

PART VII—INCIDENTAL CONSTRUCTION

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Section 701 Culverts and Storm Drains

701.01 DESCRIPTION. Furnish, install, and clean pipe, pipe arch, storm drains, and sewers, also referred to as culverts or conduits, in accordance with these specifications and in conformity with the lines and grades shown on the plans or as established by the engineer.

701.02 MATERIALS. Materials shall comply with the following sections and subsections:

Usable Soil	203.06.1
Selected Soil	701.08.1
Plastic Soil Blanket	203.10
Flowable Fill	710
Portland Cement Concrete	901
Mortar	1001.03
Reclaimed Asphalt Pavement (RAP)	1003.01.3.2, 1003.06.5
Stone	1003.03.1
Recycled Portland Cement Concrete	1003.03.2
Granular Material	1003.09
Bedding Material	1003.10
Thermoplastic Pipe	1006
Split Plastic Coupling Bands	1006.06
Plastic Yard Drain Pipe	1006
Gasket Material	1016.01.1
Reinforced Concrete Pipe	1016.02
Reinforced Concrete Pipe Arch	1016.03
Bituminous Coated Corrugated Steel Pipe and Pipe Arch	1007.02
Structural Plate for Pipe, Pipe Arch and Arch	1007.04
Corrugated Aluminum Pipe and Pipe Arch	1007.05
Coupling Bands	1007.09, 1007.08.1
Reinforcing Steel	1009
Geotextile Fabric	1019

701.02.1 Side Drain Pipe or Side Drain Pipe Arch: When an item for Side Drain Pipe or Side Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe

arch, or reinforced concrete pipe or reinforced concrete pipe arch as allowed by Sections 1006, 1007, or 1016, respectively, unless otherwise specified.

701.02.2 Cross Drain Pipe or Cross Drain Pipe Arch: When an item for Cross Drain Pipe or Cross Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, corrugated metal pipe or corrugated metal pipe arch, or reinforced concrete pipe or reinforced concrete pipe arch as allowed by Sections 1006, 1007, or 1016, respectively, unless otherwise specified.

701.02.3 Storm Drain Pipe or Storm Drain Pipe Arch: When an item for Storm Drain Pipe or Storm Drain Pipe Arch is included in the contract, furnish thermoplastic pipe, reinforced concrete pipe or reinforced concrete pipe arch allowed by Sections 1006 or 1016, respectively, unless otherwise specified.

701.02.4 Yard Drain Pipe: When an item for Yard Drain Pipe is included in the contract, furnish thermoplastic pipe in accordance with Section 1006 unless otherwise specified.

701.02.5 Material Type Abbreviations:

701.02.5.1 Reinforced Concrete Pipe:

RCP	Reinforced Concrete Pipe
RCPA	Reinforced Concrete Pipe Arch

701.02.5.2 Corrugated Metal Pipe:

CAP	Corrugated Aluminum Pipe
CAPA	Corrugated Aluminum Pipe Arch
CMP	Corrugated Metal Pipe
CMPA	Corrugated Metal Pipe Arch
CSP	Corrugated Steel Pipe
CSPA	Corrugated Steel Pipe Arch
BCCSP	Bituminous Coated Corrugated Steel Pipe
BCCSPA	Bituminous Coated Corrugated Steel Pipe Arch

701.02.5.3 Thermoplastic Pipe:

TPP	Thermoplastic Pipe
PVCP	Polyvinyl Chloride Pipe
RPVCP	Ribbed Polyvinyl Chloride Pipe
CPEPSW	Corrugated Polyethylene Pipe Single Wall
CPEPDW	Corrugated Polyethylene Pipe Double Wall

701.02.6 Joint Type Abbreviations:

T1	Type 1 Joint
T2	Type 2 Joint
T3	Type 3 Joint

701.02.7 Quality Assurance for Pipe: Manufacturing plants will be periodically inspected for compliance with specified manufacturing methods, and material samples will be randomly obtained for laboratory testing for verification of manufacturing lots. Materials approved at the manufacturing plant will be subject to visual acceptance inspections at the jobsite or point of delivery.

