling metal rail components; breaking back and restoring concrete rail; furnishing and placing all materials; salvaging and reinstalling existing expansion joints; and all labor, tools, equipment, and incidentals necessary to complete the work.

Item 780

Concrete Crack Repair



1. DESCRIPTION

Repair cracks in concrete members by epoxy injection, gravity filling, routing and sealing, or surface sealing.

2. MATERIALS

Provide materials in accordance with the Department's *Concrete Repair Manual*. Select a pre-approved material in conformance with the applicable DMS when available.

3. WORK METHODS

Follow the procedures in accordance with the Department's *Concrete Repair Manual*. Submit alternative procedures to the Engineer for approval before proceeding with repair work.

The manual includes the following categories of concrete crack repair:

- pressure-injected epoxy,
- gravity-fed sealant,
- routing and sealing, and
- surface sealing.

4. MEASUREMENT

This Item will be measured by the foot of exterior crack length, injected gallon, square footage for flood coats, or lump sum.

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 Crack Repair" of the type specified. This price is full compensation for furnishing and installing all repair materials, equipment, labor, and incidentals.

Item 784

Steel Member Repair



1. DESCRIPTION

Repair steel bridge members, such as beams, girders, diaphragms, trusses, and piling.

2. MATERIALS

Furnish materials in accordance with the following.

- Epoxy in accordance with [DMS-6100](#), "Epoxies and Adhesives"
- Grout in accordance with Item 421, "Hydraulic Cement Concrete"
- Replacement steel in accordance with Item 442, "Metal for Structures"
- Paint in accordance with Item 446, "Field Cleaning and Painting Steel"

3. EQUIPMENT

Provide equipment, including restraining equipment when required, capable of indicating the amount of force applied.

4. GENERAL

Repair or replace steel bridge members in accordance with the plans. Submit a plan that includes the repair method, application of heat and restraint, material, temporary bracing or shoring, and equipment. Obtain approval of the plan before beginning work. Field-weld in accordance with Item 448, "Structural Field Welding." Perform heat straightening using welding personnel certified for unlimited thickness and all positions in accordance with Item 448. Perform shop fabrication in accordance with Item 441, "Steel Structures," excluding Section 441.3.1.5., "Qualification of Plants and Personnel."

Coatings on existing steel contain hazardous materials unless otherwise shown on the plans. Remove paint and dispose of steel coated with paint containing hazardous materials in accordance with Article 6.10., "Hazardous Materials."

Only welders certified or working directly under the supervision of a welder certified in accordance with Item 448 may handle torches when applying heat to steel members.

Use drills to place holes in steel members. Ensure torches are not used to place holes unless authorized or as shown on the plans.

Do not fill holes with weld metal.

- 4.1. **Heat Straightening.** Return all distorted members to their original section, tilt, and straightness by heat straightening. Use approved mechanical devices to restrain the member while applying heat to straighten the distorted metal. Ensure mechanical forces are not used to straighten or bend the metal. Ensure impact loads, such as hammer blows, are not applied. Repair cracks as shown on the plans before straightening. Repair minor dents, nicks, and gouges by grinding the defect to an acceptable contour and appearance, with all corners rounded to a 1/16-in. radius. Grind so the finished grinding marks run in the direction of the applied stresses. Straighten steel members to the tolerances shown in Table 1.

Table 1
Straightening Tolerances

Greatest Cross-Section Dimension	Max Cross-Section Displacement	Max Departure from Straightness (per foot of length)
>36"	0.5"	0.05"
12-36"	0.375"	0.0375"
<12"	0.25"	0.025"

