DIVISION 600 – INCIDENTAL CONSTRUCTION

SECTION 601 – GUARDRAIL

601.01 Description

This work shall consist of the fabrication, assembly, and installation of guardrail, guardrail components, guardrail transitions, guardrail end treatments, and impact attenuators, all in accordance with 105.03 and as shown on the plans. This work may also consist of the extension of existing guardrail with new guardrail, the removal of existing guardrail, or adjusting the height of existing guardrail.

MATERIALS

601.02 Materials

Materials shall be in accordance with the following:

Alternate Material Guardrail Blockouts	926.03
Guardrail Posts	910.10
Guardrail Accessories, Fittings, and Fasteners	910.11
Guardrail and Guardrail Components	910.09
Steel Thrie-Beam Rail	910.09
Steel W-Beam Rail	910.09
Timber Posts and Blockouts	911.02(f)

Guardrail end treatments shall be in accordance with 601.07. Impact attenuators shall be in accordance with 601.08.

PCC in anchors, and in pads, or bases for impact attenuators shall be Class A and in accordance with 702. Sheet signs and sign posts shall be in accordance with 802.

Barrels used in impact attenuators shall be yellow with black lids. The coarse aggregate used in the barrels shall be size 93PG, Class F or higher, in accordance with 904.

All other impact attenuators shall have end reflectorization as shown on the plans or attached to the nose of the attenuator in accordance with the attenuator manufacturer's recommendation.

W-beam or Midwest Guardrail System, MGS, W-beam guardrail, components, assembly, post spacing, post lengths, and installation for each location shall be as shown on the plans. Double-faced guardrail shall be required at the locations shown on the plans. For W-beam guardrail, in locations where conditions will not allow the use of 7 ft posts, 6 ft posts may be substituted when approved. Timber posts may be used within a run of MGS W-beam guardrail as shown on the plans. Timber posts shall not be used within a run of W-beam guardrail.

The base metal thickness of the steel W-beam rail element for a curved guardrail system shall be 0.105 in. The base metal thickness of the steel W-beam terminal connector shall be 0.135 in. The controlled released terminal, CRT, timber breakaway posts shall be S4S timber and shall otherwise be in accordance with 911. The curved rail timber posts shall be in accordance with 911. All structural tubing shall be in accordance with ASTM A500. The remaining steel components shall be in accordance with 910.

CONSTRUCTION REQUIREMENTS

601.03 General Requirements

Posts shall be installed plumb at the spacing and embedment depth shown on the plans. Posts shall be driven where subsurface conditions or overhead obstructions enable the use of normal driving equipment. Where such conditions prohibit driving the posts, a 12 in. diameter hole shall be bored to the required embedment depth. The hole shall be backfilled with suitable material in 6 in. maximum lifts, compacted as directed, and then the posts driven.

Posts damaged during installation shall be repaired or replaced as directed with no additional payment.

When new guardrail is being installed to replace existing guardrail and traffic is to be maintained during the work, the installation of the new guardrail shall follow the removal of the existing guardrail as closely as practical. Adequate safety protection shall be provided as directed between the time that the existing guardrail is removed and the time that the installation of the new guardrail is completed.

When new guardrail is being installed where there is no existing guardrail and traffic is to be maintained during the work, the mounting of the blockouts and the rail elements to the posts shall be completed as soon as practical after the posts are installed. The time between the installation of the posts and the mounting of the blockouts and rail elements shall not exceed 24 h. Drums shall be placed to mark all installed guardrail posts left bare overnight. The spacing of these devices shall be numerically equal to the worksite speed limit, but not less than 20 ft.

All damaged galvanized surfaces shall be coated in accordance with 910.11(a)4.

W-beam guardrail shall be installed as shown on the plans with the W-beam rail element splice at the post. MGS W-beam guardrail shall be installed as shown on the plans with the W-beam rail element splice at midspan. MGS W-beam guardrail installed with half or quarter post spacing shall be spliced as shown on the plans.

The nested W-beam guardrail element shall consist of two rail elements, one set inside the other. The length of nested guardrail placed over a culvert shall not be spliced.

601.04 Guardrail Erection

Blockouts and rail elements shall be erected in a manner resulting in a smooth, continuous installation. All bolts shall be of sufficient length to extend beyond the nuts and shall be drawn tight. Rail installed along a radius of 150 ft or less shall be shop curved. Rail elements shall be lapped as shown on the plans.

601.05 Curved W-Beam Guardrail Systems

This work shall consist of the fabrication, assembly, and installation of specified types of curved W-beam guardrail connector system or curved W-beam guardrail terminal system in accordance with the requirements herein and as shown on the plans.

The installation of the terminal end buffer may utilize an alternate single piece having similar dimensional shape to the terminal end buffer as shown on the plans, and which mates with the W-beam guardrail.

Where the W-beam terminal connector is lapped on the outside of the guardrail, a galvanized 1 in. inside diameter, 2 in. outside diameter, 0.134 in. thick, narrow plain washer shall be placed under the splice bolt heads.

Nuts for the anchor cable assembly shall be hand tightened, plus one complete turn at the anchor plate end. All other nuts shall be torqued to 50 ft lb.

The installation of the Type 5 anchor shall include tightening the cable with the swaged end to eliminate all slack.

The W-beam rail in the Type 5 anchor shall be attached to the steel pipe with 5/8 in. diameter by 1 1/4 in. button head bolt with no washer. Connection to the post will not be required.

601.06 Guardrail Transitions

Guardrail transitions shall be required to connect guardrail to bridge rail, guardrail to piers, and new W-beam guardrail to guardrail. The required type of guardrail transition shall be as shown on the plans.

An MGS guardrail transition, with or without curb, shall be required to connect guardrail to bridge rail and guardrail to piers. An MGS height transition shall be required to connect MGS W-beam guardrail to existing W-beam or existing rub rail type guardrail. The required type of guardrail transition shall be as shown on the plans.

The fabrication, assembly, and installation of thrie-beam rail, W-beam rail components, and posts and blockouts for guardrail transitions will be required for the locations shown on the plans.

601.07 Guardrail End Treatments

Guardrail end treatments shall terminate guardrail installations at the locations

shown on the plans. Type I and Type II guardrail end treatment shall be as shown on the plans. Type OS or Type MS guardrail end treatments shall be selected from the QPL of Guardrail End Treatments. The grading requirements shall be as shown on the plans.

Assembly and installation or resetting shall be supervised or performed at all times by an installer trained and certified by the unit's manufacturer, and shall be in accordance with the manufacturer's recommendations. The installer shall be included on the Department's list of Qualified Guardrail End Treatment and Impact Attenuator Installers prior to the start of work.

The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals and working drawings in accordance with 105.02.

Double facing of guardrail end treatment Type I shall be required when it is used in conjunction with double faced guardrail.

When installing end treatments to existing rub rail type guardrail, the rub rail, if spliced at the last existing post, shall be cut and the end repositioned behind the flange of the post. If the rub rail is spliced at the last existing post, the existing splice material shall be removed and the end of the rub rail repositioned behind the flange of the post. In both cases, the rub rail shall be connected to the post as shown on the plans.

Guardrail end treatments shall be installed within 24 h of the completion of the guardrail installation to which they are to be attached. Drums in accordance with 801.09 shall be placed for overnight marking of the bare end of the guardrail when the installation of the end treatment will not be completed until the day following the completion of the guardrail installation to which it is to be attached.

601.08 Impact Attenuators

Impact attenuators shall be placed or reset to obtain the proper height as shown on the plans. The unit for each new location shall be of the width recommended by the manufacturer and for the test level specified and shall be selected from those shown on the QPL of Impact Attenuators. Each unit shall be placed in accordance with the manufacturer's recommendations on a PCC pad.

Assembly, installation, or resetting of the impact attenuators shall be supervised or performed by an installer trained and certified by the unit's manufacturer and shall be in accordance with the manufacturer's recommendations. The installer shall be included on the Department's list of Qualified Guardrail End Treatment and Impact Attenuator Installers prior to the start of work.

The Contractor shall provide the Department with original copies of all necessary current manufacturer's installation manuals and working drawings in accordance with 105.02.

Transition panels and all other necessary hardware shown in the manufacturer's recommendations for bi-directional traffic protection shall be included in the installation or resetting, if the unit is installed at a location where traffic is passing the unit on both sides in opposite directions.

601.09 Extension of Existing Guardrail

Extension of existing rub rail type guardrail with new W-beam guardrail shall require adjusting the post heights in the last 25 ft of existing rub rail type guardrail adjacent to the extension as shown on the plans. Guardrail transition Type VH shall be used to make this adjustment. The post spacing of the guardrail transition Type VH shall equal that of the last 25 ft of existing rub rail type guardrail adjacent to the extension. The rub rail shall be terminated at the last existing post in the transition in accordance with 601.06.

Extension of existing rub rail type or W-beam guardrail with new MGS W-beam guardrail shall require adjusting the splice location and post height in the last 37 ft 6 in. of the existing rub rail type or W-beam guardrail as shown on the plans. MGS height transition shall be used to make this adjustment. The rub rail shall be terminated at the last existing post in the transition in accordance with 601.06.

601.10 Removal of Existing Guardrail

Removal of existing guardrail shall be in accordance with the applicable requirements of 202 and these requirements. The locations shall be as shown on the plans. When it is specified that the removed guardrail is to become the property of the Department, the rail elements, posts, and blockouts shall be removed without being damaged. The removed material shall be stored as directed.

601.11 Adjusting Existing Guardrail Height

The height of the existing guardrail shall be adjusted by the use of moveable blockouts as shown on the plans. The height shall be measured to the top of the rail element along the face of the rail. Existing fixed blockouts shall be replaced with moveable blockouts installed at the proper height. Existing moveable blockouts shall be disconnected from the posts and re-mounted at the proper height.

601.12 Resetting Guardrail

This work shall consist of the removal of existing guardrail and if necessary, storing and then re-erecting where shown on the plans or as directed.

601.13 Method of Measurement

Guardrail, guardrail with rub rail, shop curved guardrail, adjusting guardrail height, guardrail removal, and resetting guardrail will be measured by the linear foot along the top of the rail element, complete in place. Nested guardrail will be measured per each 100 lft run placed.

Modified posts for nested guardrail will be measured per each, complete in place.

MGS structure top-mounted posts will be measured per each, complete in place. Long span MGS W-beam guardrail will be measured per each for the type specified and corresponding run length between outermost CRT posts.

Guardrail transitions, W-beam and MGS W-beam guardrail cable terminal anchors, and guardrail end treatments will be measured per each, complete in place. Guardrail buried end treatments Type II will be measured per each.

Impact attenuators and resetting impact attenuators will be measured per each for the type and width and test level, complete in place. The curved W-beam guardrail connector system and the curved W-beam guardrail terminal system will be measured per each for the type specified.

Grading at guardrail end treatments, the reflectorization of guardrail end treatments, and concrete used in anchoring guardrail end treatments will not be measured for payment.

Aggregate used to fill gravel barrel impact attenuators will not be measured for payment.

601.14 Basis of Payment

W-beam and MGS W-beam guardrail will be paid for at the contract unit price per linear foot for the specified post spacing. Thrie-beam and thrie-beam double faced guardrail will be paid for at the contract unit price per linear foot for guardrail, thrie-beam and guardrail, thrie-beam, double faced, complete in place. Nested guardrail will be paid for at the contract unit price per each 100 lft run, complete in place for guardrail, W-beam, nested.

Long span MGS guardrail will be paid for at the contract unit price per each type specified and corresponding run length between outermost CRT posts, complete in place for guardrail, MGS, long span.

W-beam and MGS W-beam guardrail cable terminal anchor will be paid for at the contract unit price per each, complete in place. Modified posts for nested guardrail will be paid for at the contract unit price per each for modified posts, nested guardrail. Structure top-mounted posts will be paid for at the contract unit price per each for guardrail, MGS, structure top-mounted posts.

W-beam guardrail with rub rail will be paid for at the contract unit price per linear foot for guardrail, WR-beam complete in place. Shop curved guardrail, adjusting guardrail height, guardrail removal, and resetting guardrail will be paid for at the contract unit price per linear foot. Guardrail transitions and guardrail end treatments will be paid for at the contract unit price per each for the type specified. Guardrail buried end treatments Type II will be paid for at the contract unit price per each, complete in place.

Impact attenuators and resetting impact attenuators will be paid for at the contract unit price per each for the type and width, and test level specified. The curved W-beam guardrail connector system and curved W-beam guardrail system will be paid for at the contract unit price per each for the type specified, complete in place.

Where existing guardrail height is adjusted, such work will be paid for at the contract unit price per linear foot. The cost of removal, all necessary storage, new adjustable post brackets, attachment of rail section, and miscellaneous nuts and bolts as required shall be included in the cost of adjust guardrail height.

Payment will be made under:

Pay Item	Pay Unit Symbol
Guardrail Connector System, W-Beam, Curved, _____ type	EACH
Guardrail End Treatment, _____ type	EACH
Guardrail Height Transition, MGS	EACH
Guardrail Height Transition, VH, ____ ft ____ in. Spacing	EACH
Guardrail Transition, _____ type	EACH
Guardrail Transition, MGS, _____ type	EACH
Guardrail, Adjust Height	LFT
Guardrail, MGS W-Beam, ____ ft ____ in. Spacing	LFT
Guardrail, MGS W-Beam, Cable Terminal Anchor	EACH
Guardrail, MGS W-Beam, Double Faced, _____ ft _____ in. Spacing	LFT
Guardrail, MGS W-Beam, Shop Curved, _____ ft _____ in. Spacing	LFT
Guardrail, MGS, Long Span, _____ type	EACH
Guardrail, MGS, Structure Top-Mounted Posts	EACH
Guardrail, Remove	LFT
Guardrail, Reset	LFT
Guardrail Terminal System, W-Beam, Curved, _____ type	EACH
Guardrail, Thrie-Beam	LFT
Guardrail, Thrie-Beam, Double Faced	LFT
Guardrail, W-Beam, ____ ft ____ in. Spacing	LFT
Guardrail, W-Beam, Cable Terminal Anchor	EACH
Guardrail, W-Beam, Double Faced, _____ ft _____ in. Spacing	LFT
Guardrail, W-Beam, Nested	EACH

Guardrail, W-Beam, Shop Curved,
_____ ft _____ in. Spacing..... LFT
Guardrail, WR-Beam..... LFT
Impact Attenuator, _____, _____..... EACH
type-width test level
Impact Attenuator, Reset, _____, _____ ..... EACH
type-width test level
Modified Posts, Nested Guardrail..... EACH

For W-beam guardrail, the substitution of 6 ft posts for 7 ft posts where conditions will not allow the use of the longer post will be at the same contract unit price of the longer post.

The substitution of W 6 x 8.5 for W 6 x 9 steel posts, in MGS W-beam guardrail, will be at the same contract unit price for heavier post.

The cost of resetting guardrail shall include the removal, necessary storage, resetting, and replacement of damaged or missing parts and new posts as required.

The cost of reflectorization of impact attenuators and guardrail end treatments shall be included in the respective pay items.

The cost of all grading required for the guardrail buried end treatment shall be included in the cost of guardrail end treatment, Type II.

The cost of earthwork, grading, transition panel, if required, and PCC pad shall be included in the cost of the impact attenuator. The cost of aggregate used to fill gravel barrel impact attenuators shall be included in the cost of the impact attenuator.

The cost of excavation, concrete footings, reinforcement, and structural steel tubing required for modified posts, nested guardrail, shall be included in the cost of the pay item.

The cost of all materials, including replacing damaged or missing parts, labor, and necessary incidentals required to reset impact attenuators, shall be included in the cost of impact attenuator, reset.

Where guardrail transition Type TGB is used with bridge railing Type TR, the cost of eliminating the thrie-beam terminal connector and driving the posts to the height above ground shown on the plans shall be included in the cost of the guardrail transition.

SECTION 602 – CONCRETE BARRIER

602.01 Description

This work shall consist of the construction of concrete barriers and concrete glare screens in accordance with these specifications and as shown on the plans.

MATERIALS

602.02 Materials

Materials shall be in accordance with the following:

Barrier Delineators	926.02(c)
Cast-in-Place Barriers	702
Cast-in-Place Concrete Glare Screens	702
Concrete Sealers	709
Construction Warning Lights	923.03
Precast Barriers	707
Precast Concrete Glare Screen	707
Reinforcing Bars	910.01

CONSTRUCTION REQUIREMENTS

602.03 Concrete Barrier and Concrete Glare Screen

Concrete barrier and concrete glare screen may be precast or cast-in-place. The option selected shall be used continuously throughout the project. Irregular sections shall be cast-in-place regardless of the option selected.

Concrete glare screen may only be precast when constructed in combination with new precast barrier. Concrete glare screen shall be cast-in-place when constructed in combination with cast-in-place barrier and when constructed on top of existing concrete barrier.

Excavation and compaction shall be in accordance with 605.03(a). Backfilling shall be in accordance with applicable requirements of 605.03(d).

(a) Precast Concrete Barrier and Concrete Glare Screen

Precast concrete barrier and concrete glare screen shall be constructed in accordance with applicable requirements of 707, except the minimum 28-day compressive strength shall be 3,000 psi. The precast units shall not be shipped or used until this strength is attained. The surfaces of individual precast units shall vary no more than 1/4 in. in 10 ft from the specified cross-section, as measured from a longitudinal straightedge. The maximum variation in the vertical and horizontal alignment of adjacent units shall be 1/4 in. across the joint, as measured from a 10 ft longitudinal straightedge. Approved bedding may be used to obtain proper alignment of the concrete barrier sections.

(b) Cast-in-Place Concrete Barrier and Concrete Glare Screen

Cast-in-place concrete barrier and concrete glare screen shall be constructed in accordance with applicable requirements of 706.03. The surfaces of the concrete shall vary no more than 1/4 in. in 10 ft from the specified cross-section, as measured from a longitudinal straightedge. Where concrete pavement or concrete shoulder abuts the concrete barrier, 1/2 in. preformed joint filler shall be placed as shown on the plans.

Where the concrete barrier is to be placed on PCCP, epoxy coated reinforcing bars shall be placed as shown on the plans. The epoxy coated reinforcing bars shall be installed in the PCCP by drilling and grouting.

The barrier wall shall be constructed in single pours without subsequent vertical extensions.

When shown on the plans, cast-in-place modified concrete barrier sections shall be in accordance with the above requirements and the concrete shall be Class A in accordance with 702.02.

(c) Finishing

Concrete barrier and concrete glare screen shall be finished in accordance with 702.21. If slip-form construction is used, an approved brush finish will be allowed. Curing material in accordance with 912.01(e) shall be applied as a bond breaker to all areas which result in concrete-to-concrete contact. It shall be applied at a minimum rate of 1 gal./75 sq ft. If material is applied at a rate less than the minimum rate, a second application shall be applied.

(d) Sealing

Regardless of the method of construction, all exposed surfaces of the concrete barrier and concrete glare screen shall be sealed in accordance with the applicable requirements of 709.

(e) Joints

The type, size, and location of joints and preformed joint filler shall be as shown on the plans.

(f) Reflectorization

All concrete barrier shall be reflectorized with barrier delineators spaced a minimum of 40 ft apart and centered 2 ft above the surface of adjacent pavement or shoulder. The reflectorization shall be on both sides of the wall if traffic is on both sides. All delineators damaged during installation or placement of the concrete barrier shall be replaced with no additional payment. The color of the reflectors shall match the color of the adjacent pavement traffic markings.

602.04 Blank

602.05 Method of Measurement

Concrete barrier will be measured by the linear foot along the centerline of the barrier, including irregular barrier sections around median obstructions such as bridge piers. Barrier delineators will be measured per each provided there is a pay item shown in the Schedule of Pay Items. Concrete glare screen will be measured by the linear foot along the centerline of the glare screen. Class A concrete for cast-in-place modified concrete barriers will be measured by the cubic yard for the modified barrier section. No deductions will be made for reinforcing bars or joints. Reinforcing bars for cast-in-place modified concrete barriers will be measured in accordance with 703.07.

602.06 Basis of Payment

Concrete barrier will be paid for at the contract unit price per linear foot, complete in place. Class A concrete for cast-in-place modified concrete barriers will be paid for at the contract unit price per cubic yard. Reinforcing bars for cast-in-place modified concrete barriers will be paid for in accordance with 703.08. Barrier delineators used on concrete barrier will be paid for at the contract unit price per each, complete in place. Concrete glare screen will be paid for at the contract unit price per linear foot, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Barrier Delineator	EACH
Concrete Barrier Glare Screen	LFT
Concrete Barrier	LFT
Concrete Barrier, Modified Section	CYS

The cost of polyethylene film, surface seal, and curing material shall be included in the cost of concrete barrier.

SECTION 603 – FENCES

603.01 Description

This work shall consist of the construction of fence and gates in accordance with 105.03.

MATERIALS

603.02 Materials

Materials shall be in accordance with the following:

Barbed Wire	910.18(b)4
Chain Link Fabric	910.18(b)
Concrete, Class B	702

Farm Field/Woven Wire .....910.18(a)
Fence Posts 910.13
Gates.....910.18(d)
Packaged Patching Products.....901.08
Tension Wire.....910.18(b)1

CONSTRUCTION REQUIREMENTS

603.03 General Requirements

Clearing and grubbing shall be in accordance with 201.03.

At locations where breaks in a run of fencing are required, or at intersections with existing fences, appropriate adjustment in post spacing shall be made in accordance with the requirements for the type of closure indicated.

When the plans require that posts, braces, or anchors be imbedded in concrete, temporary guys or braces shall be installed, if required to hold the posts in proper position. Unless otherwise specified, no materials shall be installed on posts or strain placed on guys and bracing shall be set in concrete until 96 h have elapsed from the time of placing of the concrete.

The tops of all posts shall be set to the required grade and alignment. Cutting of the posts will only be allowed with the approval by the Engineer. Post caps shall be installed at the time the fence fabric is placed on the posts.

Wire or fencing of the size and type required shall be firmly attached to the posts and braces in the manner indicated. All wires shall be stretched taut and installed to the required elevations. At each location where an electric transmission, distribution, or secondary line crosses any of the types of fences covered by these specifications, a ground, conforming to applicable requirements of the NEC, shall be furnished and installed.

603.04 Setting Posts

Posts, including the concrete foundation for posts, braces and anchors shall be set so that the entire fence is inside the right-of-way and the fence can be placed on the side of the post facing the roadway. If an object, such as a tree, is located on the right-of-way and is to remain in place, the fence may be adjusted to miss the obstruction. There shall be a gradual offset for at least three posts in each direction of the obstruction.

Line posts for farm field type fence shall be set on 16 ft centers, and for chain link fence on 10 ft centers. In either case, a tolerance of ±2 ft in spacing will be allowed at special locations as approved. Spacing of these posts shall be as uniform as practicable under the existing conditions. Additional posts shall be set to maintain the bottom clearance dimensions as required.

Pull posts shall be set at 500 ft maximum intervals in straight runs and at each

vertical angle point of 10° or more. Corner posts shall be set at each horizontal angle point of 10° or more. End, corner, and pull posts for both types of fence, line posts for chain link fence, and diagonal braces for farm field type fence shall be set in concrete as shown on the plans.

Except where rock is encountered, intermediate or line posts shall be driven and furnished with an approved anchor plate or other satisfactory device to hold the post in proper alignment and plumb. The plate or anchor shall be welded or riveted to the post with no less than two rivets.

Gate posts shall be set in concrete as shown on the plans.

Extra length posts shall be required at stream crossings as shown on the plans or as directed and also at ground depressions where it is not practicable for the fencing to follow closely the contour of the ground. These posts shall be set in concrete as shown on the plans.

At small stream crossings and ground depressions, the space below the fence fabric shall be closed with barbed or ground tension wire, either on horizontal lines or fanned, as shown on the plans or as directed. The wires shall be stretched taut between and fastened to the posts to prevent vertical movement of the wires. Barbed or tension wire shall not be placed where its installation would cause collecting drifts in the channel.

603.05 Placing Barbed and Tension Wire and Fabric

The bottom of the fabric shall be placed above the ground line as shown on the plans. Over irregular ground, a minimum of 1 in. and a maximum of 4 in. clearance will be allowed. All necessary excavation and backfilling required shall be in accordance with 201.03.

The tension required to stretch the fabric and wire shall be applied by mechanical fence stretchers and with single wire stretchers designed and manufactured for the purpose, and in accordance with the fence manufacturer's recommendations. All splices in the fabric and wire shall be securely made in accordance with the best practice and the manufacturer's recommendations, and by the use of tools designed for that purpose.

Farm field fence shall be placed by fastening one end and then applying sufficient tension to remove all slack before making permanent attachments elsewhere. The line wires shall be fastened to end, corner, and pull posts by wrapping the wires around the posts and tying the wire back on itself with no less than 1 1/2 tightly wrapped twists. Tying shall be with tools designed for the purpose in accordance with the fence manufacturer's recommendations. This same method shall be used in placing barbed or tension wire. Fence fabric shall be fastened to intermediate or line posts with at least five wire ties. Barbed or tension wire shall be fastened in the same manner with one fastening device for each post.

The top and bottom tension wires of chain link fence shall be placed, stretched taut, and secured at the ends and to all posts before the fabric is placed. The ends of the fabric shall be secured by the use of stretcher-bars threaded through the loops of the fabric and secured to the posts by means of clamps with bolts and nuts. The number of clamps shall be as indicated on the plans. The fabric shall be placed by securing one end and then applying tension to remove all slack before making attachments elsewhere. The fabric shall be fastened to the line posts and to the top and bottom tension wires with tie wires spaced as shown on the plans.

603.06 Resetting Fence

Resetting fence shall consist of the removal of existing fence within the specified limits and, if necessary, storing and resetting as shown on the plans or as directed. Resetting fence shall be in accordance with 603.03, 603.04, and 603.05. Damaged or missing parts, including posts, shall be replaced.

603.07 Method of Measurement

Fence and resetting fence will be measured by the linear foot for the type specified. Measurement will be made along the top of the fence from outside to outside of end posts for each continuous run of fence.

Gates will be measured as complete units of the size and type specified.