701.03 EXCAVATION. For all trench excavation, ensure that the sides of the trench are stable, as evidenced by the sides of the trench being able to maintain a vertical cut face. Consider the sides unstable if fissures develop in the face of or adjacent to the open excavation; if the edge of the excavation subsides; if material ravel, spalls, or slumps from the face of the excavation; or if the bottom of the excavation bulges or heaves. In all cases of apparent distress, or when the trench excavation exceeds 5 feet in depth, sloping, benching, and shoring will be required in accordance with the OSHA trench safety standards, 29 CFR § 1926 (P). Consider these and any more stringent trench safety standards as minimum contract requirements.

Submission of bid and subsequent award of contract will serve as certification that all trench excavation in excess of 5 feet will be in compliance LA R.S. 48:251.1.

Consider all available geotechnical information when designing the trench excavation safety system, including groundwater. Evaluate trench stability due to the effects of surcharge loads from adjacent structures, stored materials and equipment, or traffic. Ensure that excavated material is placed a sufficient distance back from the trench edge to preclude material from falling back into the trench, otherwise provide an adequate retention system.

Ensure that the bottom width of a pipe trench provides at least 18 inches of clearance on each side of the pipe. In accordance with 202.02, satisfactorily dispose of surplus excavated material that does not conform to the requirements of 203.06.1. Control rainfall runoff or excess moisture by proper selection of backfill materials, dewatering sumps, wells, well points, or other approved procedures during excavation, bedding installation, over-excavated trench backfilling, pipe placement, and pipe backfill.

701.03.1 Over-Excavation: When encountering unsuitable soils as defined in 203.04, or a stable, non-yielding foundation cannot be obtained at either the established pipe grade or at the grade established for placement of the bedding, remove unstable or unsuitable soils below this grade and replace with granular material complying with 1003.09, bedding materials complying with 1003.10, or Type A backfill complying with 701.08.1. Place all granular backfill materials below the established pipe or bedding grade in

lifts less than 8 inches thick. Compact sufficiently with a dynamic mechanical hand compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

When encountering rock, remove the rock below grade and replace it with granular material, bedding materials, or Type A backfill. Provide a compacted earth cushion thickness under the pipe of at least 1/2 inch per foot of fill height over the top of the pipe with a minimum thickness of 8 inches. Place all granular backfill materials below the established pipe or bedding grade in lifts less than 8 inches thick. Sufficiently compact with a dynamic mechanical hand operated compaction device over the surface of each lift to form a stable, non-yielding foundation at the surface of the established bedding or pipe grade.

Materials used to backfill in an over-excavated portion of a trench do not require encasement in a geotextile fabric.

701.04 FORMING PIPE BED. When specifying bedding material, construct in accordance with Section 726. Materials allowed for bedding shall comply with 1003.10 or may be type a backfill materials. When specifying bedding materials, perform additional excavation below established pipe grade and place the bedding material in lifts less than 8 inches thick. Lightly compact with a dynamic hand compaction device over the surface of each lift.

When the bottom of the pipe is not laid in a trench but constructed above natural soils, construct a uniform bed as specified for the bottom of a trench.

In lieu of removing and replacing unstable soil with granular material, bedding material, or Type A backfill material, a cabled articulated concrete block mattress meeting the requirements of Section 712 may be used with a 6-inch layer of bedding material between the pipe and the mattress installed in accordance with Section 726. Excavate the trench to a depth 6 inches plus the thickness of the mattress below the grade line of the pipe. Join adjacent mattress segments together to form a continuous supporting foundation beneath the pipe to the satisfaction of the engineer.

701.05 LAYING PIPE. Begin laying pipe at the downstream end of the line. Ensure that the pipe is in contact with the foundation throughout its length. Place bell or grooved ends of pipe and outside circumferential laps of riveted metal pipe facing upstream. Place riveted seam metal pipe with longitudinal laps at sides. Pipes in each continuous line shall have the same

wall thickness. Handle metal pipes provided with lifting lugs only by these lugs.

After laying pipe and before placing backfill, the engineer will inspect the pipe for alignment, grade, integrity of joints, and coating damage.