- 4.1.1. **Restraining Force.** Apply and lock-off load before applying heat when jacks are used. Limit restraining forces applied before heating to the values shown on the plans or as approved. Ensure the member is not loaded in a manner that causes material to yield without the application of heat.
- 4.1.2. **Heating Process.** Heat steel and maintain temperature above 700°F while straightening, but no greater than 1,200°F for typical steel grades, and 1,100°F for quenched and tempered, High-Performance Steel 70W, or 100/100W grade steel.
- Use only multi-flame heating tips unless approved otherwise, and proportion tip size to the thickness of the material. Manipulate heating torches to guard against overheating. When vee or rectangular heat patterns are used, mark the patterns on the steel before heating. Bring steel within the planned temperature as rapidly as possible without overheating. Guard against buckling when heating relatively thin, wide plates. Closely monitor temperatures using temperature-sensitive crayons, pyrometers, or infrared non-contact thermometers. Measure the temperature 5–10 sec. after the heating flame leaves the area to be tested.
- 4.1.3. **Cooling.** Use dry compressed air for cooling after the steel has cooled to below 600°F. Ensure the steel is not cooled with water or mist. Allow the steel to cool below 250°F before applying another set of heating patterns.
- 4.2. **Section Replacement.** Replace sections of steel members as shown on the plans or as approved. Use steel backing plates in accordance with AASHTO/AWS D1.5 when placing complete joint penetration groove welds from one side only. Remove backing plates after completing welding operations.
- 4.3. **Bearing Establishment.** Repair areas of incomplete bearing between the slab and the beam by epoxy injection in accordance with Item 780, "Concrete Crack Repair," or placement of a grout mixture in accordance with Item 421, as directed.
- 4.4. **Painting.** Complete repairs before painting. Paint repaired area only, unless otherwise shown on the plans, in accordance with Item 446. Ensure remaining paint adjacent to repaired area is tightly adhering to steel before cleaning and painting repaired area. Match the color of the existing appearance coating.

5. MEASUREMENT

This Item will be measured by each repaired member or lump sum for the entire bridge. A member is defined as one of the following individual components:

- steel beam or girder over the length of one span, unless otherwise shown on the plans;
- diaphragm and its connecting hardware between adjacent steel beams;
- truss vertical;
- truss diagonal;
- truss sway brace;
- piling; or
- other elements shown on the plans.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Steel Member Repair" of the component specified when measured by each member, or for "Steel Structure Repair" when measured by lump sum. This price is full compensation for repairing steel bridge members and steel, grout, epoxy, materials, equipment, labor, tools, and incidentals.

No additional payment will be made if the Contractor elects to replace a member indicated to be repaired.

Item 785

Bridge Joint Repair or Replacement



1. DESCRIPTION

Repair or replace damaged bridge joint as shown on the plans.

2. MATERIALS

Provide materials in accordance with the following Items except as shown on the plans.

- Item 429, "Concrete Structure Repair"
- Item 449, "Anchor Bolts"
- Item 454, "Bridge Expansion Joints"
- [DMS-6100](#), "Epoxies and Adhesives"

Submit information regarding pre-packaged repair materials and concrete mix design at least 10 days before beginning work.

3. EQUIPMENT

Provide equipment in accordance with Item 429 and Item 448, "Structural Field Welding."

4. WORK METHODS

Obtain approval for all materials and work methods before beginning work.

Repair damaged bridge joints as shown on the plans. Perform the work in accordance with Item 429; Item 438, "Cleaning and Sealing Joints"; Item 448; and Item 454, as directed. Provide certified welder when shown on the plans.

Remove concrete and steel sections to limits shown on the plans and as approved when damage extends past specified regions. Repair concrete and steel members damaged by the Contractor beyond limits shown at no additional cost. Contain concrete during removal to prevent falling onto lower roadway or into waterway. Remove existing joint and seal. Ensure prestressed concrete deck panel is not damaged during concrete removal. Clean and extend existing reinforcing steel and replace any damaged steel or add additional steel as shown on the plans.

Examine existing steel joint, finger plate, armor plate, or sliding plate to determine whether the items are salvageable. Reinstall anchor bolts, anchor studs, and other steel attachments if loose and shown on the plans.

Install replacement joint system as shown on the plans. Set joint opening as shown on the plans and as directed. Restore concrete under and around joint flush with top of riding surface. Cure repaired concrete at least 4 days, unless directed otherwise.