603.08 Basis of Payment

The accepted quantities of fence and resetting fence will be paid for at the contract unit price per linear foot for the type specified, complete in place. Gates will be paid for at the contract unit price per each for fence gate, of the type and size specified, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Fence Gate, _____ (type), _____ (height) in. x _____ (length) ft	EACH
Fence, _____ (type), _____ (height) in.	LFT
Fence, _____ (type), Reset	LFT
Fence, Farm Field, Barbed Wire, _____ in.	LFT
Fence, Farm Field, Tension Wire, _____ in.	LFT

The cost of ground installation in accordance with the NEC, including all materials and labor, shall be included in the cost of the fence.

The cost of fence fabric, corner, end, line, and pull posts shall be included in the cost of the fence.

The cost of fence fabric for gates, posts, and miscellaneous hardware shall be included in the cost of the gate.

The cost of all miscellaneous hardware related to the type of fence including brace connections, caps, clips, clamps, hinges, rivets, ties, truss rods, diagonal braces, and stretcher bars shall be included in the cost of the fence.

The cost of concrete for posts, braces, or anchors shall be included in the cost of the fence and gates.

The cost of removal, storage, re-installation, and the replacement of damaged or missing parts shall be included in the cost of the resetting fence.

SECTION 604 – SIDEWALKS, CURB RAMPS, STEPS, AND HANDRAILS

604.01 Description

This work shall consist of constructing HMA or PCC sidewalks, curb ramps, concrete steps, or the reconstruction of PCC sidewalks in accordance with 105.03.

MATERIALS

604.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53	904.03
Concrete, Class A	702
Detectable Warning Surfaces	905.05
Fine Aggregate, Size No. 23, No. 24, or No. 15	904.02
Joint Filler	906.01
Joint Sealing Materials	906.02
Reinforcing Bars	910.01
Structural Steel Coating System	909.03
Silica Sand	ASTM C778

Hand railing shall be aluminum pipe in accordance with ASTM B221, Alloy 6063, temper T52, or galvanized steel pipe in accordance with ASTM A53, Grade B, all as specified.

Railing designated to be painted shall be coated with the structural steel coating system with the exception that the epoxy intermediate coat will not be required.

The detectable warning surface in concrete curb ramps shall be selected from the QPL of Detectable Warning Surfaces in accordance with 905.05.

The mortar bed material shall be high-strength mortar in accordance with ASTM C387. Part of the mix water shall be replaced with a Type II polymer modifier meeting the requirements of ASTM C1438. The proportioning of water and polymer modifier shall be as recommended by the manufacturer of the polymer modifier.

A Type C certification in accordance with 916 shall be provided for the masonry mortar and polymer modifier.

A Type C certification in accordance with 916 shall be provided for the silica sand.

CONSTRUCTION REQUIREMENTS

604.03 Portland Cement Concrete Sidewalks and Curb Ramps

(a) General Requirements

The location of curb ramps shall take precedence over the location of drainage structures and signal, utility, or light poles. Drainage structures and poles shall not be located within the limits of the curb ramp, exclusive of flared sides. Poles located within a sidewalk shall not reduce the clear width to less than 4.0 ft. Crosswalk markings shall be located such that the curb ramps and curb ramp clear spaces are contained within the markings unless otherwise specified. The flared sides need not fall within the crosswalk lines. The normal gutter flow line shall be maintained throughout the curb ramp area, and appropriate drainage structures shall be used, as needed, to intercept the flow prior to the curb ramp area. Positive drainage shall also be provided to carry water away from the intersection of the curb ramp and the gutter line.

The bottom edge of curb ramps and the top of curb shall be flush with the edge of the adjacent pavement or the gutter line. Vertical surface discontinuities shall be a maximum of 1/2 in. Vertical surface discontinuities greater than 1/4 in. up to 1/2 in. shall be beveled at a slope no steeper than 1V:2H.

The curb ramp running slope shall not exceed 8.33%. Curb ramp and sidewalk cross slope shall not exceed 2.00%. The slope of the turning space shall not exceed 2.00% in any direction. A running slope or cross slope that exceeds the maximum shall be as shown on the plans.

Construction tolerance shall not apply to running slope and cross slope percentages.

(b) Excavation

Excavation shall be made to the required depth and to a width that will enable the installation and bracing of the forms. The foundation shall be shaped and compacted to a firm even surface in accordance with the section shown on the plans. All soft and yielding material shall be removed and replaced with acceptable material.

(c) Forms

Forms shall be of wood, metal, or other approved material and shall extend for the full depth of the concrete. Forms shall be straight, free from warp, and of sufficient strength to resist the pressure of the concrete without springing. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

(d) Placing Concrete

The foundation shall be thoroughly moistened immediately prior to the placing of the concrete. The proportioning, mixing, and placing of the concrete shall be in accordance with 702. The thickness of the concrete in the curb ramp, including flared sides, shall be as shown on the plans.

(e) Finishing

Immediately after striking off, the grade, running slopes, and cross slopes shall be checked with a 2 ft level and a long-handled straightedge of light construction that can completely span the surface. The level and straightedge shall be laid parallel and perpendicular to the grade or running slope at intervals of no more than 2 ft on curb ramps and 10 ft along sidewalks. All high spots shall be removed and depressions filled with fresh concrete and then leveled. Checking and leveling shall continue until the surface has the required grade, running slope, cross slope, and is free of voids.

The surface shall be finished with a wooden float. No plastering of the surface will be allowed. The final surface shall be free from porous spots caused by the disturbance of coarse aggregate particles. Curb ramp surfaces shall be coarse broomed transverse to the running slope as shown on the plans. All exposed edges shall be finished with a 1/4 in. radius.

(f) Joints

The type and location of joints and the size of preformed joint filler shall be as shown on the plans. All concrete joints shall be finished with a 1/4 in. radius.

Preformed 1/2 in. joint filler shall be placed around all appurtenances, such as manholes and utility poles which extend into and through the sidewalk, and between the sidewalk and any fixed structure, such as a building or bridge. The preformed joint filler shall extend for the full depth of the sidewalk or curb ramp and shall be flush with the surface of the adjacent concrete.

(g) Detectable Warning Surfaces

Detectable warning surfaces shall be placed the full width of the curb ramp. Where forming is required for installation of the detectable warning surfaces, the border width shall not exceed 2 in. within the ramp width, as shown on the plans.

Detectable warning surfaces shall contrast visually from the adjacent surfaces. The surface shall consist of truncated domes aligned in a square or radial grid pattern as shown on the plans.

Surfaces shall be installed to be level across joints or seams and shall be flush with the edges of adjoining concrete. Surfaces from various manufacturers shall not be mixed in any individual curb ramp.

1. Brick Surfaces

Brick surfaces shall be placed in a mortar setting bed within the hardened concrete block out. The concrete base of the block out shall have a rough textured finish, such as would be produced by a screed or wood float. The depth of the block out shall be such that a mortar bed thickness of 3/8 to 3/4 in. is achieved for the nominal depth of the brick. The hardened concrete base shall be free of all material which might prevent the mortar setting bed from adhering. The concrete base shall be dampened with water but the surface dry immediately prior to the placing the mortar setting bed. The mortar setting bed shall be placed at the desired thickness, and no more than 2 ft ahead of laying the bricks. The bricks shall be buttered with mortar on the bottom before placement into the setting bed.

Brick surfaces shall be installed in a running or stacked bond pattern with a 1/16 in. average joint width. The joint width shall not exceed 1/8 in. Whole bricks should be laid first, followed by bricks cut to size, keeping the number of joints to a minimum. A masonry saw shall be used to produce a clean, accurate, and straight cut. The joint between bricks shall be completely filled with a dry fine aggregate. The fine aggregate may be obtained from a non-Certified Aggregate Producer, but it shall be natural sand having a gradation where at least 95% of the material passes the No. 4 sieve. Excess fine aggregate shall be removed from the surface of the bricks.

2. Cast Surfaces

Cast iron surfaces shall be installed in accordance with the manufacturer's recommendations. When required, cutting of the cast iron shall be in accordance with the manufacturer's recommendations. Cut edges shall be ground to a smooth shape consistent with the manufactured edges.

(h) Curing

Concrete shall be cured for at least 72 h. Curing shall be in accordance with 504.04 except curing compound shall not be used in the area where detectable warning surfaces are to be installed.

604.04 PCC Steps

PCC steps shall be in accordance with the applicable provisions of 604.03.

604.05 Reconstructed PCC Sidewalk and Curb Ramp

Where existing concrete sidewalk is to be reconstructed, all disintegrated concrete, brick, stone, or other material shall be completely removed and replaced with new concrete sidewalk in accordance with 604.03.

Such sidewalk shall be constructed to a minimum depth of 4 in. unless another depth is designated and to the width of the adjoining walk, or to a width of no less than 48 in. from the back face of curb, or to other width as directed.

The removal of concrete sidewalk shall be to uniform lines as directed. The sidewalk to be removed shall be cut in a straight line with an approved power driven concrete saw. The sidewalk to remain in place shall not be damaged. All portions which are damaged or removed beyond the established line shall be replaced.

Unless otherwise directed, sidewalk to be removed shall be removed between tool marks or joints. At locations where the sidewalk and curb are adjacent and the curb is deteriorated, the curb shall also be replaced as directed.

The new sidewalk shall have a joint pattern similar to the surrounding sidewalk. Sidewalk placed at drives shall be 6 in. thick, or the same depth of the existing drive, whichever is greater.

Where existing curb ramp is to be reconstructed for placement of detectable warning surfaces, all concrete, brick, stone, or other material shall be completely removed and replaced in accordance with 604.03.

604.06 Re-Laid Sidewalk

This work consists of the removal and re-laying of concrete, stone-slab, or brick sidewalk at the locations shown on the plans or as directed. In the operations of removing and re-laying, care shall be taken not to damage any of the sidewalk. Before re-laying, a cushion of fine aggregate shall be spread on the prepared subgrade to a depth of no less than 2 in. Cracked or damaged sections shall not be re-laid but shall be disposed of as directed. The cross slope of the re-laid sidewalk shall be checked with a 2 ft level in accordance with 604.03(e).

604.07 HMA Sidewalk

(a) Excavation and Forms

Excavation and forms, when required, shall be in accordance with 604.03(b) and 604.03(c).

(b) Bed Course

Bed course material shall be coarse aggregate No. 53 and shall be placed in lifts not exceeding 4 in. in depth. Each lift shall be thoroughly compacted.

(c) Placing HMA Sidewalk

HMA sidewalk material shall be placed on a compacted bed course in one or more courses. The mixture shall consist of HMA base, intermediate, or surface, Type B in accordance with 402, except the 9.5 mm surface gradation can go above or below the PCS control point in accordance with 401.05. An MAF, in accordance with 402.05, will not apply. Aggregate requirements of 904.03(d) do not apply. Compaction shall be accomplished by means of a hand operated or power roller of an acceptable type and weight in accordance with 402.15. In areas inaccessible to the roller, hand tamping will be allowed. In any case, the HMA sidewalk material shall be uniformly

compacted. The grade and cross slope shall be checked with a 2 ft level in accordance with 604.03(e).

If the finished compacted surface is too open or remains sticky, the surface shall be given a coating of fine aggregate, well broomed over the surface, leaving no excess.

604.08 Backfilling and Finishing Shoulders and Slopes

After forms have been removed, the space on each side of the sidewalks shall be filled to the required elevation with suitable material which shall be firmly compacted and neatly graded. Adjacent shoulders and slopes shall be finished to the required grade and cross-section.

604.09 Handrails

This railing shall be erected in a workmanlike manner, straight and true to grade. Posts shall be vertical and railings shall be parallel to the walk surface or the plane of the steps and spaced as shown on the plans. Fastenings shall be as shown on the plans. Railing posts on masonry shall be held in place in a manner that develops the full strength of the railing post in bending.

Fabrication and placement of railings shall be completed in accordance with the applicable requirements of 711. Ends of tube sections shall be milled or sawed. Cut ends shall be true, smooth, and free from burrs and ragged edges. Welds shall be ground smooth. The rail system shall be continuous except as shown on the plans. Joints shall be spliced as detailed on the plans. Welding of steel shall be in accordance with 711.32 and welding of aluminum shall be in accordance with the applicable requirements of 803. Radiographic, magnetic particle, and dye penetrant inspection will not be required.

All aluminum surfaces in contact with concrete shall be coated with an aluminum impregnated caulking compound prior to installation. After installation and alignment, openings between metal surfaces and concrete shall be sealed in a watertight manner with the caulking compound.

The surface of galvanized steel railing designated on the plans to be painted with a coating shall be prepared using a light brush-off blast cleaning in accordance with SSPC-SP16. The resulting surface profile shall be 15 to 30 microns in accordance with ASTM D4417. Primer in accordance with 909.02(a)1 shall then be shop-applied prior to delivery to the jobsite. The polyurethane finish coat shall be in accordance with 909.02(c) and shall be applied after the railing installation. The color of the dry film of the finish coat shall be as shown on the plans. Applying coatings shall be in accordance with the applicable portions of 619.

604.10 Method of Measurement

Concrete sidewalk, reconstructed concrete sidewalk, and re-laid concrete sidewalk will be measured by the square yard of finished surface. HMA for sidewalk

will be measured by the ton of mixture placed. Bed course material will be measured by the ton.

Concrete curb ramps will be measured by the square yard and will include the ramp, turning space, flared side, and setback. Turning spaces shared by more than one curb ramp will be measured only once. Detectable warning surfaces and retrofitted detectable warning surfaces will be measured by the square yard.

Concrete steps will be measured by the cubic yard based on the neat lines shown on the plans.

Handrail will be measured by the linear foot in accordance with the dimensions shown on the plans or as directed. Measurements will be made from end to end of the railing along the centerline. Curb and curb and gutter will be measured in accordance with 605.09. Reinforcing bars, if used, will be measured in accordance with 703.07. Joint material will not be measured.

604.11 Basis of Payment

The accepted quantities of concrete sidewalk will be paid for at the contract unit price per square yard for sidewalk, concrete. HMA for sidewalk will be paid for at the contract unit price per ton, complete in place. Bed course material will be paid for at the contract unit price per ton. Concrete steps will be paid for at the contract unit price per cubic yard for steps, concrete. Reconstructed sidewalk and re-laid sidewalk will be paid for at the contract unit price per square yard for sidewalk, reconstruct, or sidewalk, re-lay. Detectable warning surfaces and retrofitted detectable warning surfaces will be paid for at the contract unit price per square yard.

The accepted quantities of curb ramps will be paid for at the contract unit price per square yard for curb ramp, concrete, complete in place.

Handrail will be paid for at the contract unit price per linear foot. Curb and curb and gutter will be paid for in accordance with 605.10. Reinforcing bars, if used, will be paid for in accordance with 703.08. Curb, if directed to be replaced, will be paid for in accordance with 605.10.

Payment will be made under:

Pay Item	Pay Unit Symbol
Bed Course Material	TON
Curb Ramp, Concrete	SYS
Detectable Warning Surfaces	SYS
Detectable Warning Surfaces, Retrofit	SYS
Handrail, _____ (type)	LFT
HMA for Sidewalk	TON

Sidewalk, Concrete.....SYS
Sidewalk, Concrete, Reconstruct.....SYS
Sidewalk, Concrete, Re-Lay.....SYS
Steps, Concrete.....CYS

The cost of the ramp, including border, turning space, flared side, return curb, and setback shall be included in the cost of the curb ramp.

The cost of excavation, backfill, joint material, and necessary incidentals shall be included in the cost of the pay items in this section.

The removal and disposal of concrete sidewalk which is unsuitable for re-laying and which has not been damaged due to negligence will be paid for in accordance with 202.14.

Concrete sidewalk which is specified to be re-laid or to remain in place and which is damaged shall be removed and disposed of and replaced with no additional payment.

If directed, concrete sidewalk shall be constructed to a depth greater than that shown on the plans. Such additional thickness will be converted into the equivalent square yards quantity of concrete sidewalk of the thickness shown on the plans and will be paid for as such.

The cost of furnishing and applying sand to finished compacted surfaces shall be included in the cost of HMA for sidewalk.

The cost of the detectable warning surfaces, thin set mortar, and fine aggregate for filling joints shall be included in the cost of the detectable warning surfaces.

The cost of removal, disposal, and replacement of portions of the concrete curb ramp, concrete base, including border, detectable warning surfaces, thin set mortar, and fine aggregate for filling joints shall be included in the cost of the detectable warning surfaces, retrofit.

The cost of aluminum impregnated caulking compound and the coating of steel hand railing shall be included in the cost of the handrail.

SECTION 605 – CURBING

605.01 Description

This work shall consist of the construction of curb or curb turnouts, combination curb and gutter, combined curb and gutter turnouts, or resetting curb in accordance with 105.03.

605.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher, Size No. 53	904.03
Joint Materials	906
Joint Mortar	907.12
Precast Concrete Curbing	905.04
Reinforcing Bars	910.01

Concrete shall be in accordance with 502 except the minimum modulus of rupture shall be 550 psi at 28 days.

605.03 Precast Cement Concrete Curbing

(a) Excavation

Excavation shall be made to the required depth and the base upon which the curb is to be set shall be compacted to a firm even surface. All soft and unsuitable material shall be removed and replaced with suitable material which shall be thoroughly compacted.

(b) Installation

The curb shall be set in accordance with the line and grade required. The face and top of the curb shall be checked with a 10 ft straightedge. Portions showing irregularities of 1/4 in. or more shall be removed and replaced with no additional payment. All spaces under the curbing shall be filled with thoroughly tamped bed course material. The bed course material shall be coarse aggregate No. 53.

(c) Joints

Curbing shall be placed with joints as shown on the plans. These joints shall be filled with mortar as specified. Where a portland cement concrete pavement is to be constructed contiguous to a curbing, joints shall be constructed in the curbing directly in line with pavement expansion joints. The joint in the curbing shall be the same width as the pavement joint and shall be filled with an expansion joint filler of the nominal thickness as the pavement joint. Any voids between the joint filler and the curb shall be filled with mortar.

(d) Backfilling

After the curb has set, any remaining excavated areas shall be filled with approved material. This material shall be placed and thoroughly tamped in layers not to exceed 6 in. in depth.

605.04 Cast in Place Cement Concrete Curbing

(a) Excavation

Excavation and bedding shall be in accordance with 605.03(a).

(b) Forms

Forms shall be of wood or metal, straight, free from warp, and of such construction that there will be no interference to the inspection of grade or alignment. All forms shall extend for the entire depth of the curb and shall be braced and secured sufficiently so no deflection from alignment or grade occurs during the placing of the concrete.

(c) Proportioning and Placing

Concrete shall be proportioned, mixed, and placed in accordance with 502, except utilization of the Department provided spreadsheet is not required for the CMDS. Where integral curb and gutter are specified, that portion of the curb below the upper surface elevation of the adjoining pavement shall be constructed by extending the pavement to the outer vertical plane of the curb at the time the pavement is placed. The concrete used in this extension shall be the same composition as that of the pavement.

As an option, an integral curb and gutter may be placed at the same time as the PCCP pavement by the slip form method. The slip form machine shall have an attachment to place, consolidate, and shape the concrete to the required profile and dimensions. The reinforcing tie bars or stirrups between the pavement and the curb shall be omitted.

After the concrete for the upper portion is placed in the forms, it shall be tamped and spaded or vibrated until mortar entirely covers the surface. The top shall be floated smooth and the outer upper corner rounded to a 1/4 in. radius.

The face and top of the curb, integral curb, and gutter shall be checked with a 10 ft straightedge. Portions showing irregularities of 1/4 in. or more shall be removed and replaced.

Consolidation of concrete placed in the forms shall be by vibration or other acceptable methods. Forms shall be left in place for 24 h or until the concrete has set sufficiently so that they can be removed without injury to the curbing. Upon removal of the forms, the exposed curbing face shall be rubbed immediately to a uniform surface. Rubbing shall be accomplished using water and a carborundum brick. For the purpose of matching adjacent concrete finishes or for other reasons, other methods of finishing may be allowed. No plastering will be allowed.

(d) Curb Turnouts and Combined Concrete Curb and Gutter Turnouts

Turnouts will be required with specified inlets or with concrete gutter and paved side ditch in accordance with 607 and as shown on the plans. Concrete gutter and paved side ditch shall be constructed monolithically with the curb turnout.

(e) Joints

Joints in integral curbs shall be located at joints in adjoining PCCP. The joints

shall be saw cut or formed with 1/4 in. thick preformed joint material. Joint sealant is not required for joints in integral curbs.

Curbing not constructed integral with adjacent pavement shall be constructed with intermediate joints located at 10 ft intervals. These joints may be sawed or formed with metal separator plates, and the depth and width shall be in accordance with the plans.

Preformed expansion joints, 1/4 in. thick, shall be placed at the beginning and end of all curb returns and also at castings.

(f) Curing

Immediately upon completion of the rubbing, the curbing shall be moistened and kept moist for three days or cured by using membrane forming material. The method and details of curing shall be subject to approval.

(g) Backfilling

After the concrete has set sufficiently, the spaces in front and back of the curb shall be refilled with suitable material to the required elevations in layers of not more than 6 in. and be tamped thoroughly.

(h) Curb Machine

Curb machines may be used to construct curb provided the curb can be constructed to the requirements of the specifications.

605.05 Reflecting Cement Concrete Curbing

Construction methods for this item shall be in accordance with 605.03 and the following requirements.

The reflecting surface of the curbing shall be a mortar mix consisting of 1 part white portland cement to 1 3/4 parts of light colored, washed, mortar sand. This mortar mix shall have a thickness of approximately 1 in. Alternately, the entire curbing may be constructed of concrete made with white portland cement.

Washed mortar sand shall meet all the requirements for mortar sand and shall be of a satisfactory light color. The reflecting surface mortar shall be placed immediately after the placing of the base concrete. No more than 20 minutes shall elapse between the placing of the base concrete and the placing of the reflecting surface.

Scoring or surface deformation and finish of the reflecting surface shall be in accordance with the details shown on the plans.

605.06 Concrete Center Curbing

The subgrade shall be prepared the same as for the adjoining pavement. If subbase is provided for the adjoining pavement, it shall be carried through for the full width of the curb and at the same thickness as that for the pavement.

The temperature limitations of 502.11 shall apply to placing the concrete. The surface shall be troweled smooth with a metal trowel. Curing shall be in accordance with 504.04.

Forms shall be removed within 24 h after the concrete has been placed. Plane surfaces and exposed sides of the curb shall be checked with a 10 ft straightedge. Portions showing irregularities of 1/4 in. or more shall be removed and replaced in compliance with these specifications.

Joints in center curbs adjacent to PCCP shall be aligned with joints in adjoining PCCP. Joints in center curbs adjacent to asphalt shall be spaced at 18 ft maximum. The joints shall be saw cut or formed with 1/4 in. thick preformed joint material. Joint sealant is not required for joints in center curbs.

Where an expansion joint is constructed in PCCP adjacent to concrete center curb, the expansion joint shall be carried through the center curb in accordance with applicable requirements of 503.03(f).

605.07 HMA Curbing

(a) Excavation

Excavation shall be in accordance with 605.03(a).

(b) Preparation of Bed

When curbing is to be constructed on a fresh laid HMA surface, the curb may be laid only after the surface has been cleaned.

When curbing is to be constructed on a cured or aged portland cement concrete base, asphalt pavement, or asphalt treated base, the bed shall be thoroughly swept and cleaned with compressed air. The surface shall be thoroughly dried and, immediately prior to placing of the HMA mixture, shall receive tack coat in accordance with 406. During application, the spread of this tack coat to areas outside of the area to be occupied by the curb shall be prevented.

(c) Mixture

The mixture shall be in accordance with 402.07(d).

A Type D certification in accordance with 916 shall be provided for the HMA curbing mixture. The test results shown on the certification shall be the quality control tests representing the material supplied and include gradation and binder content. The gradation tolerances shall be ±2.5% on the No. 200 (75 μm) sieve, ±4.0% on the No. 4 (4.75 mm) sieve, and binder content tolerance shall be ±0.5% from DMF.

(d) Placing

HMA curbing shall be constructed by use of a self-propelled automatic curber, curb machine, or paver with curbing attachments. The curbing shall be in accordance with the section shown on the plans. The automatic curber or machine shall meet the

following requirements and is subject to approval prior to use.

1. The weight of the machine shall be such that required compaction is obtained without the machine riding above the bed on which curbing is being constructed.

2. The machine shall form curbing that is uniform in texture, shape, and density.

The construction of curbing by means other than the automatic curber or machine may be allowed when short sections or sections with short radii are required, or for such other reasons as may seem warranted. The resulting curbing shall match the curbing produced by the machine. The face and top of the HMA curb shall be checked with a 10 ft straightedge. Portions showing irregularities of 1/4 in. or more shall be removed and replaced.

Weather limitations shall be in accordance with 402.12.

(e) Painting and Sealing

When sealing or painting is required, it shall be performed only on a curbing which is clean and dry, and which has reached the ambient temperature.

605.08 Resetting Curbing

(a) Salvage of Curbing

Curbing specified for resetting shall be cleaned, removed, and stored. Any existing curbing that is to be reset which is lost, damaged, or destroyed as a result of operations or because of failure to store and protect it in a manner that would eliminate its loss or damage, shall be replaced.

(b) Curb Removal

Curbing, which is unsuitable for resetting and which has not been damaged due to negligence, shall be removed and disposed of as directed.

(c) Excavation

Excavation and bedding shall be in accordance with 605.03(a).

(d) Resetting

The curb shall be set on a firm bed in accordance with the required line and grade. All sections of curbing shall be set so that the maximum opening between adjacent sections is 3/4 in. wide for the entire exposed top and face. Any dressing of the ends of the curbing necessary to meet this requirement shall be performed as needed. Cutting or fitting may be necessary in order to install the curbing at the locations as directed.

After the curb has been set, the joints shall be completely filled with mortar as specified.

(e) Backfilling

The spaces in front and back of the curb shall be refilled to the required elevation with suitable material. This material shall be tamped thoroughly in layers not to exceed 6 in. in depth.