701.06 JOINING PIPE.

701.06.1 Joint Usage:

701.06.1.1 Type 1 (T1) Joints: Use Type 1 joints for side drains under driveways and similar installations.

701.06.1.2 Type 2 (T2) Joints: Use Type 2 joints for cross drains under roadways, including turnouts.

701.06.1.3 Type 3 (T3) Joints: Use Type 3 joints for storm drain systems, flumes, and siphons.

701.06.2 Concrete Pipe: Concrete pipe may be either bell and spigot or tongue and groove. Join pipe sections so that ends are fully entered and inner surfaces are flush and even.

Use an approved mechanical pipe puller for joining pipes over 36 inches in diameter. For pipe 36 inches or less in diameter, use any approved method for joining pipe that does not damage the pipe.

Joints shall comply with 1016.01.1 and 1018.03. Seal with gasket material installed in accordance with the manufacturer's recommendations.

701.06.3 Metal Pipe: Firmly join metal pipe by coupling bands. Center bands over the joint.

For Type 1 joints, place approved gasket material in one corrugation recess on each side of the joint at the coupling band and on each band connection in such manner to prevent leakage.

When Type 2 or 3 joints are specified, join metal pipe sections as follows:

701.06.3.1 General: Seal band joints with gasket material. Place gasket material in accordance with the plan details.

701.06.3.2 Circular Section: Connecting bands shall be of an approved design. Install in accordance with plan details.

701.06.3.3 Arch Section: Connecting bands shall be a minimum of 12 inches wide for a pipe arch less than 36 inches round equivalent diameter, and a minimum of 21 inches wide for pipe arch 36 inches round equivalent diameter and greater. Connect bands at the ends by approved angle or strap connections. Use two-piece connecting bands for a pipe arch 36 inches round equivalent diameter and greater.

701.06.4 Plastic Pipe: Joints for plastic pipe shall be bell and spigot or split coupling bands.

701.06.4.1 Bell and Spigot Type Joint System: Join pipe sections so that ends are fully entered and inner surfaces are flush and even.

Use any approved method for joining pipe that does not damage the pipe.

After joints approval, seal with a rubber gasket material complying with 1007.08.4.1.

701.06.4.2 Split Coupling Type Joint System: Split coupling bands shall comply with all dimensional and material requirements of 1006.06. Center the bands over the joint. Secure the split coupling band to the pipe with a minimum of five stainless steel or other approved corrosion resistant bands.

After joints approval, seal with gasket material. Place gasket material in the first two corrugation recesses on each side of the pipe connection. Also place gasket material on each band connection to prevent leakage. When using flexible plastic gasket material, it shall be a minimum of 1/2 inch in size. Tighten the bands to create overlap of the band and adequately compress the gasket material.

701.06.5 Connections: Use approved connections when joining new pipes to existing pipes. When using concrete collars to extend the ends of existing pipes that have been damaged or to join different types or sizes of pipes, construct the concrete collars in accordance with plan details, the applicable requirements of Section 901, and as directed.

701.06.6 Geotextile Fabric Wrapped Pipe Joints: For concrete, metal, and plastic pipes, use Types 2 and 3 joints wrapped with geotextile fabric for a minimum of 12 inches on each side of the joint for pipe 36 inches or less in diameter and a minimum of 18 inches on each side of the joint for pipe greater than 36 inches in diameter. Wrap the ends of the fabric around the circumference of the pipe and overlap at least 10 inches. Secure the edges and ends of fabric for the entire circumference of the pipe.

701.07 RELAYING PIPE. If specified or directed, remove existing pipes and relay suitable sections as specified for new pipes.

701.08 BACKFILLING.

701.08.1 General: Prior to backfilling, remove pipes found to be damaged or out of alignment or grade; reinstall or replace.

Type A backfill material shall be stone, recycled portland cement concrete, flowable fill, or RAP.

Type B backfill materials are select soils. Select soils are natural soils with a maximum PI of 20, a maximum liquid limit of 35, and a maximum

organic content of 5 percent. Soils with a silt content of 50 percent or greater and also a PI of 10 or less will not be allowed. Where Type B backfill materials are called for, Type A backfill materials may be substituted.