Prepare and seal joint opening. Match existing joint seal type unless shown otherwise. Splice new joint seal to existing joint seal when required in conformance with manufacturer's recommended practices to obtain adequate bond between existing seal and new seal.

5. MEASUREMENT

This Item will be measured by the foot of joint repaired, per side of joint opening, and by the foot of joint system replaced.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Bridge Joint Repair" and "Bridge Joint System Replacement" of the type identified. This price is full compensation for removing existing joint and seal; breaking back and repairing concrete damaged for joint removal and replacement; removing and replacing additional concrete as shown on the plans; furnishing and placing all materials; cleaning and sealing the joints; disposal of all materials removed; additional sealant required to extend into concrete rail or curb; additional material that may be required due to existing asphalt and concrete removal being more than estimated as shown on the plans; and for all labor, tools, equipment, and incidentals necessary to complete the work.

Item 786

Carbon Fiber Reinforced Polymer



1. DESCRIPTION

Furnish and install a carbon fiber reinforced polymer (CFRP) system for protecting or strengthening concrete members.

2. MATERIALS

Provide unidirectional high-strength carbon fiber fabric, fully saturated with compatible epoxy resin in conformance with manufacturer's recommendations, to form a CFRP system unless otherwise shown on the plans. Use carbon fibers in the CFRP system that are in accordance with [DMS-4700](#), "Externally Bonded Fiber Reinforced Polymer (FRP) System for Repairing and Strengthening Concrete Structure Members," and are pre-approved for use unless otherwise shown on the plans. Pre-approved CFRP systems are listed on the Department's MPL for *Fiber-Reinforced Polymer* and shown on the plans.

Provide appearance coating recommended by CFRP system manufacturer to protect the CFRP from ultraviolet radiation. Match color of protective appearance coating to adjacent concrete.

Submit a schedule of repair materials to be used including detailed application instructions. Provide manufacturer's product data sheets that include mechanical, physical, and chemical properties for the proposed primer, putty, resin, saturant, carbon fiber, and protective appearance coating. Provide manufacturer's Safety Data Sheets for all materials to be used onsite and certification that the materials are in conformance with local, state, and federal environmental and worker's safety laws and regulations.

Provide all CFRP components (excluding fabric) in original factory-sealed, unopened packaging clearly marked with the manufacturer's name, product identification (including brand, system identification number, and batch number), and expiration date or shelf life. Store and handle the products in conformance with the manufacturer's instructions. Ensure outdated components are not used.

3. WORK METHODS

Obtain approval for all materials, qualifications, and methods of application at least 10 days before beginning application. Provide a technical representative from a CFRP manufacturer for concrete member strengthening during the initial installation of the strengthening materials to provide onsite project support and to verify adequacy of surface preparation.

- 3.1. **Qualifications.** Provide documentation from the CFRP manufacturer showing project personnel have completed training on the CFRP system selected. Ensure trained personnel always remain at the worksite at all times to install and direct the CFRP field installation work. Provide documentation for concrete member strengthening work to demonstrate previous CFRP field installation, including successful completion of at least three CFRP field installation projects similar in scope and magnitude to the work. Additionally, the Engineer may request the presence of the manufacturer's representative for additional training if work personnel do not adequately follow manufacturer's installation directions. CFRP work will be delayed until personnel are trained and have demonstrated proper installation on approved mock location at the Contractor's expense.

- 3.2. **Working Drawings.** Working drawings are not required for CFRP application to confine or protect concrete members, unless otherwise shown on the plans. Provide working drawings and calculations signed and sealed by a licensed professional engineer for concrete member strengthening. Include in working drawings:

repair locations; relevant dimensions of the system; details of the number, thickness, and orientation of carbon fiber layers; locations of splices and corresponding lap lengths; number, size, and location of CFRP anchors; and construction procedures specifying the individual steps in the installation process. Identify the environmental and substrate conditions that may affect the application and curing of the CFRP system. Calculations must show the proposed system provides the required strengthening as shown on the plans.