605.09 Method of Measurement

Curbing, both new and reset, and curb removal will be measured by the linear foot along the front face of the section at the finished grade elevation. Combined curb and gutter will be measured along the face of the curb. Curb turnout will be measured longitudinally by the linear foot as curb of the type specified, from the ends of the radii which touch the front face of the longitudinal curb portion.

Combined curb and gutter turnout will be measured longitudinally by the linear foot as curb and gutter of the type specified, from the ends of the radii which touch the front face of the longitudinal curb portion. No deduction in length will be made for drainage structures installed in the curbing such as catch basins or drop inlets. The concrete center curb will be measured by the linear foot, unless it is of variable width, in which case measurement will be by the square yard. Bed course material will be measured by the ton.

605.10 Basis of Payment

The accepted quantities of curb work will be paid for at the contract unit price per linear foot for curb; curb and gutter; curb, reset; or center curb, of the type specified. Variable width center curb will be paid for at the contract unit price per square yard for center curb, of the width specified. Bed course material will be paid for at the contract unit price per ton, complete in place.

Curb turnout will be paid for at the contract unit price per linear foot of the type of curb specified. Combined curb and gutter will be paid for at the contract unit price per linear foot for curb and gutter of the type specified.

Payment will be made under:

Pay Item	Pay Unit Symbol
Bed Course Material	TON
Center Curb, _____ type	SYS LFT
Curb and Gutter, _____ type	LFT
Curb, _____ type	LFT
Curb, Remove	LFT
Curb, Reset, _____ type	LFT

The cost of tack coat, reinforcing bars or welded wire reinforcement for curb, curb and gutter, or center curb shall be included in the cost of the pay items. The cost of replacement curb portions for those which show irregularities or 1/4 in. or more shall be included in the cost of curb.

SECTION 606 – PAVEMENT CORRUGATIONS

606.01 Description

This work shall consist of placing corrugations in the pavement in accordance with 105.03. Corrugations shall not be constructed within the limits of reinforced concrete bridge approaches or on bridge decks.

The operation shall be coordinated such that milled materials do not encroach on pavement lanes carrying traffic and all milled materials are disposed of in accordance with 104.07. When corrugations are installed, milled materials shall be swept and vacuumed following the milling operation.

The corrugations shall be constructed by cutting smooth strips in existing or newly constructed pavement. The operation shall be conducted by means of a cutting machine that provides a series of smooth cuts without tearing or snagging. The equipment shall include guides to maintain uniformity and consistency in the alignment of the strips.

Longitudinal rumble stripes are the combination of either the center line pavement marking placed in the center line corrugation or the edge line pavement marking placed in the edge line corrugation. They shall be installed as shown on the plans and as specified herein.

Longitudinal rumble strips are corrugations placed in the shoulder near the travel lane. They shall be installed as shown on the plans and as specified herein.

When corrugations are installed, control points are required as a guide for milling corrugations and shall be spotted with paint for the full length of the road to be milled. Control points along tangent sections shall be spaced at a maximum interval of 100 ft. Control points along curve sections shall be spaced to ensure the accurate location of the milled corrugations. The location of control points shall be as approved prior to the milling operations.

If snowplowable raised pavement markers exist where center line corrugations are being placed into the existing surface, the prismatic reflectors in these markers shall be temporarily covered and corrugations gapped a maximum of 5 ft and not within 6 in. of the markers.

Milled HMA corrugations shall be the type designated in the contract documents, Conventional or Sinusoidal. Milled PCCP corrugations shall be Conventional.

MATERIALS

606.02 Materials

Materials shall be in accordance with the following:

Pavement Markings.....808

CONSTRUCTION REQUIREMENTS

606.03 General Requirements

In the presence of D-1 pavement joints or castings which conflict with the location of the corrugations, the corrugations shall be gapped a maximum of 5 ft and not within 6 in. of the joint or casting.

Corrugations shall not be installed on PCCP until the PCCP has cured for a minimum of 14 days. The milling operations for installing corrugations on PCCP shall not exceed 12 mph.

(a) Installation Tolerances

Lateral deviation of milled corrugations shall not exceed 1 in. in 100 ft. The alignment of all pavement markings placed within rumble stripes shall be ±1/2 in. of its specified location.

(b) Maintenance of Traffic

The rumble stripe traffic control procedures shall be submitted to the Engineer and shall be in accordance with 808.08. Vehicles used in performing the milling, sweeping, vacuuming, or sealing operations shall have a rear escort vehicle that follows at a distance of 100 to 500 ft.

606.04 Method of Measurement

HMA and PCC pavement corrugations will be measured by the linear foot, measured parallel to the center line of the roadway. Gaps longer than 20 ft will not be included in the measurement for milled corrugations.

606.05 Basis of Payment

HMA and PCC pavement corrugations will be paid for at the contract unit price per linear foot, for the type specified.

Payment will be made under:

Pay Item	Pay Unit Symbol
Milled HMA Corrugations, _____ (type)	LFT
Milled PCCP Corrugations, Conventional	LFT

The cost of temporarily covering existing prismatic reflectors in rumble strip retrofit sections shall be included in the cost of the pay items. Milling, sweeping, vacuum cleaning, operation protection and maintenance of traffic associated with these pay items, and all necessary incidentals shall be included in the cost of the pay items.

SECTION 607 – PAVED SIDE DITCH OR CONCRETE GUTTER

607.01 Description

This work shall consist of placing a portland cement concrete lining, gutter, or reinforced concrete gutter turnout for side ditches in accordance with 105.03.

MATERIALS

607.02 Materials

Materials shall be in accordance with the following:

Concrete, Class A.....702
Reinforcing Bars 910.01

CONSTRUCTION REQUIREMENTS

607.03 General Requirements

The excavation shall be to the required depth and shape of the bottom of the type and size of the side ditch being constructed, the details of which are shown on the plans.

All soft, yielding, or unsuitable materials encountered at the required excavation elevation shall be removed and replaced with approved materials which shall be compacted and finished to a firm, smooth surface.

The applicable requirements of 605.04(b) shall apply to forms.

Placing, finishing, and curing shall be in accordance with 605.04 except the curing period shall be no less than 72 h. The finished surface need not be brushed.

Reinforcement will be required for all paved side ditch, cut-off-walls, and lugs as shown on the plans.

Paved side ditch transitions will be required at intersections with earth ditches and pipe culverts. Transitions of 10 ft or less will be required between two different types of paved side ditches.

Cut-off wall and lug details shall be as shown on the plans. A cut-off wall shall be constructed at the beginning and end of any paved side ditch. Lugs shall be poured

monolithic with paved side ditch on steep grades. Their locations shall be as shown on the plans or as otherwise directed. Backfilling shall be in accordance with 605.04(g).

607.04 Cement Concrete Gutter and Turnout

Concrete gutter and concrete gutter turnout shall be constructed as shown on the plans or where directed. Construction shall be in accordance with all applicable requirements set out herein for paved side ditch.

607.05 Method of Measurement

Paved side ditch or cement concrete gutter will be measured by the linear foot along the centerline of the ditch per each type specified. Each cutoff wall or lug will be measured as 8 lft of paved side ditch or cement concrete gutter.

Paved side ditch transitions at earth ditches and pipe culverts will be measured as equivalent lengths in linear feet of the paved side ditch specified at each location. Transitions at the intersection of two different types of paved side ditch will be converted to equivalent lengths in linear feet of the larger type of paved side ditch specified at each site.

Reinforced concrete gutter turnout will be measured as 50 lft of concrete gutter. Additional length, if required, will be measured by the linear foot of concrete gutter.

607.06 Basis of Payment

The accepted quantities of paved side ditch or cement concrete gutter of the type specified, including cutoff walls and lugs measured in accordance with 607.05, will be paid for at the contract unit price per linear foot complete in place.

Concrete gutter turnout will be paid for at the contract unit price per linear foot for gutter, concrete, of the type specified.

Payment will be made under:

Pay Item	Pay Unit Symbol
Gutter, Concrete, _____ type	LFT
Paved Side Ditch, _____ type	LFT

The cost of reinforcing bars or welded wire reinforcement, excavation, joints, and necessary incidentals shall be included in the cost of the pay items.

SECTION 608 – SHOULDER DRAINS

608.01 Description

This work shall consist of constructing shoulder drains in accordance with these specifications and in accordance with 105.03.

MATERIALS

608.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class D or Higher,
Size No. 8 .....904.03

CONSTRUCTION REQUIREMENTS

608.03 General Requirements

Unless otherwise designated, shoulder drains shall be installed on both sides of the pavement by trenching from the edges of the pavement through the shoulders and backfilling with aggregate at low points in the grade and at other locations when so directed. This work shall precede the finishing of the shoulders.

The width of the trench shall be approximately 12 in. unless otherwise directed. Other dimensions shall be as shown on the plans.

After the trench has been prepared, it shall be backfilled to the required elevation with aggregate and then be well compacted.

Any remaining unfilled trench area shall be filled with material approved for shoulders and compacted by rolling or tamping, or both. The finished shoulder elevation shall be as shown on the plans.

608.04 Method of Measurement

Shoulder drains will be measured by the ton of aggregate placed.

608.05 Basis of Payment

The accepted quantities of aggregate for shoulder drains will be paid for at the contract unit price per ton for aggregate for shoulder drains complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Aggregate for Shoulder Drains	TON

Excavation, trenching, backfilling, and other related miscellaneous items will not be paid for separately, but the cost thereof shall be included in the cost of the pay item.

SECTION 609 – REINFORCED CONCRETE BRIDGE APPROACHES

609.01 Description

This work shall consist of constructing reinforced concrete bridge approaches, RCBA, and extensions required for bridge railing transitions in accordance with 105.03.

MATERIALS

609.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class B or Higher, Size No. 8	904.03
Coarse Aggregate, Class D or Higher, Size No. 53	904.03
Concrete, Class A	702
Curing Materials	912.01
Geotextile for Pavement and Subgrade	918.02
Hot Poured Joint Sealant	906.02(a)2
Reinforcing Bars, Epoxy Coated	910.01
Silicone Joint Sealants	906.02(a)1
Support Devices	910.01(b)11
Threaded Tie Bar Assembly	910.01(b)2

CONSTRUCTION REQUIREMENTS

609.03 General Requirements

Subgrade shall be prepared in accordance with 207. Subbase shall be prepared in accordance with 302. Geotextile shall be installed in accordance with 214.

The RCBA extension shall be placed only where a concrete bridge-railing transition shall be located on the RCBA. If the transition shall be placed on the bridge, the RCBA shall be placed as shown on the plans.

609.04 Forms

Forms shall be either steel or wood and shall be in accordance with 508.04(c)1 or 508.04(c)2.

609.05 Joints

Longitudinal construction joints will only be allowed as shown on the plans. The Type I-A joint shall be constructed as shown on the plans.

Type I-A joints shall be created by sawing slots using sawing equipment in accordance with 508.07. The saw cut shall commence as soon as the concrete has

hardened sufficiently to enable sawing without raveling, usually 2 to 12 h after placement.

Slurry or saw residue remaining in the slot shall be immediately flushed. Construction traffic shall not be on the RCBA after the saw cut until the joint is sealed.

The sawed slot shall be cleaned to remove all foreign matter from the entire depth of cut. Joint sealing shall be in accordance with 503.05, except that either hot poured joint sealant or self-leveling silicone joint sealant may be used. The same sealant material shall be used throughout the structure.

609.06 Reinforcing Bars

Furnishing and placement of reinforcing bars shall be in accordance with 703.

609.07 Thickness

The depth of the RCBA will be checked by the Engineer prior to pouring, by making stringline measurements every 3 ft across the width of the approach. Any location deficient in depth by 1/2 in. or more shall be corrected prior to placing the concrete.

609.08 Concrete Placement

The subbase shall be uniformly moist at the time of concrete placement. Delivery and placement of concrete shall be in accordance with 702.

609.09 Finishing

The RCBA shall be finished with equipment in accordance with 508.04(c)3 and 508.04(c)4. The operations shall be controlled so that an excess of mortar and water is not worked to the top. Long-handled floats may be used to smooth and fill in open textured areas. The edges of formed RCBA shall be tooled or chamfered.

The finished RCBA surface shall be textured with a double thickness burlap drag or a minimum 4 ft wide turf drag. Longitudinal grooving shall be in accordance with 722.11 and shall not commence until the smoothness has been measured in accordance with 609.11.

609.10 Curing

RCBA shall be wet cured in accordance with 702 or shall have liquid membrane forming curing compound applied and maintained in accordance with 504.04(a) to exposed surfaces within 30 minutes after the finishing operations have been completed. The edges of the RCBA shall be cured immediately upon removal of the forms. The edge shall be covered with curing materials equal to the material used on the surface or banked with soil 12 in. wide or greater.

When conditions arise which prevent timely application of curing materials the surfaces shall be kept wet with a fine spray of water. The fine spray of water shall continue until application of curing materials is resumed.

609.11 Smoothness

The smoothness of the surface of the RCBA will be measured by means of a 10 ft straightedge as soon as practical following curing or completion of adjoining roadway or structure sections. All surface variations shall be corrected to 1/8 in. or less.

Smoothness variations outside specified tolerances shall be corrected in accordance with 502.20.

609.12 Opening to Traffic

The RCBA may be opened to equipment and traffic when the flexural strength of the test beams indicates the concrete has attained a modulus of rupture of 550 psi or greater.

The Contractor and Engineer will conduct an inspection of the new RCBA for any damage. The inspection and all necessary repairs shall be completed prior to opening to traffic.

609.13 Method of Measurement

Reinforced concrete bridge approaches, including extensions required for bridge railing transitions, will be measured by the square yard.

Subbase for PCCP will be measured in accordance with 302.08. Subgrade treatment will be measured in accordance with 207.05. Geotextile will be measured in accordance with 214.05.

Reinforcing bars will be measured in accordance with 703.07. Threaded tie bar assemblies will be measured in accordance with 703.07.

Longitudinal grooving will be measured in accordance with 722.15.

Finishing and curing of the RCBA will not be measured for payment. Construction joints or Type I-A joints will not be measured.

609.14 Basis of Payment

Reinforced concrete bridge approaches, including extensions required for bridge railing transitions, will be paid for at the contract unit price per square yard.

Subbase for PCCP will be paid for in accordance with 302.09. Subgrade treatment will be measured in accordance with 207.06. Geotextile will be paid for in accordance with 214.06.

Reinforcing bars will be paid for in accordance with 703.08. Threaded tie bar assemblies will be paid for in accordance with 703.08. Longitudinal grooving will be paid for in accordance with 722.16.

Payment will be made under:

Pay Item	Pay Unit Symbol
Reinforced Concrete Bridge Approach, _____ in. (thickness)	SYS

The cost of finishing, furnishing and placing curing materials shall be included in the cost of the RCBA. The cost of corrections for smoothness or re-texturing shall be included in the cost of the RCBA.

The cost of all labor and materials for the placement of construction joints and Type I-A joints shall be included in the cost of the RCBA.

SECTION 610 – APPROACHES AND CROSSOVERS

610.01 Description

This work shall consist of constructing or resurfacing public road intersections; turn lanes, passing lanes, acceleration lanes, deceleration lanes, or recovery lanes where the total longitudinal dimension is less than 100 ft, excluding tapers; mailbox approaches; private and commercial driveways; and crossovers; in accordance with 105.03.

MATERIALS

610.02 Materials

Materials shall be in accordance with the following:

Aggregate Base	301.02
Geogrid, Type IB	918.05
HMA	402.03
Prime Coat	405.02
Seal Coat	404
Subbase	302.02
Tack Coat	406.02

Concrete shall be in accordance with 502 except the minimum modulus of rupture shall be 550 psi at 28 days.

CONSTRUCTION REQUIREMENTS

610.03 General Requirements

Subgrade for approaches shall be prepared in accordance with 207. Aggregate base shall be constructed in accordance with 301. HMA for approaches shall be

constructed in accordance with 402. HMA mixture for approaches shall be HMA surface or intermediate, Type B, Type C, or Type D in accordance with 402.04. An MAF, in accordance with 402.05, will not apply.

Dense graded subbase shall be constructed in accordance with 302. PCCP for approaches shall be constructed in accordance with 502. The CMDS shall be submitted to the Engineer for approval. Utilization of the Department provided spreadsheet is not required.

610.04 Existing Approaches and Crossovers

If an existing surface is to be left in place as an approach pavement or crossover, the surface shall be patched in accordance with 304.04 or 305.04, or as directed.

Existing approaches or crossovers that have been rubblized shall be primed in accordance with 405 prior to being paved.

610.05 Method of Measurement

Compacted aggregate base will be measured in accordance with 301.08. HMA mixture for approaches will be measured by the ton of the type specified, in accordance with 109.01(b). Dense graded subbase will be measured in accordance with 302.08. PCCP for approaches will be measured by the square yard of the thickness specified. Subgrade treatment will be measured in accordance with 207.05.

HMA patching in accordance with 610.04, will be measured by the ton in accordance with 304.06. PCCP patching in accordance with 610.04, will be measured by the square yard in accordance with 305.06. Geogrid Type IB will be measured in accordance with 214.05.

Prime coat will be measured in accordance with 405.09. Tack coat will be measured in accordance with 406.06. Seal coat will be measured in accordance with 404.13.

610.06 Basis of Payment

The accepted quantities of HMA mixture for approaches will be paid for at the contract unit price per ton of the type specified, complete in place. Compacted aggregate base will be paid for in accordance with 301.09. PCCP for approaches will be paid for at the contract unit price per square yard of the thickness specified, complete in place. Dense graded subbase will be paid for in accordance with 302.09. Subgrade treatment will be paid for in accordance with 207.06. Geogrid Type IB will be paid for in accordance with 214.06.

HMA patching will be paid for in accordance with 304.07. PCCP patching will be paid for in accordance with 305.07.

Prime coat will be paid for in accordance with 405.10. Tack coat will be paid for in accordance with 406.07. Seal coat will be paid for in accordance with 404.14.

The quantities of materials placed on the 3 ft wedge on approaches, when placed with the mainline pavement shall be included in the mainline HMA items and paid for in accordance with 401.22 or 402.20. The quantities, when placed separately from the mainline pavement, shall be included in the quantities for HMA for approaches and paid for in accordance with 610.06.

The quantities of materials for the paving or resurfacing of turn lanes, passing lanes, acceleration lanes, deceleration lanes, and recovery lanes greater than 100 lft, excluding tapers, shall be included in the mainline quantities and paid for in accordance with 401.22, 402.20, 501.31, or 502.23 whichever is applicable.

The accepted quantities of HMA material for mailbox approaches will be included with quantities required to construct the shoulder section when the shoulder is to be paved. If the shoulder is not to be paved, the HMA material for mailbox approaches will be paid for as HMA mixture for approaches of the type specified.

Payment will be made under:

Pay Item	Pay Unit Symbol
HMA for Approaches, Type __*__	TON
PCCP for Approaches, _____ thickness	SYS

* Mixture type in accordance with 402.04.

The cost of excavation, shaping, leveling, forming, compaction, placing, and all necessary incidentals shall be included in the cost of the pay items in this section.

The cost for curbing placed monolithically with the PCCP on approaches shall be included in the cost of PCCP for approaches.

SECTION 611 – MAILBOX INSTALLATIONS

611.01 Description

This work shall consist of the construction of mailbox installations, or the removal and resetting of existing mailboxes and assemblies, in accordance with 105.03.

MATERIALS

611.02 Materials

Materials shall be in accordance with the following:

Mailbox Support Galvanized Hardware	ASTM A153
Nominal Standard Galvanized Pipe	ASTM A53
Treated Wood Posts	911.02(e)

611.03 Mailbox Assembly

Existing mailboxes and assemblies shall be removed without damage from the highway right-of-way.

Mailboxes, which must remain in service between removal and erection of the new assembly, shall be securely mounted to an empty 55 gal. metal drum. The temporary assembly shall be located where it is accessible for mail delivery but placed as far as possible from the traveled roadway. The apparent owner of the existing mailbox shall be contacted and allowed to take possession of the existing mailbox and assembly. If the owner refuses to take possession, the existing mailbox and assemblies shall be removed.

Mailbox assemblies shall be furnished and installed as shown on the plans. Alternate mailbox assemblies which have been crash tested and approved in accordance with NCHRP 350 requirements may be considered upon receipt of a written request. Alternate mailbox assemblies approved for use shall be furnished and installed in conformance with the manufacturer's recommendations.

Mailboxes complying with the requirements of the United States Postal Service, including markings and sizes, shall be furnished and installed with the mailbox assembly.

The mailbox shall be of comparable size to the existing mailbox previously removed from the highway right-of-way. The markings shall include "approved by U.S. Postmaster" stamped on the mailbox by the manufacturer and the address number, box number, or house number, in 2 in. or larger reflective material placed on the side of the mailbox in view of motorists in the nearest travel lane.

Existing mailboxes and assemblies that are to be reset shall be removed and reinstalled without damage. If the existing mailboxes and assemblies are damaged during removing and resetting, they shall be replaced in kind at no additional cost.

611.04 Method of Measurement

Mailbox assemblies will be measured by the number of units of the type installed.

Resetting of mailbox assemblies will be measured by the number of units of the type reinstalled.

611.05 Basis of Payment

Mailbox assemblies will be paid for at the contract unit price per each per type, complete in place.

Resetting of mailbox assemblies will be paid for at the contract unit price per each per type, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Mailbox Assembly, Double	EACH
Mailbox Assembly, Single	EACH
Mailbox Assembly, Reset, Double	EACH
Mailbox Assembly, Reset, Single	EACH

The cost of wood or pipe posts, support hardware, mailbox, and removal of existing mailbox and its assembly shall be included in the cost of the mailbox assembly.

The cost of all materials, labor, equipment and incidentals required to remove and reset the existing mailboxes shall be included in the cost of mailbox assembly, reset.

SECTION 612 – UNDERSEALING

612.01 Description

This work shall consist of drilling holes and furnishing and pumping an asphalt material under cement concrete pavement in accordance with 105.03.

MATERIALS

612.02 Materials

Asphalt material shall be in accordance with the following:

Utility asphalt, UA-III .....902.01(d)

CONSTRUCTION REQUIREMENTS

612.03 Weather Limitations

Undersealing shall not be performed when pavement surface temperatures are below 40°F or when the subgrade or subbase is frozen. If proper undersealing cannot be achieved due to excessive temperatures or direct sunlight, work shall be performed at night.

612.04 Shoulders

All holes, low areas, or displaced areas in the shoulders immediately adjacent to the pavement edge shall be filled with loam, clay, or other approved material and compacted to the elevation of the pavement. Such areas, including all other shoulder areas immediately adjacent to the pavement edge, shall be compacted with a roller or other approved methods.

612.05 Drilled Holes

Where the existing pavement has transverse joints, holes not to exceed 1 1/2 in.

in diameter shall be drilled on the centerlines of the pavement lane to be treated. These holes, unless otherwise directed, shall be located longitudinally between transverse joints or cracks at approximately 30 to 36 in. from the joints or cracks. Intermediate holes, if necessary, shall be spaced as directed.

If the existing pavement does not have transverse joints, holes not to exceed 1 1/2 in. in diameter shall, unless otherwise specified, be located on the centerline of the pavement lane to be treated and be spaced as directed.

An approved method shall be used to prevent the drill from entering the subgrade after penetrating the pavement. Automatic stops on mechanical equipment and marked drill bits on hand operated jackhammers may be approved subject to satisfactory operation.

Just prior to pumping operations, the surface of the pavement around each hole for an area of at least 1/2 the width of the lane being treated shall be thoroughly sprinkled with water to prevent the undersealing material from adhering to the pavement surface.

612.06 Pumping

All storage tanks, pipes, retorts, booster tanks, and distributors used for storing or handling the materials shall be kept clean and in good operating condition at all times so there is no contamination of the materials.

Where undersealing operations are being performed under traffic, necessary signs, barricades, watchers, and flaggers shall be used to maintain one lane of traffic in the immediate vicinity of pumping operations. Traffic may be allowed to use the pumped areas upon removal of the original plugs and after the hardwood plugs are driven.

When directed, certain portions may be required to be undersealed a second time. The number of holes involved in this second undersealing shall not exceed 5% of the number of holes indicated in the Schedule of Pay Items.

(a) Asphalt Material

The asphalt shall be pumped through the drilled holes and under the pavement with an approved type of self-propelled pressure distributor. The pressure shall be as directed. A metallic hose shall connect the asphalt tank through an asphalt pump to a 1 in. nozzle and a return metallic hose shall connect the nozzle to the asphalt distributor tank. The nozzle shall be equipped with a 3-way valve that allows the asphalt to circulate back to the distributor tank when pumping operations are not in progress.

The nozzle shall be inserted in the hole, driven to a snug fit, and pumping of the asphalt continued until the undersealing is complete, or to such other amount as directed. In case of an existing asphalt resurface on concrete, holes shall be drilled through the resurface and the underlying concrete and the nozzle shall be of sufficient length that it can be driven to a snug fit into the concrete without the upper part of the nozzle being below the elevation of the existing asphalt resurface.

The asphalt shall not be heated above 500°F at any time and, when pumped under the pavement, the temperature shall be no less than 350°F. All material heated beyond 500°F shall be rejected.

(b) Wood Plugs

Upon completion of the pumping operation, the nozzle shall be removed and a wood plug driven into the hole. After the pumped material has hardened, the original plug shall be removed and a 4 in. or longer hardwood plug a minimum of 1/16 in. larger than the diameter of the drilled hole shall be driven flush with the surface of the pavement. All material extruded during the pumping operations shall be immediately cleaned from the pavement surface and removed from the limits of the contract within a period of 24 h.

The hardwood plugs shall be inspected after any milling operation when a resurface exists on the concrete. Damaged or missing plugs shall be replaced prior to overlaying with a new surface.

612.07 Method of Measurement

Asphalt material will be measured by the ton. Drilled holes for underseal will be measured per each hole drilled.

612.08 Basis of Payment

This work will be paid for at the contract unit price per ton for material for underseal. Drilled holes for underseal will be paid for at the contract unit price per each, complete in place.

Additional holes and materials required for a second undersealing operation will be paid for at the contract unit prices for the quantities involved.