When using corrugated metal pipe, the backfill material shall be tested and shall have a resistivity greater than 1500 ohm-cm and a pH greater than 5 when tested in accordance with DOTD TR 429 and DOTD TR 430 respectively.

When using Type A backfill material, place geotextile fabric to surround this backfill in accordance with 726.03 between the aggregate backfill material and all other natural or placed soils in the trench or embankment. Take care to prevent damage to geotextile fabric during placement of backfill material. For concrete pipe, enclose not only the initial backfill with the fabric, but wrap the fabric over the top of the pipe with at least 12 inches of overlap.

When using a trench box or trench sheeting in unstable soils and/or for worker safety, and when moved during backfilling operations, immediately fill and provide additional compaction of the disturbed zone of backfill to the satisfaction of the engineer.

Initial backfill is a structural backfill encasing the pipe from the bottom of the pipe to the springline for concrete pipe and to a point one foot above the top of the pipe for both metal and plastic pipe. Final backfill is not a structural backfill. Final backfill extends from the top of the initial backfill to the top of the natural ground or subgrade in cut areas or to the top of existing ground in fill areas. Consider and treat any fill required above the final backfill as embankment.

701.08.2 Backfill Applications: For projects using the A+B+C bidding method where considering rigid and flexible pavement alternates, use the backfill application in 701.08.2.2 for either rigid or flexible pavements.

701.08.2.1 Pipe Under Concrete Pavements: Type B backfill may be used as initial and final backfill for all pipes, culverts, or drains under portland cement concrete pavements. Place and compact as specified in 701.08.4.

701.08.2.2 Cross Drains Under Flexible Pavements: All reaches of cross drains, exclusive of those portions of the pipe which are under shoulders, and all other culverts, pipes, or drains that cross the centerlines of new or existing flexible pavement roadways, including intersections that are under flexible pavements, shall receive an initial backfill of Type A material. Type B backfill materials may be used as final backfill for all pipes. Place and compact as specified in 701.08.3 and

701.08.4. Where the subgrade is above existing ground, use embankment material as specified for the remainder of the project from the top of the final backfill to the top of the established embankment grade.

701.08.2.3 Other Drains Under Flexible Pavements: All reaches of all culverts, pipes, or drains under flexible pavements that do not cross the centerlines of new or existing roadways, and exclusive of those portions of the pipe which are totally under shoulders, shall receive an initial and final backfill of Type B material. Place and compact as specified in 701.08.4. Where the subgrade is above existing ground, use embankment material as specified for the remainder of the project from the top of the final backfill to the top of the established embankment grade.

701.08.2.4 Other Areas: All culverts, pipes, or drains in unpaved areas or paved areas that serve as driveways or shoulders shall receive an initial and final backfill of Type B material. Place and compact as specified in 701.08.4.

701.08.2.5 Pipes Subject to Construction Traffic: Construct the embankment or pipe backfill to a minimum height of 24 inches over the pipe before allowing heavy construction equipment to cross the installation. Where practical, do not construct installations with less than 24 inches of cover over the top of the pipe until after completing the heavy hauling over the pipe location. After completion of hauling operations, remove excess cover material. Remove and reinstall or replace, pipe damaged by hauling and backfilling operations at no direct pay.

701.08.3 Placement and Compaction - Type A Backfill: For all pipes, culverts, and conduits under paved and unpaved areas, where using Type A backfill material, thoroughly hand compact the Type A backfill under the pipe haunches and then dynamically compact in layers not exceeding 8 inches compacted thickness. Initially compact under the haunches of the pipe by hand tamping or other acceptable means, until reaching a level in which the dynamic tamping can commence. Compact each lift by applying at least eight passes of a hand operated, dynamic mechanical compaction device over the surface of each lift. With approval of the engineer, layer thickness may be increased to 12 inches with verification of satisfactory installation and performance. If using flowable fill, furnish, place, and consolidate in accordance with Section 710. Control placement operations during initial backfill operations without damage to protective coatings on metal pipes. Repair damaged coatings at no additional pay.