- 3.3. **Concrete Structure Repair.** Perform concrete structure repair in accordance with Item 429, "Concrete Structure Repair," as shown on the plans. Allow enough time for concrete repair material to cure in conformance with CFRP manufacturer's specifications before placing CFRP. Repairing surface defects to ensure required contact surface condition is not considered concrete structure repair and is required work for this Item.

- 3.4. **Surface Preparation.** Prepare concrete substrate surfaces to promote continuous intimate contact between the CFRP and the concrete by providing a clean, smooth, and flat or convex surface. Grind away all irregularities, unevenness, and sharp protrusions to provide less than 1/32-in. surface profile deviation. Fill all voids or depressions of diameters larger than 1/2 in. or depths greater than 1/8 in. with approved material. Provide surface roughness requirements for strengthening as shown on the plans. Round or chamfer all inside and outside corners and sharp edges to a minimum radius of 1/2 in. Remove all laitance, dust, dirt, oil, foreign particles, disintegrated materials, and any other matter that could interfere with the bond of the CFRP to the concrete using abrasive blasting.

Drill holes in concrete using a rotary impact drill when CFRP anchors are shown on the plans. Ensure existing reinforcing steel is not cut when drilling holes. Thoroughly clean holes by using a wire hole-brush and oil-free compressed air to remove all drill powder from interior surfaces of hole.

- 3.5. **Installation.** Monitor environmental conditions before and during installation of the CFRP system in conformance with the Contract requirements and manufacturer's recommendations. Ensure CFRP components are not installed if the substrate surface is moist or wet, or if ambient or concrete surface temperatures are outside the 50–95°F range. Apply CFRP only when relative humidity is below 85% and the surface temperature is at least 5°F above the dew point temperature.

Apply system using the wet lay-up method unless otherwise approved. Install the CFRP system in conformance with Contract requirements and the manufacturer's recommendations and shown on the plans. Release or roll out entrapped air beneath each layer before the resin sets. Obtain approval before implementing any change to the approved installation procedure.

Place CFRP anchors between layers of the applied system when shown on the plans.

- 3.6. **Testing.** Perform the following tests after the initial resin has cured for at least 24 hr. and in conformance with manufacturer's specifications:
- a visual inspection of the entire CFRP surface,
 - an acoustic tap test of any areas suspected to contain air pockets, and
 - at least two direct pull-off tests for each member strengthened in accordance with ASTM D4541 to verify the tensile bond between the concrete and the CFRP system.

The Engineer will select areas to perform the direct pull-off test. Perform some or all direct pull-off tests on CFRP test samples prepared at locations of similar substrate near the CFRP installation area at the discretion of the Engineer. Prepare the test samples using identical application procedures at the same time the project CFRP is installed. The required minimum pull-off stress is 200 psi, or failure in the concrete substrate, unless otherwise shown on the plans. Repair the damaged CFRP and concrete at test areas after testing is completed with thickened resin or putty.

- 3.7. **Remediation.** Epoxy-inject behind CFRP layers where small voids and bubbles that have a nominal size of 3 in. or less are located. Analyze defect areas larger than 3 in., and perform repair work as directed, which

may include removal and replacing portions or all of the applied CFRP. Perform required remediation for pull-off test results failing to meet the required minimum as directed.

- 3.8. **Protective Appearance Coat.** Clean and paint CFRP system in conformance with manufacturer's specifications.

4. MEASUREMENT

This Item will be measured by the square foot of concrete area covered with CFRP system. This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal, unless modified by Article 9.2., "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

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 "Carbon Fiber Reinforced Polymer Protection" and "Carbon Fiber Reinforced Polymer Strengthening." This price is full compensation for all materials, labor, equipment, pull-off testing (including repair of test sites), manufacturer's supervision, and related work necessary to prepare the surface of the concrete, to install the CFRP system as shown on the plans, and to apply the protective appearance coat.

Payment will be under this Item unless otherwise stated.

Item 787

Replacing Elastomeric Bearing Pads



1. DESCRIPTION

Replace elastomeric bridge bearings.

2. MATERIALS

Furnish elastomeric bearings meeting the requirements of Item 434, "Bridge Bearings." Fabricate new bearings to the indicated dimensions.