Payment will be made under:

Pay Item	Pay Unit Symbol
Drilled Hole for Underseal	EACH
Material for Underseal	TON

The cost of shoulder material, wood and hardwood plugs, and necessary incidentals shall be included in the cost of the pay items.

SECTION 613 – SALVAGED ROAD MATERIALS

613.01 Description

This work shall consist of removing approved material from an existing road within the limits of the contract, including intersecting approaches, and using it in reconstruction of the road in accordance with these specifications or as directed.

MATERIALS

613.02 Materials

Approved materials may be asphalt treated or untreated gravel, stone, slag, or all combinations of these or other materials which are suitable for salvaging.

CONSTRUCTION REQUIREMENTS

613.03 Construction Requirements

Before any filling or further work is performed at locations where material is to be salvaged, such material shall be removed and stored in stockpiles outside the construction limits and adjacent thereto, or it may be incorporated directly into the work without stockpiling if conditions allow.

The quantities removed, if available, shall be sufficient to complete the item of work or certain portions thereof for which it is intended. The depth of excavation shall be as directed. The incorporation of the salvaged material into the work shall be in accordance with applicable provisions of the specifications for which the material is to be used.

613.04 Method of Measurement

Salvaged road material will be measured by the cubic yard in stockpiles after removal from its original position or, if the Contractor prefers, it will be measured by the cubic yard in its original position. All measurements will be made by means of cross-sections. The volumes will be computed by the average end area method.

If salvaged road material is used as subbase, the combined pay quantities of subbase and salvaged road material for subbase shall equal but shall not exceed the total theoretical volume as calculated to the neat lines shown on the plans for subbase.

If the volume of salvaged road material used as subbase determined by the cross-section method does exceed the total theoretical volume of subbase, the final pay quantity for salvaged road material for subbase shall be the total theoretical volume.

The final pay quantity of subbase will be determined by deducting the final pay quantity of salvaged road material for subbase from the total theoretical volume of subbase.

If salvaged road material is obtained from within the pay limits of the new construction, such cubic yardage of salvaged material will be deducted from the excavation quantities to be measured for payment.

613.05 Basis of Payment

The accepted quantities of salvaged road material for the use shown in the Schedule of Pay Items will be paid for at the contract unit price per cubic yard, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Salvaged Road Material for _____	CYS

The cost of removal of the material, storage, incorporating it into the work, and necessary incidentals shall be included in the cost of the pay item.

SECTION 614 – CONCRETE HEADER

614.01 Description

This work shall consist of the construction or reconstruction of PCC headers adjacent to railroad tracks, bridges, and similar locations in accordance with 105.03.

MATERIALS

614.02 Materials

Materials shall be in accordance with the following:

Concrete	702
Reinforcing Bars	910.01

If the header is adjacent to cement concrete base or pavement, the header concrete shall be the same composition as that of the base or pavement header constructed monolithic with the base or pavement. If the adjacent base or pavement is thickened, that portion forming the thickening shall be considered as part of the header.

If the header is adjacent to asphalt pavement, the concrete shall be Class A in accordance with 702 using Class AP coarse aggregate.

CONSTRUCTION REQUIREMENTS

614.03 PCC Header

Construction shall be in accordance with the applicable provisions of 702 and with these requirements. Welding shall be in accordance with 711.32 Headers at railroad crossings shall be as shown on the plans.

614.04 Reconstructed Cement Concrete Header

This work shall be in accordance with the plans. Round plug welds or rectangular shaped plug welds may be used to weld the steel angle to the existing steel edge protection. Round plug welds shall be a minimum of 1 in. diameter.

Welding shall be in accordance with 711.32.

614.05 Method of Measurement

Cement concrete header and reconstructed cement concrete header will be measured by the linear foot.

614.06 Basis of Payment

The accepted quantities of this work will be paid for at the contract unit price per linear foot for header, cement concrete, of the type specified, or header, cement concrete, reconstruct, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Header, Cement Concrete, _____ type	LFT
Header, Cement Concrete, Reconstruct	LFT

The cost of edge protection, metal chairs, excavation, and necessary incidentals shall be included in the cost of the pay items.

SECTION 615 – MONUMENTS, MARKERS, AND PARKING BARRIERS

615.01 Description

This work shall consist of furnishing and setting, setting only, or resetting right-of-way markers, monuments for marking section or other lines, benchmark posts and tablets, and parking barriers in accordance with 105.03.

MATERIALS

615.02 Materials

Materials shall be in accordance with the following:

Coarse Aggregate, Class A or Higher, sizes No. 8 or No. 91	904.03
Fine Aggregate, Size No. 23	904.02
Portland Cement	901.01(b)
Post	911.02(f)
Reinforcing Bars	910.01

615.03 Reinforced Cement Concrete Right-of-Way Markers

These markers shall conform with the dimensions and lettering shown on the plans. The reinforcement shall be securely held in place by at least four spacers of an approved design. The concrete ingredients shall be graded and proportioned to produce strong dense concrete.

When tested as hereinafter described, a specimen shall support a total load of at least 2,400 lb before the first crack appears. The specimen will be tested as a simple beam. The distance between supports shall be exactly 24 in. with the load applied at the rate of approximately 1,200 lb per minute in the center of the span. Loading will continue until the first crack appears.

The cement concrete shall absorb no more than 8% water. Specimens for absorption may be taken from the markers tested for strength. The absorption test shall be as described in accordance with AASHTO T 280 except the specimen tested shall be the full cross-section marker.

The markers shall have a smooth workmanlike finish free from cracks, patches, honeycomb, exposed reinforcement, and excessive bubble holes. Each marker shall be plainly marked near the bottom with the trademark or initials of the manufacturer and the date of manufacture. These letters and figures shall be no less than 1 in. in height and shall be indented 1/8 in.

A Type C certification in accordance with 916 shall be provided for the right-of-way markers.

615.04 Monuments

Monuments shall be of the type specified in the Proposal, the details of which are shown on the plans. Any portion extending above the ground shall be finished in accordance with 702.21.

Where concrete is required, it shall be Class A in accordance with 702. When placed in the forms it shall be tamped in layers until mortar covers the outer surface. The tops of the monument shall be floated smooth. Monuments may be precast or cast-in-place.

The pin shall be set perpendicular to and flush with the top of the monument while the concrete is plastic and left undisturbed until the concrete has set. The pin shall be steel and shall be 1 in. in diameter and 5 in. long. For Type D monuments, the hole shall be drilled in the center with a 1/8 in. drill for a depth of 1 1/2 in. The hole shall be filled with lead flush with the end of the pin. Castings for protected monuments shall be in accordance with 910.05(b).

615.05 Benchmark Posts

Benchmark posts shall be of the dimensions shown on the plans and cast in accordance with applicable provisions of 615.03, except the strength shall be determined by concrete cores taken from the finished product. At least two concrete cores will be taken from each unit and the average strength of the unit shall be at least 4,000 psi with no individual core strength less than 3,600 psi. Tablets will be furnished by the Department and shall be set in the posts as shown on the plans.

615.06 Parking Barriers

Parking barriers shall be of the dimensions shown on the plans.

Placement of parking barriers shall be at the locations and in accordance with the details shown on the plans, or as otherwise directed.

Existing parking barriers to be removed and reset shall be removed without damage, stored and reinstalled as shown on the plans.

(a) Concrete

The concrete barriers shall be cast and tested in accordance with the applicable requirements of 615.03, except the strength shall be determined by concrete cores taken from the finished product. At least two concrete cores will be taken from each unit and the average strength of the unit shall be at least 4,000 psi with no individual core strength less than 3,600 psi.

(b) Timber Post

Vertical timber posts as parking barriers shall be round, roofed on top, and be dimensioned as shown on the plans. The posts shall be in accordance with the applicable requirements of 911.02(f).

CONSTRUCTION REQUIREMENTS

615.07 Setting Right-of-Way Markers

The back face of these markers shall be set on the right-of-way lines approximately 1,000 ft apart as hereinafter provided. They shall be set at all corners of irregular right-of-way lines, opposite each P.C. and P.T. of curves, and not to exceed 500 ft apart on the inside and outside of curves. Care shall be used in locating markers on tangents so that a marker is plainly visible from each adjacent marker.

Markers shall be set plumb, to the depth required on the plans, and with the letters facing the pavement. Portions of the holes not occupied by markers shall be backfilled and compacted in layers with suitable material up to the level of the original ground. The markers shall not be displaced during backfilling.

615.08 Resetting Right-of-Way Markers

When the proposal provides that existing right-of-way markers be reset, the existing markers shall be removed and reset at designated locations in accordance with 615.07.

615.09 Setting Monuments

If the location of a monument falls within the limits of a cement concrete pavement, a steel pin, the details of which are shown on the plans, shall be set perpendicular to and flush with the top of the finished pavement. It shall be placed just before the concrete takes initial set and then left undisturbed until the concrete has set. Other monuments shall be of the type shown on the plans, depending on the type or surface of the pavement in which they are to be placed or if they are to be placed

outside of pavement. Necessary excavation shall be to the required depth. The bottom of the excavation shall be firm and true to line and grades given. After a monument is in place, the remaining excavated areas shall be backfilled with suitable material firmly tamped in layers. The monument shall not be disturbed.

Existing monuments which are not required to be disturbed or re-established, but which are disturbed during construction operations, shall be re-established.

615.10 Re-Established Monuments

It may be necessary to re-establish existing monuments in pavements or bases which are disturbed unavoidably or covered during construction operations.

If the existing monument is, or contains a brass, copper, or steel pin, the pin shall be extended to the surface of the new pavement by attaching a pin of the same metal with at least a 1 in. diameter and of the length required. Such extensions shall be attached by tapping the original pin and providing a necessary screw attachment such that the extension can be fastened securely to the original pin. The tapped hole shall be at least 1/4 in. in diameter and no less than 1 in. deep. The screw attachment shall have the same diameter as for the hole in the original pin and shall be no less than 1 in. in length.

Where an existing monument of the type specified above has not been re-established on a previous contract, the monument shall be re-established in the same manner as set out above.

Where existing monuments are protected and encased in cast iron, such castings shall be adjusted to meet the elevation of the proposed surface by means of an asphalt coated, cast iron, adjustment casting. The size shall be the same as the original casting and of the depth necessary to meet the elevation of the proposed new surface.

615.11 Setting Benchmark Posts and Tablets

Benchmark posts shall be set at locations marked on the plans or as directed. Excavation shall be to the depth indicated and to dimensions sufficient to provide for the concrete backfilling. This concrete shall be Class A and shall extend for 6 in. around and below the post. The bottom shall be monolithic with the sides. The remainder of the excavation up to the original ground line shall be backfilled with suitable material well tamped in layers. Care shall be taken not to disturb the post. When specified on the plans, or directed, benchmark tablets furnished by the Department shall be placed in newly constructed or existing drainage structures located within the limits of the contracts.

615.12 Reset Benchmark Posts

When the Proposal provides that existing benchmark posts be reset, the existing benchmark posts shall be removed and reset at designated locations in accordance with 615.11.

615.13 Method of Measurement

Right-of-way markers, reset right-of-way markers, monuments, re-established monuments, castings adjusted to grade monuments, benchmark posts, reset benchmark posts, parking barriers, and reset parking barriers will be measured by the number of units installed.

615.14 Basis of Payment

The acceptable quantities of right-of-way markers, reset right-of-way markers, monuments, re-established monuments, castings adjusted to grade monuments, benchmark posts, and reset benchmark posts, parking barriers, and reset parking barriers will be paid for at the contract unit price per each, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Benchmark Post	EACH
Benchmark Post, Reset	EACH
Casting Adjusted to Grade, Monument	EACH
Monument, _____ type	EACH
Monument, Re-Establish	EACH
Parking Barrier, Concrete	EACH
Parking Barrier, Reset	EACH
Parking Barrier, Timber Post	EACH
Right-of-Way Marker	EACH
Right-of-Way Marker, Reset	EACH

The cost of extensions for monuments, adjustment castings, backfill, disposal of surplus materials, re-establishing disturbed existing monuments, and all other necessary incidentals shall be included in the cost of the pay items in this section. The cost of setting tablets in benchmark posts or structures shall be included in the cost of Construction Engineering.

The cost of existing parking barrier removal, storage, resetting, and all other necessary incidentals needed for resetting shall be included in the cost of parking barrier, reset. Existing barriers that are damaged by the Contractor shall be replaced with no additional payment.

SECTION 616 – RIPRAP AND SLOPEWALL

616.01 Description

This work shall consist of placing broken stone or concrete which may or may not be grouted, precast slabs, or slopewall in accordance with these specifications and in accordance with 105.03.

MATERIALS

616.02 Materials

Materials shall be in accordance with the following:

Clay	903.01
Concrete, Class A	702
Fine Aggregate, Size No. 23	904.02
Geotextile for Riprap	918.02
Joint Filler	906.01
Portland Cement	901.01(b)
Precast Concrete Riprap	904.04(e)
Riprap	904.04
Water	913.01
WWR, Smooth	910.01(b)5

CONSTRUCTION REQUIREMENTS

616.03 Placing Dumped Riprap

Dumped riprap shall be placed to produce a surface of approximate regularity and may not need to be hand placed. The finished surface shall vary no more than 9 in. from a true plane. The thickness perpendicular to its surface shall be no more than 2 ft nor less than 1 ft unless otherwise directed.

616.04 Placing Grouted Riprap

The aggregate, preparation of the slope, and the depth of riprap aggregate for grouted riprap shall be in accordance with 616.05. After the aggregate has been placed and accepted, all openings shall be filled with cement grout. The finished surface shall be approximately smooth, solid, and true to line, grade, and section.

Grout shall be composed of 1 part portland cement and 4 parts fine aggregate. The portland cement and fine aggregate shall be dry-mixed to a uniform mixture. Water shall be added as the mixing continues until the grout attains a consistency that will enable it to flow into the openings.

616.05 Placing Revetment, Class 1, and Class 2 Riprap

Revetment, Class 1 and Class 2 riprap may be placed by dumping and shall be placed to the required thickness. The finished surface shall be placed in a uniform manner and be free of segregated clusters. The finished surface shall vary from a true plane no more than 9 in. for revetment riprap or 18 in. for Class 1 or Class 2 riprap. The placed riprap shall not be less than the minimum depth specified.

616.06 Placing Uniform Riprap

Uniform riprap shall be placed to produce a surface of approximate regularity with edges having projections no more than 3 in. above the required cross-section. The material shall be hand laid or placed by other approved means.

616.07 Blank

616.08 Placing Precast Cement Concrete Riprap

The slope on which the riprap is to be placed shall be in accordance with that shown on the plans unless otherwise designated. Placement shall begin in a trench below the toe of the slope and progress upward. Each piece shall be placed by hand perpendicular to the slope. It shall be firmly embedded against the slope in such a manner that the vertical joint space between individual units does not exceed 3/8 in., unless otherwise specified. Half blocks, odd shaped blocks, or Class A concrete shall be used to fill the voids at the ends of sections to be placed or on curved shaped sections. The top course shall conform, as nearly as practicable, with the prescribed berm or shoulder elevation. Any adjustment necessary to achieve this shall be obtained by constructing a wedge course near the top of the slope as directed. This wedge course, when required, shall consist of Class A concrete. If the thickness of the course does not allow Class A concrete, it shall be constructed of a 1:2 mortar proportioned by volume. Toewalls, when required, shall consist of Class A concrete.

616.09 Slopewall

The slope on which the slopewall is to be placed shall be as shown on the plans unless otherwise designated.

The concrete mixture shall be Class A. Where paved slopewall abuts or surrounds columns, piers, or other structures, 5/8 in. of asphalt joint filler shall be used between the slopewall and such structure. Welded steel wire reinforcement shall be placed within the middle 1/3 of the slopewall thickness unless otherwise directed. The fabric shall extend through all construction joints. The surface of the slopewall shall be cured for 48 h in accordance with 501.20. Construction joints may be either butt or keyway type.

Inspection holes shall be provided at the locations shown on the plans or as directed. The holes shall be approximately 3 ft by 3 ft in size.

Precast concrete riprap, Type B, as shown on the plans, may be used in lieu of slopewall of 4 in. thickness.

616.10 Undermined Paved Side Ditch

Treatment of undermined existing paved side ditch and placement of revetment riprap shall be as shown on the plans or as otherwise directed.

Undermined paved side ditch shall be broken up and left in place. If it is determined that erosion is excessive, the eroded area shall be backfilled with a cohesive material, compacted, regraded, and lined with revetment or uniform riprap.

616.11 Installation of Geotextile Under Riprap

Storage and handling of geotextiles shall be in accordance with the manufacturer's recommendations. Geotextile shall be stored in such a manner as to prevent exposure

to direct sunlight, ultraviolet rays, water, temperature greater than 140°F, mud, dirt, dust, and debris. Each geotextile roll shall be labeled or tagged to provide product identification sufficient for inventory and quality control purposes. Exposure of geotextiles to the elements between lay down and cover shall be a maximum of 14 calendar days. If defects, rips, flaws, deterioration, or damage incurred during manufacture, transportation, storage, or construction is evident at the time of installation, the geotextile will be rejected and shall be replaced with no additional payment.

The surface to receive the geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions, and debris within the limits indicated on the plans.

Geotextiles used along channels shall be placed with the machine direction of the geotextile parallel to the channel. Successive geotextile sheets shall be overlapped in such a manner that the upstream sheet is placed over the downstream sheet and the upslope sheet over the downslope sheet.

Geotextiles used for 2:1 or steeper slopes shall be placed with the machine direction of the geotextile sheets perpendicular to the toe of slope. The geotextile sheets shall be overlapped in the direction of the anticipated movement of water.

Adjacent pieces of geotextile may be joined by sewing if approved, or by overlapping and pinning. The minimum overlap shall be 18 in. except when placed under water. When placed under water, the overlap shall be a minimum of 3 ft. Securing pins shall be steel, 3/16 in. in diameter, 18 in. long, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 1 1/2 in. Securing pins with washers shall be inserted through both strips of overlapped geotextile at spacing intervals in Table 1 along a line through the midpoint of the overlap. The geotextile strip shall be placed so that the lower strip will be overlapped by the next higher strip. Pins shall be driven until the washer bears against the geotextile and secures it firmly to the ground.

Whether the fabric is joined by sewing or pinning, additional pins shall be installed as necessary to prevent any slippage of the fabric regardless of location.

Slope	Pin Spacing
steeper than 3:1	2 ft
3:1 to 4:1	3 ft
4:1 or flatter	5 ft

Table 1

The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch or tear the geotextile and will not pull the required overlap or seam apart. Construction equipment shall not be on the exposed

geotextile. Placement of riprap or stone shall start from the base of the slope, moving upslope and from the center outward. Riprap shall not roll downslope and the height of drop for riprap shall be kept to less than 2 ft.

616.12 Method of Measurement

Dumped, revetment, Class 1, and Class 2 riprap obtained from outside the right-of-way will be measured by the ton. If obtained from inside the right-of-way, no measurement will be made if placed as shown on the plans unless direct payment is specified. If placed at locations not shown on the plans, measurement will be made by the square yard.

Grouted riprap and precast concrete riprap, including the area occupied by the wedge course, will be measured by the square yard, parallel to the slope. Slopewall will be measured by the square yard. Holes for inspecting slopewalls will be measured per each. Geotextiles used under riprap will be measured by the square yard by the type specified, complete in place. Uniform riprap will be measured by the ton.

Treatment of undermined paved side ditch will be measured by the linear foot of paved side ditch, broken and left in place.

616.13 Basis of Payment

The accepted quantities of dumped, revetment, Class 1, and Class 2 riprap obtained from outside the right-of-way will be paid for at the contract unit price per ton. Dumped, revetment, Class 1, and Class 2 riprap obtained from within the project limits will be paid for at the contract unit price per square yard. Uniform riprap will be paid for at the contract unit price per ton. Grouted riprap will be paid for at the contract unit price per square yard of the specified depth. Precast concrete riprap and concrete slopewall will be paid for at the contract unit price per square yard, complete in place. If slag is used as dumped riprap and payment will be made per ton, the pay quantity will be adjusted in accordance with 904.01.

The accepted quantities of geotextiles used under riprap will be paid for at the contract unit price per square yard, complete in place.

Inspection holes will be paid for at the contract unit price per each.

The treatment of undermined paved side ditch will be paid for at the contract unit price per linear foot for paved side ditch, break. Backfill required for treatment of paved side ditch will be paid for at the contract unit price per cubic yard for borrow, cohesive.

Payment will be made under:

Pay Item	Pay Unit Symbol
Borrow, Cohesive	CYS

Geotextiles for Riprap, _____ (type) ..... SYS
Inspection Hole ..... EACH
Paved Side Ditch, Break ..... LFT
Riprap, Class _____ ..... SYS
TON
Riprap, Dumped ..... SYS
TON
Riprap, Grouted, _____ in. (depth) ..... SYS
Riprap, Precast Concrete ..... SYS
Riprap, Revetment ..... SYS
TON
Riprap, Uniform ..... TON
Slopewall ..... SYS
Slopewall, Concrete, _____ in. (depth) ..... SYS

If the contract includes a pay item for removing materials from within the project limits which are used as grouted riprap, the cost of such removal shall be included in the cost of the pay item for the removal work. The cost of placing such material shall be included in the cost of the riprap pay item.

The cost of placing grout in accordance with 616.04 shall be included in the cost of the grouted riprap item.

The cost of paved side ditch required at the top of riprap and along the edge of riprap will be paid for in accordance with 607.06.

The cost of welded steel wire reinforcement shall be included in the cost of the slopewall.

The cost of excavation below the finished riprap or slopewall shall be included in the cost of the riprap and slopewall pay items.

The cost of excavation, grading, sewing, pinning, and necessary incidentals shall be included in the cost of geotextiles.

SECTION 617 – BLANK

SECTION 618 – BLANK

SECTION 619 – COATING BRIDGE STEEL

619.01 Description

This work shall consist of preparing surfaces, disposing of waste, and applying a coating to steel bridges, steel piling, bearing assemblies, or other steel items in accordance with 105.03.

MATERIALS

619.02 Materials

Materials shall be in accordance with the following:

Epoxy Intermediate Coat	909.02(b)
Finish Coat for Weathering Steel	909.02(e)
Multi-Component Inorganic Zinc Silicate Primer	909.02(a)1
Organic Zinc Primer	909.02(a)2
Polyurethane Finish Coat	909.02(c)
Structural Steel Coating System	909.03
Waterborne Finish Coat	909.02(d)

Safety data sheets shall be provided in the QCP for all materials to be delivered to the project site.

Caulk used to form the drip bead on weathering steel shall be a clear, 100% silicone caulk.

Caulk used on joints of lapping members shall be compatible with either the structural steel coating system or the partial coating system, and in accordance with the coating manufacturer's recommendations.

CONSTRUCTION REQUIREMENTS

619.03 Quality Control and Quality Assurance

The Contractor shall be responsible for the quality of work on the contract and shall ensure that all work has been performed by accepted quality control methods. A QCP shall be prepared and submitted by the Contractor in accordance with ITM 803. No work may begin until written notice has been received that the QCP was accepted by the Engineer. The QC manager shall furnish the current referenced SSPC Standards at the project site.

Cleaning and applying a coating shall be done by a Contractor certified as SSPC-QP 2 on steel structures shown in the contract documents as being built before 1995.

Cleaning and applying a coating shall be performed by a Contractor that at a minimum is certified as SSPC-QP 1 on steel structures shown in the contract documents as being built after 1994.

The Department will accept work performed on the project through quality assurance inspections and testing. Acceptance testing will be performed and will be the basis for which acceptance will be made.

(a) Test Methods and Procedures

The current version of the following test methods and procedures shall be performed as a minimum for quality control by the Contractor. These and other tests may be performed for acceptance testing by the Engineer. The results of the following tests and procedures shall be compiled and submitted to the Engineer on a daily basis.

Test/Procedure	Method and Procedure
Clean Compressed Air	ASTM D4285
Cleaning of Steel	SSPC-Vis 1, Vis 3
Cleanliness of Recycled Ferrous Metallic Abrasives	SSPC-AB 2
Dry Film Thickness	SSPC-PA 2
Relative Humidity	ASTM E337
State of Cure of Inorganic Zinc Primers	ASTM D4752
Surface Profile	ASTM D4417, Method B or C

Relative humidity, dew point, and surface temperature shall be recorded before the application of any coating and at least once per hour during the application of any coating.

Air compressor output and blasting abrasives shall be inspected at least once every four hours for contamination.

Visual inspections for cleaning shall be performed after each phase of the applicable cleaning operations for compliance with the specified requirements for each lot. The surface shall be wiped with a white glove or white rag to ensure the surface is free of dust and other contaminants.

The blast cleaned surface shall be inspected for surface profile, oil contamination, dust, and blasting residue, and accepted prior to the application of the primer.

The required number of surface profile measurements and dry film thickness measurements shall be in accordance with SSPC-PA 2.

If a lot is non-conforming, corrective action shall be taken to make the lot acceptable. Corrective action shall be submitted in writing and performed as approved. A phase shall not be covered until the whole lot has been accepted.

(b) Acceptance Testing

Acceptance testing for the coating of steel bridges will be in accordance with ITM 803. The results of the acceptance testing will be compared to the specific requirements for that phase of work. The Contractor shall not proceed to the next phase of work until written approval has been received from the Engineer that the current phase is accepted.

619.04 Prosecution of Work

Prosecution of work shall be in accordance with the applicable requirements of 108.04. Once the cleaning and coating operations have begun, it shall be performed on all days of work without stoppage until all work has been completed. If the contract contains more than one bridge, a schedule shall be included in the QCP which provides the sequence of work on the bridges. Once work has begun on a bridge, it shall be performed until complete, including all cleanup. When cleaning and coating beam ends for encasement in concrete is specified, that work may be performed as a separate operation.

Permission shall be obtained in writing to start or continue work at the hold points as follows:

(a) prior to the acceptance of the QCP and start of work,
(b) immediately following each phase of surface preparation,
(c) immediately before the application of the first coat,
(d) prior to the application of each succeeding coat, and
(e) after the final coat has cured.

A minimum of one day's notice shall be given in advance of each of the hold points.