701.08.4 Placement and Compaction - Type B Backfill: For all pipes, culverts, and conduits where Type B backfill is allowed, place the

Type B material in layers not exceeding 8 inches compacted thickness. Compact with suitable mechanical equipment. With approval of the engineer, layer thickness may be increased to 12 inches with verification of satisfactory installation and performance.

701.08.5 Placement and Compaction- Trenchless or Partial Trench Condition: All pipes, culverts, drains, and conduits placed with any portion of the pipe above existing ground shall comply with 701.08.1, 701.08.2, 701.08.3; 701.08.4 shall be for the portion of the pipe within a trench and the portion of the pipe not constructed in a trench. The initial and final backfill of that portion of pipe above existing ground and not within a trench shall be constructed to such a width that the requirements for placement, compaction, and density are met.

701.08.6 Density Requirements: The in-place density of Type A backfill materials and bedding materials will not be measured or calculated. Place Type A backfill, exclusive of RAP and flowable fill, at or near optimum moisture content in accordance with DOTD TR 415 or 418. Place and compact RAP materials in a slightly moist condition.

Determine the maximum dry density of initial or final Type B backfill under all paved areas which are to be under traffic in accordance with DOTD TR 415 or TR 418. Determine in-place density in accordance with DOTD TR 401. Place initial and final Type B backfill under all paved areas under traffic, at or near optimum moisture content in accordance with DOTD TR 415 or TR 418. Compact each layer by approved methods prior to the placement of a subsequent layer. The engineer will approve the compaction method upon validation that such method, including moisture control, will achieve at least 95 percent of maximum dry density in accordance with DOTD TR 401. Density testing on subsequent backfill layers may be waived by the engineer if installation has been in accordance with approved compaction methods and performance has been continuously satisfactory. Place initial and final backfill in unpaved or paved areas, such as shoulders or driveways, evenly and compact along the length of the culvert, pipe, or drain from the top of the initial backfill to the top of the subgrade. Compact layered backfill to at least the density of the adjoining existing soils or the compaction required of the laterally adjoining layers of soil immediately outside the trench for embankment elevations. Place and compact initial and final backfill at or near optimum moisture content in accordance with DOTD TR 415 or TR 418.

701.09 INSPECTION OF PIPES. After completion of embankment and prior to roadway surfacing, the engineer shall inspect pipes for proper

alignment and integrity of joints. Correct any misaligned pipe or defective joints at no direct pay.

701.09.1 Plastic Pipe: Test installed plastic pipe to ensure that vertical deflections do not exceed 5.0 percent. Maximum allowable deflections shall be governed by the mandrel requirements stated herein.

Perform deflection tests no sooner than 30 calendar days after installation and compaction of backfill. Clean the pipe and inspect for offsets and obstructions prior to testing.

For pipe 36 inches and less in diameter, pull a mandrel through the pipe by hand to ensure that maximum allowable deflections have not been exceeded. The mandrel must be approved by the engineer prior to use. Use of an unapproved, mandrel or a mandrel altered or modified after approval mandrel will invalidate the test. If the mandrel fails to pass through the pipe, the pipe is over-deflected.

Unless otherwise permitted, uncover over-deflected pipe and, if not damaged, reinstall. Do not reinstall damaged pipe. Remove and replace with new pipe. Any pipe subjected to any method or process other than removal, which attempts, even successfully, to reduce or cure any over-deflection, shall be removed and replaced with new pipe.

Use a rigid, nonadjustable, odd-numbered leg (minimum 9 legs) mandrel having a length not less than its nominal diameter or 24 inches, whichever is less. The minimum diameter at any point shall be 5.0 percent less than the base inside diameter of the pipe being tested. The mandrel shall be fabricated of steel, aluminum, or other approved material fitted with pulling rings at each end. The nominal pipe size and outside diameter of the mandrel shall be stamped or engraved on some segment other than a runner. Furnish a suitable carrying case.

For pipe larger than 36 inches in diameter, determine deflection by a method approved by the engineer. If a mandrel is selected, the minimum diameter, length, and other requirements shall conform to the above requirements.