3. CONSTRUCTION

Raise spans as necessary to replace the indicated bearings in accordance with Item 495, "Raising Existing Structures." Individual girders may be raised if approved and if no damage occurs to the slab or adjacent girders.

Remove indicated bearings. Do not use flame-cutting techniques to remove bearing pads.

Clean existing bearing seats and the bearing contact area on the bottoms of concrete girders by pressure washing, scraping, or other approved method to remove all wax residue and other deleterious materials. Use oil-free compressed air for final cleaning to remove all loose material from bearing contact areas.

Repair spalls at bearing areas as indicated in accordance with Item 429, "Concrete Structure Repair." Restore or reconstruct damaged bearing seats as necessary in accordance with Section 420.4.9, "Treatment and Finishing of Horizontal Surfaces."

If indicated, construct pedestals in conformance with the pertinent Items and the details shown on the plans.

Place new bearing pads after all bearing seat or spall repair materials have attained a compressive strength of 3,000 psi. Do not use dry cement powder under the new bearings.

Completely remove all hardware or appurtenances used to raise the spans or girders. Repair any damage resulting from the lifting operation at no expense to the Department.

4. MEASUREMENT

This Item will be measured by each bearing replaced.

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 "Replacing Elastomeric Bearing Pads." This price is full compensation for raising the spans or girders, removing the original bearing pads, cleaning and restoring the bearing contact areas, furnishing and installing new bearing pads, equipment, labor, shoring, falsework, tools, and incidentals. The work performed to raise the spans or girders in accordance with Item 495 will not be paid for directly but will be subsidiary to this Item. Concrete spall repairs will be measured and paid for in accordance with Item 429. Pedestals will be paid for in accordance with Item 420, "Concrete Substructures," or Item 442, "Metal for Structures," as indicated.

Item 788

Concrete Beam Repair



1. DESCRIPTION

Repair damaged concrete beams. Beam damage may include delamination, surface spalling, section loss, reinforcement damage, and cracking.

2. WORK METHODS

Provide materials and perform work in accordance with the Department's *Concrete Repair Manual*, as shown on the plans, and in accordance with the following:

- Item 429, "Concrete Structure Repair," for repairing unsound, delaminated, or spalled concrete;
- Item 780, "Concrete Crack Repair," for sealing concrete cracks with pressure-injected, gravity-fed, or surface-applied epoxy; and
- Item 786, "Carbon Fiber Reinforced Polymer (CFRP)," for confining or strengthening concrete using a CFRP system.

Provide strand and hardware meeting the requirements of Item 424, "Precast Concrete Structural Members (Fabrication)," if strand splicing and re-tensioning are required. Follow work methods as shown on the plans.

Pre-load the damaged beam before repair work if shown on the plans. Pre-load by loaded 10-cu. yd. dump truck or other approved method. Keep the pre-load in place until repair concrete has attained a minimum compressive strength of 3,600 psi.

Remove damaged bridge protective assembly as directed. Replace assembly if required in accordance with Item 441, "Steel Structures."

The Engineer will test the quality of the repair work by hammer blows, bond strength test, and any other means necessary to ensure satisfactory performance. Rework or replace defective or debonded work at the Contractor's expense.

Apply supplemental CFRP strengthening or protection as shown on the plans.

3. MEASUREMENT

This Item will be measured by each beam repaired.

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 bid price for "Concrete Beam Repair," "Concrete Beam Repair plus Strand Splicing," "Concrete Beam Repair plus CFRP," and "Concrete Beam Repair plus Strand Splicing and CFRP." This price is full compensation for repair; supplemental exterior confinement or strengthening; and furnishing equipment, labor, materials, tools, and incidentals.

Item 790

Lane Closures



1. DESCRIPTION

Install, maintain, and remove lane closures as shown on the plans, or as directed. This Specification is intended for lane closures approximately 24 hr. in duration or less.

2. MATERIALS

Furnish material in accordance with the following.