619.05 Inspection Access to Bridges

Safe and reasonable access to all points of the bridge shall be provided for the Engineer's inspections immediately upon request.

619.06 Maintaining Traffic

Traffic lanes may be restricted when surface preparation or coating phases are being performed on a portion of the bridge over the traveled roadway, or as directed, when the need exists.

Construction signs in accordance with 801.04 shall be furnished and placement at each project site shall be as shown in the QCP. However, a "Bridge Painting Ahead" sign may be used in place of the "Road Construction Ahead" sign.

The traffic maintenance plan shall include a type of barrier system which shall protect against blasting of vehicles or pedestrians, eliminate abrasive materials and debris from falling onto the traveled portion of the pavement, and prevent the spreading of abrasive materials and debris in the area which may create a traffic

hazard. If the intended purpose of the protective devices has not been accomplished, work shall stop until adequate corrections have been made. All abrasive material or debris shall be removed by the end of each day's work in accordance with 619.07.

619.07 Safety and Environmental Requirements

Safety requirements, pollution control, and disposal of existing coating waste and debris shall be in accordance with the following requirements.

(a) Safety Requirements

The containment system shall be in accordance with 619.07(b)1a or 619.07(b)1b, as applicable, based on the year the structure was built as shown in the contract.

The Contractor shall follow OSHA rules and regulations and be responsible for determining the level of hazards that are present in the containment during the removal of the existing bridge coating operation. Once the Contractor establishes the level of hazard present, the Contractor shall be responsible for furnishing personal protective equipment to provide the degree of protection necessary for the established level of hazard. All Contractor and Department personnel on the project site shall wear personal protective equipment to the level of hazard as determined by the sampling and monitoring requirements performed by the Contractor. The protective equipment shall be furnished by the Contractor, including to Department personnel. Training shall be given to all personnel who are provided with personal protective equipment. Personal protective equipment shall include, but not be limited to, clean air supplied respirators, air purifying respirators, conventional hood as applicable, eye protection, and protective clothing.

(b) Pollution Control

Pollution control shall consist of two different operations. One shall be controlling and containing the atmosphere generated during the coating removal operation. The other shall be controlling and containing the solid waste stream generated as a result of the coating removal operation.

1. Pollution Control during Existing Coating Removal Operations

During existing coating removal operations, the Contractor shall recognize that the environment created by removal of the existing coating from the structure may create an atmosphere in which hazards to personnel on the jobsite are likely to be generated, and thus the Contractor shall be responsible for controlling and protecting the exposure of all workers and the surrounding environment from the hazards.

The characterization of the level of hazard of the existing coating that the Department considers to be present on the structure will be dictated by the year the structure was built as described below. The characterization of the level of hazard of the existing coating is not related to the results of the TCLP.

a. Containment for Structures Built Before 1995

For structures shown in the contract documents as being built before 1995, the

Contractor shall provide a containment system in order to contain all blasting materials, scrapings, wire brushings, and coating particles in accordance with SSPC-Guide 6, Class 2A or greater with Method A, Level 1 emission control capability. The Contractor shall take samples and monitor the work environment in accordance with IOSHA requirements and shall provide personal protective equipment appropriate to the conditions present within the work environment.

b. Containment for Structures Built After 1994

For structures shown in the contract documents as being built after 1994, the Contractor shall provide a containment system in order to contain all blasting materials, scrapings, wire brushings, and coating particles in accordance with SSPC-Guide 6, Class 2A or greater with Method A, Level 3 emission control capability. The Contractor shall take samples and monitor the work environment in accordance with IOSHA requirements and shall provide personal protective equipment appropriate to the conditions present within the work environment.

Regardless of the level of containment as listed above, if a spill, as defined in IDEM Regulation 327 IAC 2-6.1 does occur, all work shall stop and immediate action shall be taken to clean up the site. Spills of material that enter or threaten to enter the water, shall be handled in accordance with IDEM Regulation 327 IAC 2-6.1. The IDEM Emergency Response Branch, the local health department, and all water intake users within 500 ft of the bridge shall be immediately contacted and advised of the spill. Written documentation of all such contacts and actions shall be kept. All applicable Federal, State, and local rules and regulations described in 619.07(b)2b(1) shall be observed.

2. Pollution Control of the Generated Waste Stream

a. Waste Stream Sampling

Each bridge shall generate a separate waste stream and shall not be commingled with other materials. A sample of the waste stream from the bridge shall be obtained at the conclusion of the first day of the coating removal operation for that bridge. The sample will be shipped to be tested within 24 h in a manner agreed to by the Department and as described in the QCP. The Engineer will witness the extraction of the waste stream sample. The Department will maintain custody of the waste residue sample until it is shipped. The waste stream sample shall be taken by random method as described in the QCP which reflects representation of the entire bridge. The samples shall be analyzed for all contaminants listed in ITM 803 by the TCLP. The remaining waste shall be placed in an approved container. Such containers shall be labeled and maintained to comply with 40 CFR 264.

None of the waste shall remain on the booms or on any water surface overnight. All blasting debris shall be cleaned up after each day's work. All waste material shall be properly stored at the project site to prevent loss or pollution.

If the waste stream sample analysis is returned with one or more of the

contaminants meeting or exceeding the regulatory level for the respective contaminant, the entire waste stream for that bridge shall be considered to exhibit the characteristic of toxicity and thus shall be characterized as and considered to be hazardous.

If the waste stream sample characterization is returned with none of the contaminants meeting or exceeding the regulatory level for the respective contaminant, the entire waste stream for that bridge shall be considered to not exhibit the characteristic of toxicity and thus shall be characterized as and considered to be non-hazardous.

Waste stream characterization as either hazardous or non-hazardous for disposal shall be based only on the results of the TCLP. The results of the TCLP do not dictate the level of the containment system required in accordance with 619.07(b)1.

If hazardous materials are found to be present in the waste sample of a structure shown in the contract documents as being built after 1994, the Contractor shall immediately notify the Engineer that hazardous materials have been found and, if not addressed in the QCP, the Contractor shall submit revisions to the QCP that detail the necessary changes due to the presence of hazardous materials. The Contractor shall not return to work until the revised QCP is approved in writing.

b. Waste Disposal

Regardless of the waste characterization obtained from the waste stream sample, disposal of existing coating and debris shall be in accordance with SSPC-Guide 7 and the following requirements.

(1) Laws to be Observed

Federal and State laws and regulations regulate the disposal of bridge coating debris. Bridge coating debris shall be manifested or certified and shall be disposed of at an appropriate disposal facility.

The Contractor shall have direct knowledge regarding compliance with laws pertaining to pollution control and waste management such as, but not limited to, the following.

a. subtitle C of the RCRA, 40 CFR 261, 262, 263, 265, and 268,

b. the Solid Waste Rule, 329 IAC 10,

c. the Hazardous Waste Rule, 329 IAC 3.1,

d. the Air Pollution Rule 329 IAC 6.1,

e. the Water Pollution Rule, 327 IAC 2-6.1,

f. the United States Department of Transportation regulations 49 CFR 172.300, and

g. OSHA worker safety regulations 29 CFR 1926.

(2) Time Limitations

The maximum time limit from the date the generated waste is placed in a container and the date the material is transported to a permitted treatment, storage, and disposal facility shall be 90 calendar days.

(3) Marking of Spent Material Containers

Spent material containers shall be marked with the date that waste is first placed in the container. Until laboratory results described in 619.07(b)2a are received concerning the category of the waste stream, the containers shall be labeled "LEAD COATING WASTE DEBRIS" or "ZINC COATING WASTE DEBRIS", as appropriate. The labeling shall include the contract number, bridge number, sample number, and sample date.

Labeling of containers as hazardous waste will not be required until the appropriate laboratory analysis determines the waste stream to be hazardous in accordance with the current RCRA hazardous waste definitions. Immediately upon notice that the waste is hazardous, the containers shall be marked in accordance with 49 CFR 172, Subpart D.

(4) Instructions for Disposal of Coating Waste

If the waste stream is found to be hazardous, the Engineer will obtain an EPA identification number from IDEM. This number will be provided to the Contractor within 30 days of the start of waste generation for bridges having hazardous waste coating debris. The waste from different bridges shall not be commingled. The Contractor shall be responsible for:

a. determining the location for disposal, treatment, or recycling of the waste, obtaining the Engineer's approval of the site, and arranging with the approved site for acceptance of the materials,

b. preparing a hazardous waste manifest, as required by Federal and State requirements, for signature,

c. scheduling the shipment of waste to the permitted disposal site,

d. ensuring that the hazardous waste manifest is carried in the transportation vehicle,

e. ensuring that all required hazardous materials placards are properly displayed on the vehicle,

f. ensuring prompt movement of the vehicle to the disposal site, and

g. returning one copy of signed manifest documents to the Engineer. A copy of the chemical and physical analysis of the waste stream, all deposit receipts, manifests, and required paperwork for disposal shall be given to the Engineer and all waste disposed of before the waste disposal item will be paid.

If the waste stream is found to be non-hazardous in accordance with current RCRA hazardous waste definitions, the waste shall be disposed of at an appropriate disposal facility.

(5) Instructions for Disposal of Other Waste

Other wastes that may be generated on the project include, but are not limited to, spent solvents from cleaning of equipment and empty or partially empty containers of coating, paint thinners, spent abrasives, and solvents. The Contractor shall recycle or dispose of all project generated waste materials.

If the waste stream is defined as a hazardous waste in accordance with the current RCRA definitions, the waste shall be recycled or disposed of in accordance with 619.07(b)2b(4). All project generated waste and the method of recycling or disposal shall be identified in the QCP.

619.08 Surface Preparation of Concrete and Steel

The tops of all concrete and steel pier caps, concrete abutment caps, and 2 ft down all sides of concrete pier and abutment caps shall be washed. The washing shall be accomplished by means of a pressure washer with potable water. The pressure shall be between 800 and 1,500 psi. If detergents or other additives are added to the water, the surface shall be rinsed with potable water before the detergents dry.

Cleaning of steel surfaces shall be performed by an SSPC certified contractor. This requirement will not apply to the following:

(1) shop cleaning, or

(2) sections of beams or other structural members less than 180 sq ft of total area to be coated for the contract where heat-straightening or similar repairs have taken place.

Surfaces to be coated shall be cleaned in accordance with the SSPC classification, unless otherwise specified. Compressed air shall pass through an oil and water extractor before entering another apparatus.

Solvent cleaning in accordance with 619.08(a) shall be performed to remove all oils, soluble salts, visible grease, and any other surface contaminants before all other cleaning methods are started.

Field cleaned steel surfaces shall receive a coat of primer the same day as cleaned, except for areas requiring a second abrasive blast cleaning. Those areas shall receive a coat of primer the same day as the second cleaning. If rust forms after cleaning, the surface shall be cleaned again before coating. Work shall be stopped when there is disagreement about whether a surface has been adequately cleaned. Written notification shall be provided specifically identifying the problem.

Cleaning shall be scheduled so that dust or other contaminants do not fall on wet, newly coated surfaces.

A dust collector suitable for the containment type and size shall be used during all blast cleaning operations in preparation for all structural steel coating systems and as directed for a partial coating system.

On existing bridges when abrasive blast cleaning is used, clean dry media in accordance with SSPC-AB 1 or SSPC-AB 3 shall be used. The media shall produce a profile that is free of oil, soluble salts, greases, and other similar substances which can contaminate the blasted surface. If ferrous metallic media is chosen and the Contractor elects to recycle the media by running the media through recycling equipment, the recycling equipment shall be capable of separating the blasting media from the coating debris and the cleanliness of the recycled ferrous metallic media shall be in accordance with SSPC-AB 2.

The surface profile of cleaned new steel surfaces and cleaned existing steel surfaces shall not be less than 1 mil and not greater than 3 mil.

For structures shown in the contract documents as being built before 1995, the Contractor shall assume that mill scale is present on the existing steel. All mill scale shall be removed as a part of the cleaning operations.

(a) Solvent Cleaning

Solvent cleaning shall be performed in accordance with SSPC-SP 1.

After the hold point for solvent cleaning has been released, one or more of the following cleaning methods shall be performed.

(b) Hand Tool Cleaning

Hand tool cleaning shall be in accordance with SSPC-SP 2.

(c) Brush-Off Blast Cleaning

Brush-off blast cleaning shall be in accordance with SSPC-SP 7/NACE No. 4.

(d) Commercial Blast Cleaning

Commercial blast cleaning shall be in accordance with SSPC-SP 6/NACE No. 3.

(e) Near-White Blast Cleaning

Near-white blast cleaning shall be in accordance with SSPC-SP 10/NACE No. 2.

In addition, all steel within a cross-sectional area measuring 5 ft longitudinally, on both sides of a bridge deck joint, as well as all areas of visible corrosion pitting, as determined by the Engineer, shall be abrasive blast-cleaned two times. After the first cleaning, all dust shall be removed from the cleaned surfaces and the surfaces shall be wetted with potable water either by hand wiping or atomized low volume spray. The volume of water used shall be low enough to preclude runoff. The surfaces shall be left undisturbed for a minimum of 24 h then cleaned a second time to the specified standard.

(f) White Metal Blast Cleaning

White metal blast cleaning shall be in accordance with SSPC-SP 5/NACE No. 1.

(g) Power Tool Cleaning

Power tool cleaning shall be in accordance with SSPC-SP 3.

(h) Commercial Grade Power Tool Cleaning

Commercial grade power tool cleaning shall be in accordance with SSPC-SP 15.

(i) Power Tool Cleaning to Bare Metal

Power tool cleaning to bare metal shall be in accordance with SSPC-SP 11.

Upon completion of cleaning operations, the Contractor shall vacuum or blow off under full containment any residual dust remaining from the cleaning operation.

The Engineer will check the prepared surface for dust prior to the Contractor beginning painting operations.

619.09 Coating Systems

Every component of a coating system shall be from the same manufacturer and shall be compatible with each other. Coatings shall be applied in accordance with the manufacturer's recommendations. The dry film thickness of a coating will be measured with a calibrated film thickness gauge in accordance with SSPC PA 2. All coatings shall have a dry film thickness not less than 80% of the required dry film thickness.

(a) Structural Steel Coating System

The coating system shall consist of an inorganic zinc primer with a dry film thickness of 3 mil, an epoxy intermediate coat with a dry film thickness of 4 mil, and a polyurethane finish coat with a dry film thickness of 3 mil for the coating of steel bridges and other structural steel.

(b) Partial Coating System

The coating system shall consist of an organic zinc primer with a dry film thickness of 3 mil and a finish coat with a dry film thickness of 3 mil. The finish coat shall be either a waterborne finish coat or a polyurethane finish coat for coating of steel bridges and other structural steel within the limits shown on the plans.

619.10 Coating

The application of all coatings shall be performed by an SSPC certified contractor, except as noted in 619.08.

Concrete at all junction points of concrete and steel shall be adequately shielded or otherwise protected so the application of the coating on steel is full and complete, and that overspray or spatter onto nearby concrete or other surfaces is minimized.

If a blasted or coated surface is unsatisfactory, removal of the coating, a thorough cleaning of the surface, and recoating or other correction will be required as directed. Where defects or damages occur in a film of any coating, all defective areas shall be removed to soundly bonded coating or bare steel and recoated to the specified thickness.

No lettering shall be marked on bare or coated steel surfaces, except marks required for erection and project information stenciled in accordance with 619.10(g).

Joints of all lapping members shall be caulked after either the application of the epoxy intermediate coat of the structural steel coating system or the application of the organic zinc primer of the partial coating system. The intermediate coat or primer shall be cured to the manufacturer's recommended coating cure time prior to caulking.

1. All vertical and diagonal lapping members shall be caulked along the top and sides. The bottom shall remain open for drainage.

2. All horizontal lapping members shall be caulked along the leading edge and sides of steel members facing toward oncoming traffic or facing toward the prevailing wind direction.

3. All horizontal members shall remain uncaulked along the side of steel members facing away from oncoming traffic or prevailing wind direction.

(a) Weather Limitations

Field coating shall not be performed between November 15 and the following April 1 unless the Contractor requests to work during this period, provides an amended QCP, and written approval is received from the Engineer.

Coating application shall begin only when the 24 h ambient temperature is to remain above 50°F after application, and the steel surface temperature is between 50°F and 100°F unless different temperature ranges are requested in the QCP and approved in writing. Coating and curing shall be done only when the relative humidity is to remain between 30% and 80%. The pot life and induction time shall be in accordance with the manufacturer's recommendations for the existing temperature and humidity.

A coating shall not be applied when the air is misty, or when conditions are otherwise unsuitable. The surface temperature of the steel to be coated shall not be within 5°F of the dew point. When coating in a protected area to eliminate the above conditions, the steel shall remain under cover until the coating is dry. All wet or uncured coating which has been exposed to excessive humidity, rain, snow, or condensation shall be allowed to dry or cure. Damaged coating shall then be removed. The surface shall be re-cleaned and recoated as directed. The Engineer will be the sole authority to decide when work may begin or shall stop due to weather conditions.

(b) Storage

All coatings shall be stored in accordance with the manufacturer's recommendations. If a coating is allowed to remain in storage, the containers shall be turned end for end at least once per week. The coating shall be used within the manufacturer's recommended shelf life.

(c) Mixing

All coatings shall be thoroughly mixed so that the pigment is completely in suspension and the consistency is uniform. Mechanical mixers shall be used in accordance with the manufacturer's instructions. The coating shall remain in this condition during application to the steel surface. After initial mixing and before application, inorganic and organic zinc primer shall be strained through a metal screen not coarser than the No. 30 (600 µm) sieve.

Partially empty containers of a coating shall not be used. Partial mixing of containers shall not be done. All containers of a coating shall remain closed until needed for mixing.

(d) Thinning

When required for proper application, the addition of a thinner to a coating will be allowed. Only thinners recommended by the manufacturer and as approved shall be used. Thinners shall be added to a coating in accordance with the manufacturer's recommendations. The maximum quantity added shall not exceed the manufacturer's recommendations. The thinned coating shall not exceed IDEM regulations for volatile organic compounds.

The Contractor shall contact IDEM and the local air pollution control board for information about any volatile organic compound regulations or restrictions.

(e) Application of Coatings

All coatings shall be of colors to produce a distinct contrast with adjacent coatings, including the color of a clean steel surface.

Coatings shall be applied by either an airless or conventional spray method which has been recommended by the coating manufacturer. Compressed air used for the application of a coating shall pass through an oil and water extractor before meeting the coating in the pot. However, areas to be coated which are inaccessible to spray application or areas requiring touchup may be coated with brush or daubers. Epoxy intermediate coatings and polyurethane finish coatings may also be applied by brushes or rollers provided the coating cures to a smooth and uniform finish. Spray shall be adjusted to produce a uniform coating.

1. Stripe Coat

If using the structural steel coating system in accordance with 619.09(a), a stripe coat in accordance with SSPC-PA Guide 11 shall be applied. All sharp edges, welds, outside corners, bolt heads, nuts, threads, crevices, plate seams, back-to-back angle seams, pitted steel, rivet heads, and other sharp discontinuities shall be striped on the second and third coats, and then recoated with the remaining steel surfaces. Striping shall extend at least 1 in. from edges. If specified, the stripe coat shall be allowed to dry to the manufacturer's recommended recoat dry time prior to applying the second and third coats on the remaining steel surfaces.

If using the partial coating system in accordance with 619.09(b), a stripe coat in accordance with SSPC-PA Guide 11 shall be applied. All sharp edges, welds, outside corners, bolt heads, nuts, threads, crevices, plate seams, back-to-back angle seams, pitted steel, rivet heads, and other sharp discontinuities shall be striped on each of the two coats, and then recoated with the remaining steel surfaces. Striping shall extend at least 1 in. from edges. If specified, the stripe coat shall be allowed to dry to the manufacturer's recommended recoat dry time prior to coating the remaining steel surfaces. Coating application techniques shall minimize overspray or spatter. Dry overspray or spatter shall be removed prior to application of other coatings and after application of the finish coat.

For both coating systems, the stripe coat may be applied with either a brush or a sprayer. If the Contractor-chosen method of applying the stripe coat is not producing results acceptable to the Engineer, the Engineer will require the stripe coat application method to be changed.

2. Blank

(f) Curing Time

The minimum curing time between coatings shall be 24 h for inorganic zinc primers and 8 h for the epoxy intermediate coat. The curing time will vary depending on the temperature and humidity. The inorganic zinc primer shall be cured to a minimum solvent resistance rating of 4 in accordance with ASTM D4752 prior to the

application of the epoxy intermediate coat. It shall be demonstrated that the inorganic zinc primer is in accordance with this requirement. The epoxy intermediate coat shall be cured in accordance with the manufacturer's recommendations prior to the application of the polyurethane finish coat. The polyurethane finish coat shall be applied within 12 calendar days of application of the epoxy intermediate coat.

The curing time of all other coatings shall be in accordance with the manufacturer's recommendations.

(g) Stencil Identification

After the hold point for the finish coat has been released, project identification information shall be painted with a stencil in 2 in. black capital letters onto the outside of both fascia beams, at the right end of the beam and near the end bent, which reads as follows:

_____
bridge number

_____
contract number

PAINTED _____
date

619.11 Shop-Application of a Coat of Primer for New Steel

The shop performing the cleaning and the application of the coat of primer for new structural steel shall have a valid AISC-420-10/SSPC-QP 3 certification. Abrasive used for cleaning steel in the shop shall be an abrasive that produces a surface profile in accordance with 619.08. The Contractor shall coordinate with the steel fabrication shop and the Contractor applying the remaining coatings after steel erection to ensure the shop-applied primer and the remaining field-applied coats of the coating system are all from the same manufacturer. Mixing primer and coating products from different manufacturers will not be allowed. Inorganic zinc primer shall be applied to all structural steel in the shop. The remaining two coats of the structural steel coating system shall be applied in the field after final erection. A structural steel coating system in accordance with 619.09(a) shall be used. When shear connectors have been specified, the top of the top flange shall not be primed. Erection marks may be painted on zinc-coated surfaces. Machine finished surfaces for sliding contact shall be coated with heavy grease as soon as practicable after being accepted, but before removal from the shop.

Shop primed beams shall not be loaded for shipment until the primer has been allowed to cure for a minimum of 48 h.

(a) Non-Weathering Steel

All structural steel shall be cleaned in accordance with 619.08(e).

All structural steel shall receive an inorganic zinc primer, including faying surfaces of high strength bolted connections and areas in contact with concrete. Surfaces, other than the contact surfaces described above, which are inaccessible after erection shall be coated in the shop with the full coating system required on the completed bridge.

(b) Weathering Steel

All structural steel shall be left uncoated, except as shown on the plans. All diaphragms, stiffeners, and other appurtenances located within the limits shown on the plans shall be included in the area to be coated. Surfaces to be coated shall be cleaned in accordance with 619.08(e). Surfaces shall be coated in accordance with 619.09(a), except the finish coat shall be in accordance with 909.02(e). The field-applied finish coat for weathering steel will be allowed to be furnished from a different manufacturer than the manufacturer that furnished the primer and epoxy intermediate coat.

619.12 Field Coating New Steel Bridge

All structural steel surfaces which are accessible after final erection shall be coated with the remaining coatings specified for the structural steel coating system in accordance with 619.09(a) in the field after final erection.

Portions of new structural steel, including cross frames, diaphragms, stiffeners, and all other appurtenances located within the limits of concrete end bent encasement as shown on the plans, will only require the inorganic zinc primer.

Surface areas where the inorganic zinc primer was damaged during shipping, handling, and erection shall be cleaned in accordance with 619.08(a) and either 619.08(d) or 619.08(i). Likewise, all bolt and field connections shall be cleaned in the same manner. All the damaged areas, and bolt and field connections shall then be coated with the same manufacturer's inorganic zinc primer that was applied in the shop. This requirement will not apply to temporary steel bridges.

Where steel surfaces have been coated with the structural steel coating system and the coatings have been damaged, the affected steel surface areas shall be cleaned in accordance with 619.08(i). The structural steel coating system shall then be re-applied.

For weathering steel girders, caulk shall be applied to act as a drip bead as shown on the plans.

619.13 Coating Existing Steel Bridges

The surfaces to be cleaned and coated shall include the surfaces of all steel members of the superstructure, substructure, floor beams, stringers, plates, castings, bearing assemblies, ornamental handrails, lattice work, and other steel appurtenances. When shear connectors have been specified, the top of the top flange shall not be coated.

If the contract specifies clean steel bridge, the bridge steel shall be cleaned in

accordance with 619.08(a) and either 619.08(e) or 619.08(i). The structural steel coating system in accordance with 619.09(a) shall be used for coating.

If the contract specifies clean steel bridge, partial, the bridge steel shall be cleaned in accordance with 619.08(a) and either 619.08(e) or 619.08(h). The partial coating system in accordance with 619.09(b) shall be then used for coating.

When the plans show encasing the ends of existing structural steel members in concrete, all beams and girders, cross frames, diaphragms, stiffeners, and all other appurtenances located within the limits of the partial coating zone as shown on the plans shall be cleaned in accordance with 619.08(a) and either 619.08(e) or 619.08(h) and shall receive the partial coating system in accordance with 619.09(b). If the contract also includes pay items for clean steel bridge and coat steel bridge, all exposed structural steel shall be cleaned in accordance with 619.08(a) and either 619.08(e) or 619.08(i), and coated in accordance with 619.09(a), from the face of concrete encasement to opposite face of concrete encasement.

619.14 Handling of Steel Bridge Superstructure to be Removed

If the Contractor elects to take ownership of the steel in accordance with 202.03, a QCP shall be submitted in accordance with 619.03. The entire surface area of the steel shall be cleaned in accordance with 619.08(d) prior to the steel leaving the construction limits and becoming the property of the Contractor. Mill scale shall be assumed to be present on the existing steel. Cleaning in accordance with 619.08(a) shall not be performed. A level of containment in accordance with 619.07(a) shall be used.

Testing of the waste stream and disposal of the waste produced by this cleaning shall be in accordance with 619.07.

619.15 Drain Castings Treatment

Roadway drain castings located in a bridge deck shall be satisfactorily cleaned in accordance with 619.08(c) or 619.08(g). The castings shall not be shot-blasted.