- Section 7.2.6., “Barricades, Signs, and Traffic Handling”
- Section 502.4.2., “Law Enforcement Personnel”

3. CONSTRUCTION

Comply with the requirements of Article 7.2., “Safety,” and Item 502, “Barricades, Signs, and Traffic Handling.”

The type of lane closure to be implemented will be in accordance with Table 1 and shown on the plans.

Table 1
Types of Lane Closure

Type	Description	Unit (Setup and Removal or Maintenance, or by the Hour Only)
1	1 Lane Closure—2 Lane Road, No Shoulders	EA/HR, HR
2	1 Lane Closure—2 Lane Road, Paved Shoulders	EA/HR, HR
3	1 Lane Closure—1 Lane, Two-Way Operation	EA/HR, HR
4	1 Lane Closure—Traffic Shift Operation	EA/HR, HR
5	1 Lane Closure—4 Lane Road	EA/HR, HR
6	2 Lane Closure—4 Lane Road	EA/HR, HR
7	Freeway 1 Lane Closure	EA/HR, HR
8	Freeway 2 Lane Closure	EA/HR, HR
9	Freeway 3 Lane Closure	EA/HR, HR
10	Freeway 4 Lane Closure	EA/HR, HR
11	Exit or Entrance Ramp Closure	EA/HR, HR
12	Freeway Closure Sequence Daytime Only	EA/HR, HR
13	Complete Freeway Closure	EA/HR, HR
14	1 Lane Frontage Road Closure	EA/HR, HR
15	2 Lane Frontage Road Closure	EA/HR, HR
16	1 Lane Connecting Ramp Closure	EA/HR, HR
17	2 Lane Connecting Ramp Closure	EA/HR, HR
18	Work Area on Shoulder	EA/HR, HR
19	Turn-Around Closure	EA/HR, HR

Lane closures for mobile operations are specified under Item 505, “Truck-Mounted Attenuator (TMA) and Trailer Attenuator (TA).”

Additional items used for lane closures will be in accordance with Table 2 and shown on the plans.

**Table 2
Additional Lane Closure Items**

Type	Description	Unit
20	Furnish Additional Flagger	HR
21	Pilot Vehicle and Operator	HR
22	Furnish Additional Arrow Board	HR

Furnish additional flaggers shown on the plans or as directed to provide traffic control at intersecting streets and drives located within the limits of the lane closure.

Provide pilot vehicles and operators as shown on the plans or as directed.

Furnish additional arrow boards as shown on the plans or as directed.

4. MEASUREMENT

Lane closures (Type 1–Type 19) will be measured by the each (setup and removal) and by the hour (maintenance) or by the hour only (includes setup, removal, and maintenance). Additional lane closure items (Type 20–Type 22) will be measured by the hour.

When measured by the each and hour, lane closure maintenance periods begin from the time the setup of traffic control devices is completed and end when the Engineer directs the removal of the traffic control devices.

When measured by the hour only, time charges begin when the Contractor arrives at the location and time as directed. Time charges end when the last traffic control device is removed from the roadway.

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 “Lane Closure (Setup and Removal)” of the type specified, “Lane Closure (Maintenance)” of the type specified, “Lane Closure (Hourly Only)” of the type specified, or “Additional Lane Closure Items” of the type specified. This price is full compensation for furnishing all materials, equipment, labor, tools, supplies, and incidentals.

All portable changeable message signs required by these lane closures will be paid for under Item 503, “Portable Changeable Message Sign.”

Law enforcement personnel will be paid in accordance with Item 502.

All truck-mounted and trailer attenuators required by these lane closures will be paid for under Item 505.

Required flaggers will be subsidiary to the appropriate lane closure type specified. Additional flaggers will be paid for under additional lane closure Type 20, “Furnish Additional Flagger.”

Pilot vehicles and operators will be paid for under additional lane closure Type 21, “Pilot Vehicle and Operator.”

Required arrow boards will be subsidiary to the appropriate lane closure type specified. Additional arrow boards will be paid for under additional lane closure Type 22, “Furnish Additional Arrow Board.”