The roadway drain castings shall be coated with a black polyurethane finish coat in accordance with 909.02(c).

If a roadway drain casting extension pipe is damaged or missing, it shall be replaced. The extension pipe shall be in accordance with 715.

619.16 Clean and Coat Bearing Assemblies and Steel Piling

(a) Bearing Assemblies

When shown on the plans or a pay item is included in the schedule of pay items, all bearing assemblies including top and bottom plates of each assembly shall be cleaned in accordance with 619.08(a) and 619.08(d). Pollution control shall be in accordance with 619.07.

If the pay item clean and coat bearing assemblies is listed in the schedule of pay items for a particular structure, the entire bearing assembly shall be coated with the structural steel coating system in accordance with 619.09(a).

If the pay item, coat steel bridge, or coat steel bridge, partial, is listed in the schedule of pay items for a particular structure, the entire bearing assembly shall be coated with the structural steel coating system that is being used on the rest of the bridge.

(b) Steel Piling

All exposed steel piling shall be cleaned in accordance with 619.08(a) and either 619.08(e) or 619.08(i). The structural steel coating system in accordance with 619.09(a) shall be applied. The color of the finish coat shall be SAE-AMS-STD-595, color No. 13711.

619.17 Responsibility for Damage

Unless otherwise specified by the Engineer in writing, full containment shall be provided when performing the surface preparation operation and when applying all coatings, except primer, with spray equipment. All persons and property shall be protected from damage or injury from the surface preparation operations and coating operations by providing containment as described in the QCP. Persons and property shall include, but not be limited to, pedestrians, vehicles, and other traffic upon or underneath a bridge, all portions of the bridge superstructure and substructure, and all adjacent property. When applying a primer or coating using means other than spray equipment, all persons and property shall be protected from damage or injury. The means and extent of the protection shall be as described in the QCP. The Contractor shall be responsible for damages in accordance with 107.17.

619.18 Top of Top Flange of Steel Structural Members

When shown on the plans or a pay item is included in the schedule of pay items, the top of the top flange of steel structural members shall be cleaned in accordance with 619.08 by a contractor certified as SSPC-QP 2. The Contractor shall assume the existing coating on the top of the top flange contains hazardous materials and mill scale and shall use pollution control and containment in accordance with 619.07(b)1. A QCP shall be prepared and submitted in accordance with 619.03. The steel shall be cleaned to a level of cleanliness in accordance with 619.08(e) or 619.08(h), however solvent cleaning in accordance with 619.08(a) shall not be performed.

Each bridge shall generate a separate waste stream and shall not be commingled with other materials. The waste stream shall be sampled in accordance with 619.07 and all other requirements of 619.07 shall be followed. Once the result from the waste stream sampling is known and the waste stream is appropriately characterized as hazardous or non-hazardous, all waste shall be disposed of in accordance with 619.07(b).

619.19 Method of Measurement

Cleaning and coating of steel structural members, cleaning the top of the top flange of steel structural members, cleaning and coating of bearing assemblies, and cleaning and coating of steel piling will not be measured for payment. Cleaning areas around bridge joints and other areas with visible corrosion pitting a second time will not be measured for payment.

Disposal of the waste generated by the cleaning operation will not be measured for payment.

Cleaning roadway drain castings, caulking joints of lapping members, and caulking on weathering steel will not be measured for payment.

For steel that will become the property of the Contractor, cleaning existing steel, removal of mill scale, testing, disposal of the waste, containment, and all other items involved with this work will not be measured as per 202.13.

If a structure is shown in the contract documents as being built before 1995, no measurement will be made of the area covered by mill scale. Otherwise, the area of structural steel covered by mill scale will be measured for payment after a proper cleaning of the entire containment area or an agreed large portion thereof and removing all other existing materials, including all paint, coatings and rust. The percentage of the area of structural steel covered by existing mill scale will be representative of this entire area. The pre-established remedies for this changed condition apply in accordance with 104.02(d) and 619.20.

Roadway drain casting extension pipe will be measured in accordance with 715.13.

The estimated weight, length, number of steel spans, surface area of steel, and type of primer shown on the plans or in the Proposal is incidental information. Such information is approximate only. The Department will not guarantee its accuracy.

619.20 Basis of Payment

Existing steel bridges to be cleaned, or partially cleaned, whichever is specified, will be paid for at the contract lump sum price for clean steel bridge or clean steel bridge, partial, at the bridge number specified. Cleaning the top of the top flange of existing steel bridges will be paid for at the contract lump sum price for clean steel bridge, top flanges, at the bridge number specified. Existing steel bridges to be coated, or partially coated, whichever is specified, will be paid for at the contract lump sum price for coat steel bridge or coat steel bridge, partial, at the bridge number specified.

When specified as a separate pay item in the contract, cleaning and coating bearing assemblies will be paid for at the contract lump sum price for clean and coat bearing assemblies, at the bridge number specified.

When specified as a separate pay item in the contract, cleaning and coating steel piling will be paid for at the contract lump sum price for clean and coat steel piling, at the bridge number specified.

(a) Pre-Established Remedies for Changed Conditions

1. Discovery of Hazardous Materials but No Mill Scale on a Structure Shown in the Contract Documents as Being Built After 1994

The payment will be an additional 25% of the clean steel bridge item as computed in 619.20(b)1 in accordance with 109.05 as payment for all additional costs incurred.

2. Discovery of Mill Scale but No Hazardous Materials on a Structure Shown in the Contract Documents as Being Built After 1994

If, on a structure shown in the contract documents as being built after 1994 and the presence of hazardous materials has not been confirmed by laboratory analysis, the area of structural steel covered by mill scale comprises greater than 25% of the area of structural steel in accordance with 619.19, additional compensation for the removal of the mill scale will be made as an adjustment to the clean steel bridge item. The adjustment will be an additional payment of 30% of the clean steel bridge item as computed in accordance with 619.20(b)1 will be made.

3. Discovery of Hazardous Materials and Mill Scale on a Structure Shown in the Contract Documents as Being Built After 1994

If the laboratory analysis of a waste stream sample on a structure shown in the contract documents as being built after 1994 yields results indicating the presence of hazardous materials, the entire bridge shall be considered as having mill scale and the following pre-established remedy for this changed condition in accordance with 104.02(d) shall apply. If agreed to in writing between the Contractor and the Department, the work shall proceed with the Contractor assuming all risks for removal of mill scale. An additional 55% of the clean steel bridge item as computed in 619.20(b)1 in accordance with 109.05 will be paid as additional compensation for the removal and disposal of the hazardous materials, the removal of the mill scale, the additional containment required, and all other incidental items associated with the removal of the hazardous materials and mill scale.

(b) Prices used in Pre-Established Remedies to Changed Conditions

The following prices will be computed and used as the price for the pay item identified below in all pre-established remedies to changed conditions referenced in this section.

The price for the clean steel bridge item, per bridge, used in all pre-established remedies to changed conditions referenced in this section will be limited to the lesser of the following:

1. 70% of the sum of the clean steel bridge item and coat steel bridge item for that bridge, or

2. the actual amount for the clean steel bridge item for that bridge shown in the Schedule of Pay Items.

Roadway drain casting extension pipe will be paid for in accordance with 715.14.

For steel that will become the property of the Contractor, payment for cleaning existing steel, removal of mill scale, testing, disposal of the waste, containment, and all other costs involved in this work will be in accordance with 202.14.

The cost of transportation and disposal of waste materials, waste, waste containers, and all other debris generated from pollution control and cleaning that is disposed of will be paid for at the contract lump sum price for disposal of cleaning waste, hazardous or non-hazardous, at the bridge number specified.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Clean and Coat Bearing Assemblies, Br. No. ____	LS
Clean and Coat Steel Piling, Br. No. ____	LS
Clean Steel Bridge, Partial, QP- ____, Br. No. ____	LS
Clean Steel Bridge, QP- ____, Br. No. ___	LS
Clean Steel Bridge, Top Flanges, QP-2, Br. No. ____	LS
Coat Steel Bridge, Br. No.____	LS
Coat Steel Bridge, Partial, Br. No.____	LS
Disposal of Cleaning Waste, _____, Br. No.____	LS
waste type	

The cost to prepare a QCP shall be included in the cost of the pay items of this section. The cost of providing the Department with access to the bridge and seasonal or weather limitations shall be included in the cost of the pay items of this section.

If a structure is shown in the contract documents as being built before 1995, no additional payment will be made for the removal of mill scale. The cost of the removal of mill scale shall be included in the cost of clean steel bridge, clean steel bridge, partial, clean and coat bearing assemblies, clean and coat steel piling, or clean steel bridge, top flanges.

If a structure is shown in the contract documents as being built after 1994 and the percentage of the area covered by mill scale is less than or equal to 25% of the total structural steel surface area of a bridge measured in accordance with 619.19, no additional payment will be made for the removal of mill scale. The cost of the removal of mill scale shall be included in the cost of clean steel bridge or clean steel bridge, partial.

The cost of furnishing all materials, equipment, and labor required for solvent

cleaning, scraping, steel brushing, or other acceptable methods for removing coatings in the locations directed shall be included in the cost of clean steel bridge, clean steel bridge, partial, clean and coat bearing assemblies, clean and coat steel piling, or clean steel bridge, top flanges. The cost of cleaning roadway drain castings shall be included in the cost of clean steel bridge or clean steel bridge, partial.

The cost of providing containment in accordance with 619.07 and 619.17 and personal protective equipment shall be included in the cost of the pay items of this section.

The cost of furnishing all materials, equipment, and labor required to perform the quality control tasks outlined in 619.03 shall be included in the cost of clean steel bridge or clean steel bridge, partial, clean and coat bearing assemblies, clean and coat steel piling, or clean steel bridge, top flanges.

The cost of furnishing all materials including caulk, equipment, and labor to perform caulking and coating, including the stripe coats, with the structural steel coating system or the partial coating system shall be included in the cost of coat steel bridge or coat steel bridge, partial. The cost of switching stripe coat application methods shall be included in the cost of coat steel bridge or coat steel bridge, partial. The cost of furnishing all materials, equipment, and labor to perform coating of the roadway drain castings shall be included in the cost of coat steel bridge or coat steel bridge, partial.

The cost of all equipment, material, labor, testing, use of special cleaning methods, and shipping of waste stream samples shall be included in the cost of the clean steel bridge or clean steel bridge, partial, clean and coat bearing assemblies, clean and coat steel piling, or clean steel bridge, top flanges, pay items.

The cost of dust removal, wetting, and within the cross-sectional area measuring 5 ft longitudinally on both sides of a bridge deck joint as well as all areas of visible corrosion pitting, a second time shall be included in the clean steel bridge, clean steel bridge, partial, clean and coat bearing assemblies, or clean steel bridge, top flanges, pay items.

When a pay item is included in the schedule of pay items for clean and coat bearing assemblies, all costs associated with cleaning and coating bearing assemblies, except disposal of cleaning waste, shall be included in the cost of the pay item. If clean steel bridge, clean steel bridge, partial, coat steel bridge, or coat steel bridge, partial, are included as pay items in the schedule of pay items, no separate payment will be made for cleaning and coating bearing assemblies on that bridge number. The cost of cleaning and coating bearing assemblies shall be included in the cost of the respective clean steel bridge, clean steel bridge, partial, coat steel bridge, or coat steel bridge, partial, pay items for that bridge number.

When a pay item is included in the schedule of pay items for clean and coat steel piling, all costs associated with cleaning and coating steel piling, except disposal of

cleaning waste, shall be included in the cost of the pay item.

When encasing the ends of existing structural steel members in concrete is shown on the plans, all costs associated with cleaning and coating all structural steel within the limits of the partial coating zone, including but not limited to, equipment, material, labor, testing, use of special cleaning methods, and shipping of waste stream samples, shall be included in the cost of clean steel bridge, partial, and coat steel bridge, partial, pay items.

If the contract also includes pay items for clean steel bridge and coat steel bridge, all costs associated with cleaning and coating all exposed structural steel, including but not limited to, equipment, material, labor, testing, use of special cleaning methods, and shipping of waste stream samples, shall be included in the cost of clean steel bridge and coat steel bridge pay items.

SECTION 620 – BLANK

SECTION 621 – SEEDING AND SODDING

621.01 Description

This work shall consist of either or both plain and mulched seeding or placing approved sod. It includes furnishing and placing seed, fertilizer, inoculants, topsoil, and mulch, if required, in a prepared seed bed or furnishing and placing sod at locations in accordance with 105.03.

MATERIALS

621.02 Materials

Materials shall be in accordance with the following:

Fertilizer	914.03
Grass Seed	914.04
Grass Seed, Temporary	914.02
Leguminous Inoculants	914.06
Mulch	914.05(a)
Plastic Net	914.09(g)
Sod, including Nursery Sod	914.07
Staples	914.09(f)
Topsoil	914.01
Water	914.09(a)

Seed that has passed the expiration date shown on the bag tag shall not be installed.

CONSTRUCTION REQUIREMENTS

621.03 Preparation of Ground Before Seeding

The area to be seeded shall be made smooth and uniform and shall be in accordance with the finished grade and cross-section shown on the plans or as otherwise designated and shall be trimmed in accordance with 210. The seed bed, if not loose, shall be loosened to a minimum depth of 3 in. before fertilizer or seed is applied. In areas of excessive vehicular traffic, such as parking of construction equipment near a bridge repair, the soil shall be loosened to a minimum depth of 6 in.

Areas to be covered with topsoil shall be milled or disked slightly before the topsoil is placed. A disk, spike-toothed harrow, or other similar device may be used for this purpose. Such loosening will be required to ensure bond of the topsoil with the surface on which it is placed and to form a uniform surface. The topsoil shall then be spread to a sufficient depth to produce the thickness specified after it has been compacted lightly with an approved roller, tamping device, or other method.

621.04 Preparation of Ground Before Placing Erosion Control Blankets

Prior to placing the blankets, the area to be covered shall be relatively free of all rocks or clods over 1 1/2 in. in diameter, and all sticks or other foreign material, which prevent the close contact of the blanket with the seed bed.

If as a result of a rain, prepared seed bed becomes crusted or eroded, or if eroded places, ruts, or depressions exist, the soil shall be reworked until it is smooth. Such areas which are reworked shall be re-seeded.

621.05 Applying Fertilizer, Seed, and Mulch

(a) Fertilizer

Fertilizer as specified shall be spread uniformly over the area to be seeded. Fertilizer shall be spread at the rate of 800 lb/ac unless otherwise specified.

(b) Seed

Seed may be drilled in or mixed with water. The mixture shall be sprayed over the area to be seeded. An approved mechanical method which shall place the seed in direct contact with the soil may be used. In places inaccessible to mechanical equipment, or where the area to be seeded is small, a hand operated cyclone seeder or other approved equipment may be used. Seed of warm season grasses, forbs, or aquatic species shall not be covered more than 1/8 in. All other seed shall not be covered more than 1/2 in.

Leguminous seeds, unless otherwise specified, shall be inoculated with a culture in accordance with 914.06. The culture shall be mixed with sufficient water to distribute it thoroughly. The seed shall be wetted thoroughly with the solution and allowed to dry sufficiently to be in condition for sowing. Inoculated seed shall be sown

within 30 h after treatment. Where seeding is to be done by hydraulic methods, the inoculate may be added to the water in the spray tank.

(c) Mulch

Mulching material, when specified, shall be applied uniformly in a continuous blanket at the rate of 2 t/ac. Mulch shall be placed within 24 h after seeding. The percent of moisture in the mulch shall be determined in accordance with 621.14(c).

Mulching material shall be punched into the soil so that it is partially covered. The punching operation shall be performed longitudinally with the mulch tiller. The tools used for punching purposes shall be disks that are notched and have a minimum diameter of 16 in. The disks shall be flat or uncupped such as notched coulters commonly used on moldboard plows. Disks shall be placed a minimum of 8 in. apart along the axle or shaft. Shaft or axle sections of disks shall not exceed 8 ft in length.

The mulch tiller for punching shall be constructed so that weight may be added or hydraulic force from the tractor may push the puncher into the ground. If heavy weights are not used, several trips over the area may be necessary to work part of the mulch into the soil. Care shall be exercised to obtain a reasonably even distribution of mulch incorporated into the soil.

After procedures for holding the mulch in place have been completed, mulch, other than when applied by hydroseeder, shall be watered thoroughly. The seed or soil beneath it shall not be displaced. The mulching material shall be maintained in place satisfactorily until final completion and acceptance of the contract, except as provided in 107.18. When seeding is performed between June 1 and August 15, a second thorough watering shall be applied approximately 21 days after seeding.

On slopes steeper than 3:1, or when specified, the following methods will be allowed.

1. Method A

The mulch may be held in place by means of a commercially produced mulch binder which is in accordance with all applicable State and Federal regulations. Such product shall be applied in accordance with the manufacturer's written instructions. A copy of the written instructions shall be supplied to the Engineer prior to the seeding work. The product shall contain a coverage indicator to facilitate visual inspection for evenness of application. If the mulch fails to stay in place, the Contractor shall repair all damaged areas. A change in the mulch binder may be requested by the Engineer.

2. Method B

The mulch may be held in place by spraying it with a satisfactory liquid asphalt or asphalt emulsion. The bituminous material may be applied immediately after the mulch is in place or it may be injected into the mulch as it leaves a power-driven mulch spreader. If applied to the surface, the amount shall be approximately 0.06 gal./sq yd.

If applied as the mulch comes from the spreader, the amount shall be approximately 60 gal./t of mulch material. The exact amount shall be as directed.

3. Method C

The mulch may be held in place with binder twine fastened down with wooden pegs not less than 6 in. long spaced 4 ft apart. The twine shall be placed parallel to and also at 60° with the pavement edge in both directions. The distance between the intersections of the diagonal strands measured along the strands shall be 12 ft. The strand parallel to the pavement shall cross the diagonal strands at their intersections to form equilateral triangles 12 ft on a side.

4. Method D

The mulch may be held in place with a polymeric plastic net. The plastic net shall be unrolled such that it lays out flat, evenly, and smoothly, without stretching the material. The plastic net shall be held in place by means of staples. The wire staples shall be driven at a 90° angle to the plane of the soil slope. Staples shall be spaced not more than 4 ft apart with rows alternately spaced. The plastic net shall be secured along the top and bottom of the soil slope with staples spaced not more than 1 ft on center. The ends and edges of the plastic net shall be overlapped approximately 4 in. and stapled. Overlaps running parallel to the slope shall be stapled 1 ft on center and overlaps running perpendicular to the slope shall be stapled at least 3 ft on center. The plastic net shall be placed with the length running from top of slope to toe of slope, or the plastic net shall be placed with the length running horizontally or parallel to the contour.

5. Method E

The area may be covered with erosion control blankets. The Contractor will be allowed to use excelsior blanket, paper mat, or straw mat.

(d) Excelsior Blankets

Excelsior blankets may be used where mulched seeding is specified or where erosion control blanket is specified. Excelsior blankets shall be placed within 24 h after seeding operations have been completed. The ground shall be prepared in accordance with 621.04. After the area has been properly shaped, fertilized, and seeded, the blanket shall be laid out flat, evenly, and smoothly, without stretching the material. Excelsior blankets shall be held in place by means of staples. The staples shall be driven at a 90° angle to the plane of the soil slope. Staples shall be spaced not more than 5 ft apart in three rows for each strip, with a row along each edge and one row alternately spaced in the middle. The upslope edge shall be fastened by staples spaced 12 in. apart. The ends and edges of the blankets shall be tightly butted together, but not lapped. When excelsior blanket is used, the blanket shall be placed with the length running from top of slope to toe of slope, or the blanket shall be placed with the length running horizontally or parallel to the contour. The staples used for stapling shall be in accordance with 914.09(f).

(e) Paper Mat

Paper mat may be used for mulch for seeding where mulched seeding is specified or where erosion control blanket is specified. Paper mat shall be placed within 24 h after seeding operations have been completed. The ground shall be prepared in accordance with 621.04.

After the area has been properly shaped, fertilized, and seeded, two anchor trenches shall be dug, one along the foot of the slope and the other 1 ft back from the crown of the slope. These anchor trenches shall be 4 in. deep and at least 6 in. wide. One edge of the paper mat shall be placed into the top trench and stapled 9 in. on center. The trench shall then be filled with soil. The paper mat shall then be unrolled such that it lays out flat, evenly, and smoothly, without stretching the material. Paper mat shall be held in place by means of staples. The staples shall be driven at a 90° angle to the plane of the soil slope. Staples shall be placed not more than 3 ft apart with rows alternately spaced. The paper mat shall be secured in the bottom anchor trench in the same manner as it was secured in the upper anchor trench. The ends and edges of the mat shall be overlapped at least 4 in. and stapled.

Overlaps running parallel to the slope shall be stapled 18 in. on center and overlaps running perpendicular to the slope shall be stapled at least 9 in. on center. When paper mat is used, the mat shall be placed with the length running from top of slope to toe of slope, or the mat shall be placed with the length running horizontally or parallel to the contour.

(f) Straw Mat

Straw mat may be used for mulch for seeding on projects where mulched seeding is specified or where erosion control blanket is specified. Straw mat shall be placed within 24 h after seeding. The ground shall be prepared in accordance with 621.04. After the area has been properly shaped, fertilized, and seeded, the straw mat shall be unrolled over the designated area so that the plastic mesh is on top and the straw fibers are snugly and uniformly in contact with the soil surface without stretching the material. The rolls shall be butted snugly together and stapled in place. The staples shall be driven through the blanket at a 90° angle to the plane of the ground surface. Each staple shall anchor the plastic mesh. The staples shall be spaced at approximately 3 ft increments, both longitudinally and transversely.

For placement on slopes, the straw mat shall be placed with the length running from the top of slope to the toe of slope and shall extend a minimum of 3 ft over the crown of the slope. On slope applications, six staples shall be installed across the uphill end of the roll. The downhill ends of the lowermost rolls across the slope shall also be anchored with six staples, placed on uniform spacing.

For placement in ditch lines, the straw mat shall be unrolled parallel to the centerline of the ditch. The mat shall be placed so that there are no longitudinal seams within 24 in. of the bottom centerline of the ditch. In ditch lines, six staples shall be placed at uniform spacing across the upstream end of each roll.

(g) Wood Cellulose Fiber Mulch

Wood cellulose fiber may be used where mulched seeding is specified. Wood cellulose fiber mulch shall be placed at the rate of 1 ton/ac within 24 h after seeding operations have been completed. Application shall be by hydraulic mulching and consist of mixing wood cellulose fiber mulch and grass seed with water. It shall be mixed in standard hydraulic mulching equipment to form a homogeneous slurry. The slurry shall be sprayed, under pressure, uniformly over the soil surface. The hydraulic mulching equipment shall contain a continuous agitation system that keeps all materials in uniform suspension throughout the mixing and distribution cycles. Fertilizer shall be applied in accordance with 621.05(a).

621.06 Seed Mixtures

Seed mixtures are classified as follows. Mixes including warm season grasses, forbs, or aquatic species will be specified in the plans.

(a) Seed Mixture R

This seed mixture shall be applied at the rate of 202.5 lb/ac consisting of 100 lb/ac of low endophyte Tall Fescue, 50 lb/ac of turf type Perennial Ryegrass, 50 lb/ac of Creeping Red Fescue, and 2.5 lb/ac of White Dutch Clover. Seed used in this mixture shall be drought tolerant. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(b) Seed Mixture U

This seed mixture shall be applied at the rate of 196.5 lb/ac consisting of 100 lb/ac of a 4-way blend of turf type Tall Fescue, 50 lb/ac Creeping Red Fescue, 45 lb/ac Perennial Ryegrass, and 1.5 lb/ac White Dutch Clover. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(c) Seed Mixture P

This seed mixture shall be applied at the rate of 130 lb/ac consisting of 35 lb/ac of Weeping Alkaligrass, 35 lb/ac of Creeping Red Fescue, 35 lb/ac of Slender Creeping Red Fescue, and 25 lb/ac of Perennial Ryegrass. Seed used for this mixture shall be salt tolerant. Fertilizer shall be applied at the rate of 400 lb/ac. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(d) Seed Mixture Shade

This seed mixture shall be applied at the rate of 145 lb/ac consisting of 35 lb/ac of Fine Fescue, 40 lb/ac of Perennial Ryegrass, 40 lb/ac of Tall Fescue, 10 lb/ac of Kentucky Bluegrass, 15 lb/ac of Timothy, 3 lb/ac of Redtop, and 2 lb/ac of Alsike Clover. Seed used for this mixture shall be shade tolerant varieties or cultivars. Fertilizer and mulching material, where specified or directed, shall be applied in accordance with 621.05.

(e) Seed Mixture Floodplain

This seed mixture is intended for areas that require natural habitat restoration below the 100 year floodplain in conjunction with IDNR Construction in a Floodway

permit. If certain species in this mix are unavailable, substitutions may be allowed when approved by the Engineer. This mix quantity shall be measured in pure live seed, PLS, pounds per acre. This mixture shall be applied at a rate of 20 PLS lb/ac. This seed mix shall include seasonal cover crop. Fertilizer shall not be applied with this seed mixture.

Common Name	Botanical Name	Application Rate, PLS
Virginia Wild Rye	Elymus virginicus	2 lb/ac
Canada Wildrye	Elymus canadensis	2 lb/ac
Rough Dropseed	Sporobolus asper	2.5 lb/ac
Little Bluestem	Schizachyrium scoparium	8.4 lb/ac
Purpletop	Tridens flavus	0.4 lb/ac
Upland Bentgrass	Agrostis perennans	0.2 lb/ac
Partridge Pea	Chamaecrista fasciculate	0.8 lb/ac
Illinois Bundleflower	Desmanthus illinoensis	0.6 lb/ac
Black-eyed Susan	Rudbeckia hirta	0.6 lb/ac
Showy Tick Trefoil	Desmodium canadense	0.4 lb/ac
Foxtail Barley	Hordeum jubatum	0.6 lb/ac
Purple Coneflower	Echinacea purpurea	0.6 lb/ac
False Sunflower	Heliopsis helianthoides	0.4 lb/ac
Common Milkweed	Asclepias syriaca	0.2 lb/ac
Yellow Coneflower	Ratibida pinnata	0.2 lb/ac
Wild Bergamot	Monarda fistulosa	0.1 lb/ac

A seasonal cover crop shall be applied with seed mixture Floodplain. The Spring Summer Cover Crop mix shall be applied during spring and summer months and no later than July 31 of the current year. The Fall Cover Crop mix shall be applied in fall months and no earlier than August 1 of the current year. Cover crops shall be applied at 50 PLS lb/ac.

1. Spring Summer Cover Crop

Common Name	Botanical Name	Application Rate, PLS
Common Oat	Avena sativa	35 lb/ac
Annual Ryegrass	Lolium multiflorum	15 lb/ac

2. Fall Cover Crop

Common Name	Botanical Name	Application Rate, PLS
Cereal Rye	Secale cereal	35 lb/ac
Austrian Winter Pea	Pisum sativum	10 lb/ac
Crimson Clover	Trifolium incarnatum	5 lb/ac

"Do Not Spray" signs shall be placed near the beginning and end of this work, at 200 ft intervals, or as otherwise directed. The sign shall be 16 gauge aluminum. The size and message arrangement shall be as shown on the plans. The sign background shall be white. The sign lettering shall be black. The sign shall not be reflectorized. Paint and primer shall be in accordance with 909.04. The sign post shall be placed as shown on the plans. The post shall otherwise be in accordance with 910.15.

621.07 Mulched Seeding

Mulched seeding, when specified, shall consist of applying the seed mixtures in accordance with 621.06(a), 621.06(b), 621.06(c), and 621.06(d) as specified. This mixture shall include fertilizer and mulching material in the amounts set out herein. If erosion control blanket is specified, the Contractor will be allowed to use excelsior blanket, paper mat, or straw mat in accordance with 621.05(d), 621.05(e), or 621.05(f), respectively.

621.08 Preparation of Ground Before Sodding

The area to be sodded shall be smooth, uniform, and shall be in accordance with the required cross-section. Surfaces prepared for sod shall be of sufficient depth below unseated areas that newly laid sod shall be in accordance with the surrounding surface.

For those areas which shall be covered with topsoil, the procedure for the application of topsoil shall be in accordance with 621.03.

After the area has been prepared for sod, fertilizer shall be applied at the rate of 400 lb/ac. The surface shall be loosened to a depth of 1 to 2 in. and then raked before the sod is placed. All clods, lumps, boulders, or waste material shall be removed satisfactorily.

In areas where the above method of preparation is impracticable, a different method may be approved.

621.09 Laying Sod

Sod strips shall be laid in the designated direction. The sod shall be fitted to the surrounding grade and fixed objects. The sod strips shall be butted together closely to avoid open joints. Overlapping of sod will not be allowed. After laying and initial watering, the sod shall be tamped or rolled as directed to ensure contact with the soil underneath and shall be in accordance with the surrounding surface. After compaction, the sod shall present a smooth even surface free from lumps and depressions. On slopes of 3:1 or flatter, the use of broken sod strips will be allowed. Where broken pieces are laid, no overlaps will be allowed.

Sod placed in ditches with grades steeper than 1% and on slopes 3:1 and steeper shall be pegged. The pegs shall be spaced not over 2 ft apart in each strip measured lengthwise of the strip. Pegs shall be driven down until no more than 1 in. protrudes above the surface of the sod. Grades and slopes flatter than specified herein shall be pegged as directed.

Pegs shall be wood at least 1/2 in. by 3/4 in. by 12 in. In lieu of pegs, T-shaped wire pins may be used. The pins shall be machine bent from 8 gauge low carbon steel with a minimum of an 8 in. leg, a 4 in. head, and a 1 in. secondary drive. Pins shall be driven flush with the top of the sod.

621.10 Watering Sod

Sod shall be watered immediately after laying. The amount of watering shall be sufficient to saturate the sod and the upper few inches of the underlying soil. The sod shall be watered once every day of the first week, once every second day of the second week, once every third day of the third week, and once a week thereafter. Sod shall be maintained for a minimum of four weeks from the time it is laid before being accepted. During periods of ample rainfall, watering may be modified to simulate the above schedule. The requirements of 107.19 shall apply.

621.11 Seeding or Sodding Disturbed Areas Outside Construction Limits

Areas outside shown construction limits which are disturbed by the Contractor shall be repaired to their original condition or better. The areas shall be seeded with seed mixture R, U, P, Shade, or Floodplain as directed. If the contract contains seed mixtures other than the mixes listed here, the Contractor may seed the disturbed area with the mixture contained in the contract provided the area is less than 1 ac in size. If the area disturbed is well maintained and part of a residential or commercial lot, it shall be sodded unless the Engineer determines otherwise.

621.12 Seasonal Limitations

The Contractor shall post a warranty bond for all permanent seeding done from October 16 through January 31. Only completed seeding with seed mixtures R, U, P, or Shade will satisfy the requirements of the warranty bond. Seeding without mulch shall not be done between May 1 and August 15.

Sod placed during the months of June, July, and August shall be subject to the following conditions:

(a) sod shall be in good, live, growing condition; and

(b) sod shall be placed within 36 h after cutting and protected from damage during that period.

Winter sodding will be allowed when the temperature is above 35°F. No frozen sod shall be laid and no sod shall be laid on frozen soil. Sod shall be properly protected from drying out and shall be laid within 48 h after cutting.

621.13 Method of Measurement

Fertilizer and mulching material will be measured by the ton. Seed mixtures will be measured by the pound. Spring Summer Cover Crop and Fall Cover Crop seed mixtures used in conjunction with seed mixture Floodplain will not be measured for

payment. Topsoil will be measured by the cubic yard in accordance with 211.09. Mulched seeding and sodding will be measured by the square yard. Water will be measured by the 1,000 gal. Mobilization and demobilization for seeding will be measured per each trip, when directed, to the project site. "Do Not Spray" signs will be measured by the number of signs installed.

621.14 Basis of Payment

The accepted quantities of fertilizer and mulching material, furnished and delivered complete in place, will be paid for at the contract unit price per ton, except as set out below for sodding. Seed mixtures will be paid for at the contract unit price per pound for the class and type specified. Mulched seeding will be paid for at the contract unit price per square yard for the class and type specified, complete in place. Topsoil will be paid for at the contract unit price per cubic yard. Sodding and nursery sodding will be paid for at the contract unit price per square yard, complete in place. "Do Not Spray" signs will be paid for at the contract unit price per each.

Payment for mobilization and demobilization for seeding will be made for the initial movement to the project site so that permanent or mulching work, as specified, is performed. When one or more operations are completed within the same mobilization, payment will be made for one mobilization. Payment will be for all work necessary to move personnel and equipment to and from the project site. Payment will also be made for additional mobilization, when directed.

Payment will be made under:

Pay Item	Pay Unit Symbol
Erosion Control Blanket	SYS
Fertilizer for Permanent Seeding	TON
Mobilization and Demobilization for Seeding	EACH
Mulched Seeding _____ class	SYS
Mulching Material	TON
Seed Mixture _____ class	LBS
Sign, "Do Not Spray"	EACH
Sodding	SYS
Sodding, Nursery	SYS
Topsoil	CYS
Water	kGAL.

The cost of leguminous inoculants, preparing seed beds, sowing, raking, and all other necessary incidentals shall be included in the cost of seed mixtures. The cost of Spring Summer Cover Crop and Fall Cover Crop used in conjunction with seed mixture Floodplain shall be included in the cost of seed mixture Floodplain. The cost of furnishing and placing fertilizer, water, seed mixtures, and mulching material, in

addition to the incidentals listed above for seed mixtures shall be included in the cost of mulched seeding.

The cost of furnishing, hauling, and placing the material, including material used as tie-down, repair of areas for which mulch fails to stay in place, all labor, equipment, and necessary incidentals shall be included in the cost of mulching material.

Repair of areas outside the construction limits which must be disturbed to construct the work required by the contract will be paid for in accordance with 201.07(e).

Water will be paid for only when ordered after the 30 day period, in accordance with 621.10.

Payment will not be made for topsoil which is obtained from within the right-of-way.

The cost of fertilizer, water, excavation of earth bed, disposal of surplus material, and all necessary incidentals shall be included in the cost of sodding or nursery sodding.

(a) Warranty Bond

Permanent seeding that requires a warranty bond to meet the requirements of 621.12 shall be warranted against failure resulting from lack of germination or method of application. The seeding shall be warranted to germinate and shall be free of obvious erosion occurrences. The intent of the warranty bond shall be to enable the final acceptance of the contract and payment of the retainage. All seeding which has significantly failed to attain approximately 70% germination shall be replaced with no additional payment. A properly executed maintenance bond with a surety shall be provided prior to the completion of the work. A warranty shall be made, with no additional payment, to replace all seeding in areas which has not effectively performed useful service as specified, as well as for the repair of designated erosion areas caused by seeding failure. Such warranty shall be in writing with proper execution of the maintenance bond with a proper surety. The warranty shall be equivalent to 1 1/2 times the cost of the seeding work completed after October 15 with a minimum bond amount of $25,000. All requirements for seeding work will still apply during the warranty period unless otherwise directed.

For the terms of the warranty, a reseeding unit shall be defined as an area equal to or larger than 2,000 sq ft in size. An erosion unit may be of an area of significance as determined.

The warranty shall cover work completed from October 16 through January 31. The Department will determine if the Contractor shall be released from the warranty. This determination will be made within 10 calendar days after documented request for inspection is made by the Contractor. Such determination will not be made prior to

April 1. All replacement work shall be finished prior to June 15 with no additional payment. The requirements of 107.17 will apply to the warranty area only. The Engineer will certify in writing as to the completion of the work and will make proper notification for the releasing of the bond.

If the Contractor does not complete the necessary repairs before June 15, and there are no justifiable reasons for the Department to grant an extension, the Contractor shall forfeit the bond for the seeding work only. If a bond is forfeited, the Contractor will be required to explain to the Department why the Contractor's experience reduction factors do not warrant an increase.

(b) Changed Fertilizer

A fertilizer may be required with a higher nitrogen content than that specified, or the fertilizer specified may be required to be enriched by adding chemicals in order to be in accordance with such requirements. All additional cost incurred due to such procedure will be paid at the prices shown by certified vouchers. Such payment will include and will be full compensation for furnishing the required chemicals, or furnishing and processing the additional materials required.

(c) Mulching

The percent of moisture shall be determined at the time the mulching material is weighed. Facilities shall be provided for weighing in accordance with 109.01(b). Arrangements shall be made in advance so that the percent of moisture will be determined at the time of weighing and that the weight of the material will be checked.

Moisture content of the mulch will be determined on the basis of air dry weight as follows:

$$\text{Moisture Content \%} = \frac{\text{Wet Weight of Sample} - \text{Air Dry Weight of Sample}}{\text{Air Dry Weight of Sample}} \times 100$$

The gross, or wet, weight of mulching material furnished and placed will be paid for if the moisture content does not exceed 10%.

If the moisture content exceeds 10%, the weight to be paid for will be the gross, or wet, weight minus the weight of excess moisture computed as follows:

$$\text{Weight to be paid for} = G \times \frac{110}{(100 + M)}$$

where:

G = Gross, or wet, weight of mulching material
M = Moisture content, %, in the mulching material to the nearest 0.5%.

Mulching material which contains more than 50% moisture will be rejected. Wood cellulose fiber mulch containing more than 15% moisture will be rejected.

SECTION 622 – PLANTING TREES, SHRUBS, AND VINES

622.01 Description

This work shall consist of furnishing, delivering, and planting trees, shrubs, vines, and seedlings for wildlife habitat.

This work shall also consist of the performance of incidental planting procedures and plant establishment work to provide a complete operation in accordance with 105.03.

MATERIALS

622.02 Materials

Materials shall be in accordance with the following:

Backfill Material	914.01
Fertilizer	914.03
Mulch	914.05(b)
Pipe	914.09(e)
Plants	914.08
Porous Material	914.09(d)
Tree Wound Dressing	914.09(c)
Water	914.09(a)

Soil conditioners such as peat moss or calcine clay may be added with written permission.

Guy wire shall be minimum No. 14 gauge galvanized wire.

622.03 Care and Handling of Plants

(a) Bare Rooted Plants

If the outside air temperature exceeds 35°F when the plants are delivered, the plants shall be planted immediately or placed in inside or outside storage. If they are stored outside, the roots shall first be puddled in a paste solution of backfill and water. The plants shall then be separated and their root systems heeled-in by completely covering with moist soil. If they are stored inside, the roots shall be puddled in a paste solution of backfill and water. Straw, peat moss, or corncobs shall be worked in and around the root system and kept moist.

Plants which are delivered in boxes, wrapped bundles, or other forms of closed

containers, including trucks, and which are stored inside may remain in the container for 48 h from time of delivery, provided the containers are opened immediately and the plants are watered if necessary.

If the outside temperature is 35°F or less when plants are delivered, the plants shall be placed in inside storage immediately. Inside storage procedures shall be in accordance with the above requirements. Plants may be transferred to outside storage when the outside temperature exceeds 35°F provided they are puddled again and then heeled-in.

Temperature inside the storage building shall be maintained between 35°F and 55°F. Plants shall not remain in storage, either inside or outside, for more than seven days, unless otherwise specified because of unfavorable planting conditions.

Plants may be rejected on failure to comply with these specifications.

(b) Balled and Burlapped Plants and Container Grown Plants

Plants shall be planted or placed in storage before being exposed for 10 consecutive hours at temperatures less than 35°F. Storage of plants shall be in a moist storage building or they shall be placed outside in a compact group with balls or containers completely covered with corncobs and kept moist. Plants shall not remain in storage for more than 10 days, unless otherwise specified due to unfavorable planting conditions.

Plants may be rejected upon failure to comply with these specifications.

622.04 Collected Plants

At least 24 h before starting to dig collected plants, notification shall be given of the time and place of digging so inspection of the work and of the plants can be made, as desired.

Collected plants shall be dug carefully in a satisfactory manner. All operations of digging, transporting, and replanting collected plants shall be in accordance with all applicable laws and regulations of the State.

622.05 Excavation for Plant Holes

Stakes will be set to locate plant holes for each tree, shrub, or vine. The outline of each seeding bed will be staked and the planting on the required centers shall be as directed. Stakes for the staking operation shall be furnished. The location stakes shall be removed as directed. Excavation shall be such that the plant holes are cylindrical in shape with the sides approximately vertical. Material excavated from the holes may be used for backfill providing it is in accordance with 914.01. Otherwise, it shall be distributed uniformly within the construction area as directed. The excavated material shall not be stockpiled on turf or in ditches. Material unsuitable for the growth of vegetation, including rocks and boulders, shall be disposed of outside the right-of-way as directed and in accordance with 203.01 and 203.10. Plant holes shall be in

accordance with the details and tables shown on the plans. If plants have not been planted within 10 days after excavation of the hole, the hole shall be refilled and re-excavated at the time of planting. No additional payment will be made for this operation.

If, after staking or excavation of the plant holes at the locations shown on the plans, it becomes apparent that the location is unsuitable for planting due to accumulation of groundwater, possible flooding because of terrain conditions, or unsuitable soil conditions, plant holes shall be relocated as directed. Such relocation shall be done with no additional payment.

622.06 Planting Season

The planting season shall be from September 1 through the following May 25, with the exception that trees shall be planted from October 1 through the following April 15, provided that trees are dormant. Bare rooted plants shall be planted only when the outside air temperature exceeds 35°F. Unless otherwise approved, deciduous plants, except those container grown, shall be dormant at the time they arrive at the work or storage site. Evergreens shall not have active terminal growth. At least 40% of the total number of balled and burlapped, and container grown plants shall be planted from the beginning of the planting season through December 31. Bare root seedlings for wildlife habitat shall be planted from October 1 through the following April 30. Container grown seedlings for wildlife habitat shall be planted at any time.

The initial planting and spring replacements, in accordance with 622.18, shall be completed satisfactorily within the planting season which expires prior to the completion date of the contract. The establishment period for these plants shall be from the end of the specified planting period to the fall inspection. If the initial planting and spring replacements are not completed within the specified time, the completion date may be extended one year to provide an establishment period. If the completion date is extended, all requirements of 622.18 shall apply until final inspection and acceptance.

622.07 Pruning

Before the plant is placed in the plant hole, any bruised or broken parts of roots shall be cut off smoothly as approved unless otherwise specified or directed. All plants shall be pruned either before or after planting. Such pruning generally shall consist of thinning out or cutting back secondary branching to reduce the foliage by 1/3 to 1/2 in accordance with accepted horticultural practices. Pruning operations shall maintain the general crown outline and characteristic branching pattern for each species. Pruning or cutting back of terminal leaders which are over 3/8 in. in diameter at the point of cut will not be allowed. Broken or dead branches, or any other objectionable parts of the plant, shall be removed throughout the life of the contract. Pruning tools shall be kept sharp and shall be sterilized in denatured alcohol after each hour of use. All cut surfaces 3/8 in. or more in diameter shall be painted with a tree wound dressing.

Bare rooted shrubs shall be cut back to 1/2 their minimum specified height as

shown on the plans. Pruning shall be performed after the shrubs have been sealed with Department seals and prior to the leaf buds breaking dormancy. At the time of the spring and fall inspections, bare rooted shrubs will be accepted at their original specified height provided they are healthy, in good growing condition, and are no less than 1/2 the minimum specified height.

622.08 Planting, Backfilling, and Watering

The plant shall be placed in the plant hole at the proper position for depth, alignment, final grade of the surrounding ground level, and vertical position of the trunk. The planting procedure shall be performed in such a manner that the top of the ball of the plant is as shown on the plans at the time of planting. The planting procedure shall be in accordance with the details as shown on the plans. Backfill material in accordance with 914.01 shall be placed around all plants except seedlings. The quantities of backfill material required per plant shall be as shown on the plans.

In areas which are designated on the plans as beds for group planting, the soil shall be tilled to a minimum depth of 6 in. in such a manner that all sod and vegetation is destroyed. These areas shall be tilled at least two times with an interval of 14 days between tilling operations. Planting may be done immediately after the second tilling. Additional tilling shall be performed if vegetation appears before mulch is applied. Sod and vegetation shall be removed in lieu of the tilling operation when the soil temperature or moisture conditions are such that the sod and vegetation would not be destroyed by tilling. At other times, sod and vegetation may be removed in lieu of tilling. If the excavation resulting from sod removal is greater than 1 in. deep, it shall be backfilled with topsoil to 1 in. above the original ground.

After sod and vegetation removal and backfilling, the bed area shall be cultivated to a depth of 6 in. Large clods, rocks, and other debris encountered in the cultivation work and any excess soil shall be removed. The outline of beds for group plantings shall be no closer than 3 ft to the center of any of the outer plants in the area.

In addition to the water applied at the time of planting, unless excessive moisture prevails, a minimum of two supplemental waterings shall be applied between May 1 and June 15, and one every 14 days between June 15 and September 15. Sufficient water shall be applied to individual plants to saturate the backfill and the mulch area. Plants in beds shall receive water equivalent to the quantity used for individual plants. Liquid fertilizer in accordance with 622.09, may be applied with the supplemental watering and the method of application is subject to approval. Lance watering will not be allowed.

Container grown seedlings for wildlife habitat which have been planted from June 1 through August 31 shall be maintained after installation for 30 days. Maintenance shall include watering the seedlings at the time of planting and once every seven days.

(a) Plants with Bare Roots

With the plant in its proper position, the plant hole shall be backfilled with material in accordance with 914.01. The backfill material shall be worked firmly around the roots as the hole is gradually filled. The plant shall be raised gently and lowered slightly as the soil is added to help eliminate air pockets around the roots. Soil shall be added in layers of about 6 in. and each layer tamped to make it firm and to hold the plant perpendicular. Water shall be used to settle the soil and to eliminate air pockets around the roots, unless otherwise directed. The top 4 in. of soil necessary to fill the plant hole completely shall be a very fine mixture and shall be placed on top of the firmed backfill and allowed to remain loose and untamped.

(b) Balled and Burlapped Plants

Balled and burlapped plants shall be handled by the ball and placed in the holes in such a manner that the soil of the ball does not become loosened from the roots. The soil directly beneath the ball shall be firmed to minimize settling. Guy stakes shall be driven before backfilling operations begin. After the hole has been partially backfilled and the material firmed under and around the ball, the burlap shall be cut away and removed from the stem of the plant. Backfilling and firming shall then be completed in a manner to avoid loosening the soil from the root ball. Watering shall be done in accordance with 622.08(a). Backfill material shall be in accordance with 914.01.

(c) Seedlings for Wildlife Habitat

Seedlings shall be from 6 to 18 in. in height. Seedlings shall be planted as directed in the locations shown on the plans. Species shall be selected from the list as shown on the plans. Alternate species selection shall be subject to approval. Seedlings shall be planted no closer to each other than the distance shown on the plans. Seedlings shall not be planted in rows, but instead shall be planted in a natural appearing pattern. Failure to comply with this procedure will require the replanting of the seedlings as directed with no additional payment. All damaged seedlings shall be replaced with no additional payment if replanting is required.

622.09 Liquid Fertilizer Application

All plants shall be fertilized with a water soluble 5-10-10 fertilizer, or an equivalent amount of plant nutrients, at the rate of 0.75 lb/100 gal. of water. Fertilizer shall be applied to each installed plant until the mulched area over the plant hole is saturated. Three applications shall be made: one on or about July 1; one about August 1; and one about September 1.

622.10 Mulching

Mulch, in accordance with 914.05(b), shall be placed as a top layer around each plant as soon as it has been installed. The mulch shall cover the entire area as described in 622.08 and shall be placed around individual plants in accordance with the plans.

622.11 Guying and Staking

Guying and staking shall be in accordance with the details shown on the plans. Guy wire shall be placed through rubber hose material around each tree then twisted

to secure the tree in a relatively stable position. Three wood stakes shall be spaced equally about each tree. The guy wire shall be secured to each stake at an approximately right angle. Support of multi-stem trees of 4 to 6 ft in height shall consist of inner limb guying and bracing stakes. The securement point and placement of guy wire shall avoid abrasion of tree limbs. The guys and stakes shall be maintained for the duration of the contract. Prior to final inspection, all materials used to support trees shall be removed and disposed of, except as otherwise directed for trees requiring additional bracing time. However, supports for fall replacement shall remain in place. If approved, stakes may be left flush with the ground.

622.12 Plant Protection

(a) Borer Control Coatings

Within five days after planting and prior to wrapping, all trees, except evergreens, shall be protected against borer attack with an insecticide mixture applied to the tree trunk with a paint brush or a suitable hand sprayer. The application shall cover the trunk from the root crown to the first major branches. The mixture shall consist of enough powdered skim milk to form a smooth slurry when added to either dieldrin 18 at the rate of 2 qt to 50 gal. of water or thiodan 50 at the rate of 1 lb to 50 gal. of water.

(b) Wrapping for Rodent Protection

Within seven days after planting, all crabapple and shade trees with a 1/2 in. diameter or larger, except for multi-stem forms, shall be wrapped with a double layer of 18 by 14 mesh per in. aluminum mill finish screen wire mesh around the trunk of each tree as shown on the plans. The height of screen wire shall be from the existing grade to below the lowest branch. The screen wire shall be overlapped at the ends. The screen wire shall be secured to itself with hog rings or other approved methods, and to the rods by approved means.

Plastic coil type protective wrapping will be acceptable as an alternative to the screen wire and reinforcement rod method of tree protection or staked trees of less than 2 in. caliper. The wrapping shall be loosened twice each calendar year. The first adjustment shall be made between May 15 and June 15. The second adjustment shall be made between September 1 and September 30. The plastic tree protective wrapping shall extend to the height of the bottom limb.

The Contractor may submit other proposed methods of rodent protection to the Department's landscape architect for approval prior to installation. The design of the protection shall ensure an average air space diameter of 2 in. greater than the tree's callipered size at installation. The protection shall enable air movement through its surface to dry the tree trunk following periods of precipitation. The protection shall not damage the tree nor hinder its growth.

Multi-stem trees shall be wrapped with commercially available wrapping paper wrapped tightly around the trunks from the ground to the lowest branch with a minimum of 1/2 in. overlap. The wrapping paper shall be tied securely with stout cord

at top and bottom and at two intermediate intervals.

622.13 Retaining Walls and Tree Wells

Retaining walls around the roots of trees or shrubs, and tree wells around the trunks of trees or shrubs shall be constructed at the locations and to the shape and dimensions shown on the plans or as otherwise designated. They shall be of mortar and masonry, or other type as specified. Mortar shall not be used in any portion of the tree well extending below the top of contiguous porous material used for tree root protection. The inside face of a tree well shall be no less than 2 ft from the outside edge of the trunk of the tree or shrub.

No material shall be placed between the tree trunk and the wall of the tree well.

622.14 Tree Root Protection

Where tree root protection is specified, the entire area of the root spread shall be protected. The limits of this area shall be as designated, but in general this area corresponds to the area of the ground surface lying beneath the limb spread of the tree. The area shall be cleaned of all vegetation and debris. Porous material, in accordance with 914.09(d), shall be placed uniformly over the area to a depth in proportion to the height of fill, varying proportionally from 3 in. for fills of 1 ft or less to 12 in. for fills of 4 ft or more, or to such other depth as may be designated. A layer of No. 23 sand or other approved material shall then be placed in sufficient quantity to choke the top layer of porous material and will be measured and paid for as porous material.

Where the earth fill is less than 12 in. and tree root protection is specified without the construction of a tree well, the thickness of the porous material at the tree trunk shall be increased to the height of the fill and extend outward from the tree truck in collar form for a distance of 12 in., unless otherwise shown on the plans.

No fill shall be placed over the root spread of any tree or shrub that is to be protected in the above manner until the required depth of porous material has been placed.

622.15 Pipe Underdrains

Pipe underdrains, when shown on the plans or directed, shall be placed to drain tree wells or porous material for tree root protection. These shall be placed in accordance with applicable provisions of 718.

622.16 Damage to Plants

During all operations of tree protection, care shall be used to prevent unnecessary cutting of roots and to prevent scarring or damage to selected trees or shrubs. Motorized equipment shall not be operated within the drip line of trees unless specified. Where trimming of branches or cutting of roots is necessary, all cuts shall be made cleanly with proper sharp tools in accordance with generally accepted horticultural practices. Scarred areas and cut surfaces 3/8 in. or more in diameter shall be covered completely with a tree wound dressing.

622.17 Grass and Weed Control

Weeding and mowing of grass in and around all group plantings, beds, and individual trees and shrubs shall be performed until final acceptance. The grass and weed control areas shall be the areas within 2 ft of the outer limits of all group plantings and shrub beds and within 2 ft of the outer limits of the mulch area of individual shrubs. For the care of individual trees, the area shall extend to a perimeter centered from the point itself to 2 ft beyond the stub stakes of the guy wires or 2 ft beyond the mulched area. In general, these areas shall be in accordance with the plans.

622.18 Care, Inspection, and Replacement

(a) Care

Watering, fertilizing, weeding, cultivating, spraying to control insect infestation and disease, and all other good horticultural practices necessary to maintain the plants in a living healthy condition shall be performed up to the time for termination of responsibility for care as set out herein. The plants shall be cared for throughout the life of the contract. All plants stolen, damaged, or destroyed by fire, automobiles, vandalism, or any other cause, with the exception of plants damaged or destroyed by Department maintenance operations, shall be replaced with no additional payment as soon as practicable. Plants damaged or destroyed by the Department will be replaced by the Department prior to the date of final acceptance.

(b) Inspection and Replacement

On or about May 1, a spring inspection of initial plantings will be made during and before the end of the planting season and prior to the beginning of the establishment period. Plants not living, unhealthy, in a poor growing condition, or otherwise not meeting the specifications shall be replaced prior to May 15 for trees and prior to May 25 for other plants with no additional payment. These replacements shall be in accordance with all other requirements of the initial planting. All plants found to be not living or in an unhealthy condition between this replacement and final inspection shall be removed from the project immediately, as directed, and shall be replaced after September 15 as detailed below.

A fall inspection will be made on or about September 15, at which time the condition of the materials planted within the specified planting season will be determined. At the time of this inspection, all plants which are found to be dead, unhealthy, in a poor growing condition, or otherwise not meeting the specifications will be rejected. Rejected plants shall be removed and disposed of as soon as practicable and replaced prior to November 15 with no additional payment. Replacement materials and operations shall be in accordance with the requirements of the initial planting.

A final inspection of the contract will be made as soon as possible after replacement. All plants shall be cared for and maintained until final inspection and acceptance.

All seedlings for wildlife habitat shall be in accordance with ASNS Seedling Trees and Shrubs and will be inspected by a landscape architect within one week of planting. Spring and fall inspections as described above will not be required. The inspection, planting, and maintenance of seedlings as required will constitute final acceptance.

622.19 Blank

622.20 "Do Not Mow or Spray" Signs and "Do Not Disturb" Signs

These signs shall be placed at the boundaries of areas where seedlings for wildlife habitat have been placed. The locations and spacing of the signs shall be as shown on the plans or as directed. The sign shall otherwise be in accordance with 621.06(h).

622.21 Method of Measurement

Furnishing and planting trees, shrubs, and vines will be measured by the number of units of each type and size specified, installed, and accepted. Seedlings for wildlife habitat, "Do Not Mow or Spray" signs, and "Do Not Disturb" signs will be measured by the number installed and accepted.

Retaining wall masonry, either mortared or not mortared as specified, will be measured by the cubic yard. Porous material for root protection will be measured by the ton.

622.22 Basis of Payment

The number of trees, shrubs, and vines of each variety planted, determined as provided above, will be paid for at the contract unit price per each for plant, of the type, form, and size shown in the Schedule of Pay Items.

Seedlings for wildlife habitat, "Do Not Mow or Spray" signs, and "Do Not Disturb" signs will be paid for at the contract unit price per each.

Masonry wall and masonry tree well will be paid for at the contract unit price per cubic yard. Porous material for root protection will be paid for at the contract unit price per ton.

Payment will be made under:

Pay Item	Pay Unit Symbol
Masonry Tree Well	CYS
Masonry Wall	CYS
Plant, Annual	EACH
Plant, Aquatic	EACH
Plant, Biannual	EACH

Plant, Broadleaf Evergreen,
Cone, Broad Upright, _____ size .....EACH

Plant, Broadleaf Evergreen,
Spreading, Semispreading, _____ size .....EACH

Plant, Broadleaf Evergreen, Globe, Dwarf, _____ size .....EACH

Plant, Coniferous Evergreen,
Cone, Broad Upright, _____ size .....EACH

Plant, Coniferous Evergreen,
Globe, Dwarf, _____ size .....EACH

Plant, Coniferous Evergreen,
Prostrate Broad Spreading, Semispreading, _____ size .....EACH

Plant, Deciduous Shrub, _____ size .....EACH

Plant, Deciduous Tree, Multi-Stem, _____ size .....EACH

Plant, Deciduous Tree, Single Stem, _____ size .....EACH

Plant, Ground Cover .....EACH

Plant, Perennial .....EACH

Plant, Root Tuber, Corm, Bulb .....EACH

Plant, Rose Grade .....EACH

Porous Material for Root Protection .....TON

Seedling .....EACH

Sign, "Do Not Disturb" .....EACH

Sign, "Do Not Mow or Spray" .....EACH

The cost of furnishing all materials, labor, and necessary incidentals shall be included in the cost of the pay items. Progress payment for planting trees, shrubs, or vines will be based on the premise that 75% of the work has been completed when such trees, shrubs, or vines have been completely planted. The remaining portion of the payment will be for maintenance and plant replacement.

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SECTION 628 – FIELD OFFICE, COMPUTER SYSTEM, COMPUTER SYSTEM EQUIPMENT, OFFICE MACHINES AND COMMUNICATIONS

628.01 Description

This work shall consist of providing the specified facilities, equipment, supplies, and services in accordance with 105.03.

628.02 Field Office Requirements

When specified, the Contractor shall provide a field office, computer systems, computer system equipment, office machines, telephone service and equipment, services, equipment, and supplies for the Department's exclusive use in accordance with the minimum requirements listed below.

All equipment shall be covered by normal manufacturer's warranties. All cellular telephone units, computer systems, telephones and voice mail systems, office machines and associated equipment provided by the Contractor will remain the property of the Contractor and will be returned to the Contractor upon completion of the contract.

(a) Field Office

The field office shall be located as mutually agreed by the Engineer and the Contractor. If a building exists within the limits of the right-of-way that is acceptable as a field office and the building is scheduled to be removed under the terms of the contract, the building may be equipped and furnished as the field office. A building within the right-of-way that is furnished under this specification shall be removed prior to the date of the last work and other acceptable facilities for the field office shall then be provided.

The field office may be a permanent building or a trailer and shall be of the type shown in the Schedule of Pay Items. The building or trailer furnished for the field office shall be in accordance with all applicable State and local codes and applicable IOSHA/OSHA requirements.

The field office shall be complete and ready for use by the Department, including all utility connections, office machines, internet service, equipment and supplies, prior to the start of work. If the Contractor is unable to provide the permanent field office prior to the start of the work, the Engineer shall be notified in writing, and the Contractor and the Engineer will agree on temporary field office arrangements prior to the start of work. A temporary field office will not be accepted by the Department for more than two months, at which time a permanent field office shall be ready for the Department's use.

The field office shall, at a minimum, be the size listed below for the type specified.

1. Type A – 460 sq ft
2. Type C – 650 sq ft
3. Type D – 1,000 sq ft
4. Type E – 2,200 sq ft.

Minimum dimensions shall be 8 ft wide and 7 ft in height, from floor to ceiling. For a trailer, the calculation of minimum area will be based on the exterior box dimensions.

The office shall have a solid and level floor with no holes, a weatherproof roof and shall be dust-proof, and wind-tight. The field office shall have at least two doors for ingress and egress and shall have a minimum of six windows for a Type A or Type C field office and eight windows for a Type D or Type E field office, not including any windows in the doors.

Exterior doors shall have a satisfactory locking system. At least one door shall always be able to be unlocked and opened from inside the field office. If a padlock is used to secure a door, it shall be a high security type and shall be made inaccessible to bolt cutters, hacksaws, hammers, or prybars. The padlock shall be mounted in such a manner that locking and unlocking the door can be made with minimal effort. Installation of additional hardware to protect the lock or use of multiple padlocks on a door will not be allowed. Additional hardware to receive the padlock will be acceptable. The Contractor shall furnish the number of keys to the office as directed by the Engineer. The Department will maintain a list of all Department personnel who are given keys.

Windows shall be hinged or sliding and have a minimum area of 5 sq ft each. Windows shall be provided with satisfactory locks and screens. Windows, including windows in the doors, shall be provided with shades, blinds, or other approved coverings.

Type D and Type E field offices shall have at least one room with a minimum area of 196 sq ft for use as a conference or meeting room.

The field office shall have heating and air-conditioning equipment capable of maintaining a uniform temperature between 68°F and 80°F.

The field office shall have a minimum 100 amp, 120/240 volt electrical service, shall have sufficient receptacles to satisfactorily accommodate all required electrical equipment without the use of extension cords or splitters and shall be provided with satisfactory office type lighting.

If the field office is a trailer, the trailer shall be securely supported by adequate

blocking. The blocking shall provide a foundation to prevent settlement. The trailer shall be secured to the ground with a trailer tie down system that is in accordance with all State and local requirements. Each trailer shall be furnished with steps meeting IOSHA/OSHA requirements at each doorway.

The field office location shall be selected in order to provide satisfactory parking and trash disposal facilities for Department use. Parking spaces shall be either paved or surfaced with compacted aggregate, size No. 53, or other acceptable materials suitable for all-weather usage and shall be maintained, including snow removal. Satisfactory parking for a Type A field office shall be a minimum of six separate parking spaces. Satisfactory parking for a Type C field office shall be a minimum of 10 separate parking spaces. Satisfactory parking for a Type D field office shall be a minimum of 12 separate parking spaces. Satisfactory parking for a Type E field office shall be a minimum of 16 separate parking spaces.

Any type of field office may be used by other Department personnel from other Department contracts.

(b) Field Office Equipment and Supplies

The following minimum equipment and supplies shall be furnished for each field office of the type specified.

	OFFICE TYPE		
EQUIPMENT AND SUPPLIES	**A** and **C**	**D**	**E**
Bloodborne Pathogen Kit	1	1	1
Potable Water	Yes	Yes	Yes
Broom and Dust Pan	1	1	1
Calculators	1	2	4
Carbon Monoxide Detector	1	1	2
Chairs	8	12	20
Cleaning Supplies	Yes	Yes	Yes
Dry Erase Board	1	1	2
Electric Vacuum Sweeper	1	1	1
File Cabinet Drawers	4	8	12
Fire Extinguishers	2	2	3
First-Aid Kit	1	1	1

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EQUIPMENT AND SUPPLIES	OFFICE TYPE		
	A and **C**	**D**	**E**
Folding Office Tables	4	6	10
Microwave Oven	1	1	2
Office Desks and Office Chairs	4	5	10
Paper Shredder	1	1	1
Plan Holder	1	1	2
Refrigerator/Freezer	1	1	2
Shelving	20 lft	24 lft	48 lft
Six-hook Coat Rack	1	1	2
Smoke Detector	1	2	3
Toilet Facilities	Yes	Yes	Yes
TV Monitor	0	1	1
USB Speakerphone Microphone	No	Yes	Yes
Waste Paper Baskets	4	6	10

The office and the equipment shall be furnished in a condition satisfactory to the Department.

Adequate quantities of basic hygiene and office cleaning supplies shall be provided. These supplies shall include, but are not limited to, antibacterial hand soap in a pump container, hand sanitizer, paper towels, trash bags, toilet paper, spray air freshener, window cleaner, all-surface cleaner, toilet disinfectant, toilet brush and a toilet plunger.

Potable water shall be provided separately for drinking and hand washing purposes.

The plan holder shall have a minimum number of five individual holders, capable of holding full size plans, 24 in. by 36 in., per plan holder.

Fire extinguishers shall be 5 lb, Class ABC or higher rated and shall be maintained in a fully charged and operable condition and shall meet all IOSHA/OSHA requirements.

The toilet facilities shall consist of, at a minimum, a toilet and hand washing location. For a Type A or Type C field office, the toilet can be a portable toilet and the hand washing location can be a portable hand washing station. For a Type D or Type E field office, the toilet facilities shall be provided indoors. Indoor toilet facilities shall have an exhaust fan. Hot water is not required for the toilet facilities. If a portable toilet is provided, it shall be provided with a lock and at least two keys for the lock. If a

portable hand washing station is provided as the hand washing location, it shall always remain functional, including during freezing temperatures. The portable toilet or portable hand washing station shall be serviced a minimum of once per week and shall be maintained in such a manner as to provide consistent continual toilet facility service.

First-aid kits shall meet the requirements of ANSI Z308.1 current at the time of letting.

Shelving shall have a minimum width of 10 in.

Filing cabinets shall at a minimum be fire resistant steel filing cabinets with a Class D or higher classification established by UL or Safe Manufacturers National Association. Cabinet drawers shall have a filing depth of 25 in. All cabinets shall have a lock and at least half of the drawers shall be fireproof.

Office desktops shall be at least 48 in. wide and 25 in. deep. All desks shall contain at least two drawers, one of which shall be provided with a lock.

Folding office tables shall be a minimum size of 30 in. by 72 in.

Office chairs shall be height adjustable and equipped with castors. Other required chairs may be stackable or folding chairs.

Supplies to be furnished shall include all items required for proper operation of the required equipment. This includes, but is not limited to, operating manuals and paper supplies.

Calculators shall be electric powered, have a printer, a minimum 12-digit capacity, and have a counting function.

The paper shredder shall have a minimum capacity of 12 sheets of 20 lb paper, shall be capable of shredding paper clips and staples, and shall include a five-gallon capacity waste basket.

The dry erase board shall have a minimum size of 4 ft by 6 ft. Adequate quantities of dry erase markers and erasers shall be provided.

The TV monitor shall be at a minimum 55 in., LED, 4 series, 2160P, Smart, 4K UDH TV with HDR and shall work wirelessly with laptops. It shall be mounted on the wall of designated meeting or conference rooms as determined by the Engineer. A USB speakerphone microphone shall be a Conference Speaker Omnidirectional Computer Mic, with 360° voice pickup, touch sensor buttons for mute/unmute, streaming and shall be provided for use in designated meeting or conference rooms as determined by the Engineer.

The microwave oven shall have a minimum 1 cu ft capacity with a minimum 1,100 watts and shall have digital controls.

The refrigerator/freezer shall have a minimum 20 cu ft capacity for a Type D or Type E field office and shall have a minimum 10 cu ft capacity for a Type A or Type C field office.

The field office and all equipment and supplies shall be maintained and replenished in a satisfactory manner during the term of the contract or until released by the Engineer. If the field office or required equipment and supplies are not maintained by the Contractor, the Engineer may withhold partial payments until the field office is operational to the Department's satisfaction.

(c) Computer System and Computer System Equipment

When specified in the Schedule of Pay Items, the Contractor shall provide the computer system and computer system equipment in accordance with the minimum requirements listed below for the Department's exclusive use for each field office.

1. Computer System

a. Laptop computer
b. Processor - Intel compatible, minimum dual-core 2.0 GHz
c. Memory - 8.0 GB, 1866 MHz
d. Hard Drive - 500 GB, 7200 rpm or 256 GB SSD (Solid State Drive)
e. Ports - Two USB 2.0 compliant ports, one USB 3.0 compliant port
f. Network/Wireless - Ethernet or wireless card to be compatible with the selected internet and office network connections
g. Graphics - Integrated graphics card
h. Display - Minimum 15 in. 1366 by 768 LCD panel
i. Battery - Minimum 3-cell Lithium ion
j. Miscellaneous - One laptop docking station compatible with the Monitor, with AC adapter, one additional AC adapter, one DC adapter and one padded carrying case.

The initial condition of the computer system shall be nearly pristine. All owner installed email accounts, games, spyware, online services, applications, network or other profiles previously set up on the system shall be removed prior to placement in the field office. If the system was provided for a previous Department contract, all software not specified shall be removed prior to placement in the current field office.

The Contractor shall provide a minimum 900 J six-outlet surge protector for each computer system specified in the contract.

2. Computer System Equipment

a. Monitor - Minimum 22 in. digital panel that enables connectivity to DisplayPort and HDMI connections or an adapter
b. Keyboard - USB multimedia keyboard
c. Mouse - Optical USB 2-button scroll mouse
d. Miscellaneous - One laptop docking station compatible with the Monitor, with AC adapter, one additional AC adapter, one DC adapter that is compatible with the Department's provided laptop or mobile device, and one minimum 900 J six-outlet surge protector.

3. Computer Software

The Contractor shall provide software for the computer system in accordance with the minimum requirements listed below.

a. Operating System Software - Windows 10 Professional
b. Productivity Software - Microsoft Office 2013 Small Business and Adobe Acrobat Professional DC
c. Security Software - McAfee Total Protection.

All software shall include the most current updates and patches at the time the computer system is provided to the Department. The Contractor shall provide for installation of updates and patches for the operating system, productivity and security software during the term of use of the computer system by the Department. Updates and patches shall be provided by an automatic update method.

The Department may install and maintain proprietary software on the computer in order to run the Department’s construction management programs.

4. Miscellaneous Computer Requirements

The Contractor shall provide all cables, connections and software required to connect the computer system provided by the Contractor or by the Department to the printer and the scanner.

The Contractor shall provide an Ethernet and a wireless office network to enable all computer systems in the field office to access the field office internet service, the printer and the scanner.

The Contractor shall provide all manuals necessary for operation of the computer system, computer system equipment and software with the system and shall include all documentation normally furnished with the equipment and software when purchased.

The Department will be utilizing the computer system to run or access Department provided construction management software applications. These applications are

known to run on Intel compatible equipment when using the Windows 10 Professional operating system. If the Department experiences problems running these applications due to hardware or software compatibility, the Contractor shall replace the equipment to ensure compatibility to the satisfaction of the Engineer within five business days.

The computer system shall be maintained in good working order. If a portion of the system becomes defective, inoperable, damaged, or stolen, that portion shall be repaired or replaced within five business days after the Contractor is notified by the Engineer. If the computer system and related accessories are not maintained by the Contractor as required, the Engineer may withhold partial payments until the computer system is operational to the Department's satisfaction.

(d) Field Office Internet Service

The Contractor shall provide broadband internet service for the field office. Broadband internet service shall be capable of a minimum average download speed of 50 Mbps and a minimum upload speed of 5 Mbps, unless otherwise approved by the Engineer.

(e) Field Office Machine

The Contractor shall provide a fully operational all-in-one copier, printer, and document scanner machine for the Department's exclusive use in the field office in accordance with the minimum requirements listed herein.

The machine shall be supplied with, and shall be maintained with, one additional set of ink cartridges. The Contractor shall provide letter, legal, and ledger size paper as required by the Engineer.

The machine shall be compatible with, and shall be connected to, the computer system provided by the Contractor, or the Department, for use by the Department in the field office.

The machine shall be an Epson Workforce or HP OfficeJet Pro model that has the following minimum specifications:

1. Auto 2-sided color print, copy, and scan
2. Print, copy, and scan full size letter, legal, and ledger documents
3. Minimum of two automatic document feeder universal size trays
4. Wireless printing
5. Minimum printer resolution 1200 x 4800 dpi
6. Minimum scanner resolution 600 x 600 dpi.

If any office machine becomes defective, inoperable, damaged, stolen, or incompatible with the Department provided devices, that machine shall be repaired or replaced within five business days after the Contractor is notified by the Engineer. If any of the office machines are not maintained by the Contractor as required, the Engineer may withhold partial payments until the machine is operational to the

Department's satisfaction.

(f) Telephone Service

When specified in the Schedule of Pay Items, the Contractor shall provide telephone services and equipment, as specified below, for use by the Department on the contract.

Telephone service	Type A	Type B	Type C
Telephone line	1	2	2
Telephone	1	2	3
Telephone voice mail system	1	2	1

The telephone voice mail system shall be capable of providing both a minimum 1-minute outgoing message and 30 minutes total recording time for incoming messages. It shall have a remote operation feature, which may be used to retrieve, replay, erase, and save messages. An answering machine meeting these requirements may be substituted for the voice mail system.

At least one telephone shall be a cordless phone having a frequency of at least 900 MHz.

628.03 Mobile Internet Service

When specified, the Contractor shall provide mobile internet service for the Department's exclusive use.

The mobile broadband internet service access device will be used by the Department in a laptop computer provided by either the Contractor or the Department.

The device shall connect to the laptop via a USB 2.0 or USB 3.0 compliant port, or by wireless means. The device and service shall be capable of a minimum 4G speed. The internet service rate plan shall include unlimited data and time usage with no roaming charge for national domestic use. All software necessary for the operation of the device shall be provided to the Engineer.

The Contractor shall not purchase any device or enter into any service agreement until authorized by the Engineer. The Engineer will provide a minimum of 10 business days notice prior to the date the device will be required.

628.04 Cellular Telephones

The Contractor shall provide cellular telephone equipment and services, as specified below, for use by the Department on the contract.

Each cellular telephone unit shall have a service coverage area that includes the project limits. Each cellular telephone unit shall include a belt clip system, a 120V AC charger, a 12V DC mobile charger, and a hands-free kit consisting of a speaker and a microphone enabling the user to operate the unit with minimal need for the use of their

hands. The hands-free kit shall be wireless.

All equipment shall be covered by normal manufacturer's warranties. All cellular telephone units and associated equipment will remain the property of the Contractor and will be returned to the Contractor upon completion of the contract.

Cellular telephone units shall meet the following minimum requirements:

(a) Type A

1. internet ready device with minimum 5 in. display, measured diagonally
2. cellular telephone anytime minutes per month as shown in the Schedule of Pay Items
3. unlimited nights and weekends service
4. voice mail and caller ID
5. protective case to prevent damage to the unit
6. rear facing camera with a minimum 8 MP resolution
7. minimum 1080p video capture
8. 5 GB or higher data plan per unit
9. internal memory of 64 GB or higher.

(b) Type B

1. a cellular telephone with anytime minutes per month as shown in the Schedule of Pay Items
2. unlimited nights and weekends service
3. voice mail and caller ID
4. built-in camera with a minimum 5 MP resolution.

The Department will be responsible for damage or loss of the units beyond that covered by normal manufacturer's warranties, while in use by the Department. The Contractor shall provide replacement cellular telephone units, batteries, chargers, and equipment within one business day of notification of need for the item.

The Contractor shall not enter into any agreement with any service provider or purchase any cellular telephone units for use by the Department until authorized by the Engineer. The Engineer will notify the Contractor a minimum of 10 business days prior to the need for the units.

628.05 Method of Measurement

Field office will be measured by the month for the specified type. Partial months will be rounded up to the next 1/2 or whole month. The Department will provide two weeks advanced notice prior to when the facility will be vacated.

Computer system and computer system equipment will be measured by the number of units specified.

Telephone service will be measured by the month for the specified type. Partial months will be rounded up to the next 1/2 or whole month. The Department will provide two weeks advanced notice prior to when the telephone service will be vacated.

Cellular telephones will be measured by the number of units required for the type specified. Mobile internet service and cellular telephone service will be measured by the month for each system or service provided. Partial months will be rounded up to the next 1/2 or whole month. The Department will provide two weeks advanced notice prior to when mobile internet service and cellular telephone service will no longer be required.

628.06 Basis of Payment

Field office will be paid for at the contract unit price per month, complete in place until released.

Computer system and computer system equipment will be paid for at the contract unit price per each for the units provided.

Telephone service will be paid for at the contract unit price per month, complete in place until released. Mobile internet service will be paid by the month for each system or service provided.

Cellular telephone units will be paid for at the contract unit price per each per each type specified. Cellular telephone service will be paid for at the contract unit price per month per each phone. Monthly charges for cellular telephone minutes and data in excess of those specified in the contract will be paid for by the dollar amount for the invoiced price per each occurrence as cellular telephone, additional charges.

Payment will be made under:

Pay Item	Pay Unit Symbol
Cellular Telephone Service, _____ (anytime minutes)	MOS
Cellular Telephone, _____ (type)	EACH
Cellular Telephone, Additional Data	DOL
Cellular Telephone, Additional Minutes	DOL
Computer System Equipment	EACH
Computer System	EACH
Field Office, _____ (type)	MOS
Mobile Internet Service, _____ Each (quantity)	MOS
Telephone Service, _____ (type)	MOS

The cost of all heating, cooling, electrical service, and other miscellaneous utility bills required for the field office shall be included in the cost of the field office.

If a field office smaller than the specified type is approved by the Engineer, a new unit price will be established for the smaller field office. The new unit price will be equal to the original contract unit price multiplied by the smaller floor area and divided by the specified floor area.

All costs necessary to provide and maintain the telephone service, including monthly charges and installation of telephone lines, shall be included in the cost of the telephone service.

If a temporary field office is provided in accordance with 628.02, payment will be 65% of the unit price during the time the temporary field office is in use by the Department.

The cost of all materials and labor necessary to setup, secure, maintain, and remove the field office, including all required equipment and supplies and any material required to provide parking, shall be included in the cost of the respective pay item.

All costs necessary to provide and maintain the computer system, computer system equipment, including the required software, manuals, technical support, and miscellaneous computer requirements shall be included in the cost of the computer system or computer system equipment.

All costs necessary to establish, install, and maintain field office internet service, both wireless and Ethernet, field office network, including any required hardware, software, fees, monthly charges, setup, installation, and technical support shall be included in the cost of the field office.

All costs associated with providing the field office for any type of field office for use by other Department personnel from other Department contracts shall be included in the cost of the field office.

All costs necessary to provide the all-in-one copier, printer, and document scanner machine, including setup, installation, all required connections to computers, technical support, and miscellaneous office machine requirements shall be included in the cost of the field office.

All costs necessary to establish, install and maintain mobile internet service, including required hardware, software, fees, monthly charges, setup, installation, and technical support shall be included in the cost of mobile internet service. The Contractor shall provide a copy of the detailed invoice from the service provider for each cellular telephone unit each month.