Conduct mandrel testing in the presence of the engineer. Mandrel testing shall be at no direct pay.

701.09.2 Metal Pipe: If the inside diameter of metal pipe or rise dimension of metal pipe arch deflects more than 5.0 percent from original dimensions, remove and reinstall the metal pipes or pipe arches, unless they do not rebound or are damaged. Remove pipes or pipe arches which are damaged or do not rebound; and replace at no direct pay. Measurement of deflection will be made by the engineer away from rerolled ends.

701.10 CLEANING PIPES.

701.10.1 Existing Pipes: Clean designated pipes of soil, debris, and other materials to the invert of the pipe by approved methods that will not damage the pipes. Satisfactorily repair all damage caused by the contractor's operations at no direct pay.

Dispose of removed soil, debris, and other materials in accordance with 202.02 or as otherwise approved in writing.

701.10.2 Contractor Installed Pipes: Prior to final acceptance, clean pipes of all debris and soil to the invert of the pipe at no direct pay.

Dispose of removed soil, debris, and other materials in accordance with 202.02 or as otherwise approved in writing.

701.11 STUBBING AND PLUGGING PIPES. Construct pipe plugs with Class R concrete complying with Section 901. Thickness of plug and method of construction shall be as directed.

When stubbing new pipes are to be stubbed into new or existing pipes or other structures, make the connection with approved mortar complying with 1001.03.

701.12 MEASUREMENT.

1. The length of new and re-laid pipe will be measured in linear feet along the pipe from end to end unless stated otherwise.
2. Pipe tees, elbows, and other fittings will be measured per each fitting. The length of pipe in such fittings will be included in the pay length measurement of pipes of which they form a part.
3. Excavation required for pipe installation will not be measured for payment, except as otherwise specified in 203.14 and 701.12.10.
4. Furnishing and placing backfill material below existing ground level for pipes will not be measured for payment. Backfill material needed to complete backfill above natural ground and around pipes that extend above natural ground will be measured for payment under applicable earthwork items. When specifying flowable fill, measure for payment in accordance with Section 710.
5. Plugging and stubbing of pipes will not be measured for payment.
6. Cleaning existing pipes will be measured by the length of pipe cleaned and accepted.
7. Concrete collars will be measured per each.
8. Dewatering of excavated areas will not be measured for payment.

9. Special shoring and bracing (depth > 5 feet), needed in addition to OSHA requirements for trench safety, will be measured by the square foot of wall area.

10. Trench excavation safety protection (depth > 5 feet) will be measured by the length of trench having a depth > 5 feet below natural ground.

701.13 PAYMENT. Payment for concrete and metal pipe will be made at the contract unit price per linear foot of the types and sizes specified, which includes all labor, materials, equipment, tools, and incidentals necessary to complete the work.

When plastic pipe is shown on the plans or elected to be used by the contractor, payment will be made at the contract unit price per linear foot of the types and sizes specified in accordance with the payment schedule of Table 701-1.

**Table 701-1
Payment Schedule for Plastic Pipe**

Percent Payment	Stage of Completeness
75	After placement and backfill has been completed
25	After the pipe has met vertical deflection requirements in accordance with 701.09.1

Payment for fabricating pipe tees, elbows, and other fittings will be made at the contract unit price per each fitting.

When unstable conditions are encountered, the additional excavation will not be measured for payment; however, the additional materials furnished and placed for the pipe foundation will be measured and paid for as follows:

1. Granular Materials: Payment will be made under the embankment item. The net section volume of the materials will be multiplied by 3 to determine the pay volume. When the contract does not include a pay item for embankment, payment will be made in accordance with 104.02.

2. Bedding Material: Measurement and payment will be made in accordance with Section 726. When the contract does not include a pay item for bedding material, payment will be made in accordance with 104.02.

3. Trench Excavation Safety Protection: When excavation depths exceed 5 feet from natural ground, safety precautions for excavations in compliance with OSHA are required and will be paid per linear foot of trench. When the

contract does not include a pay item for trench excavation safety protection, payment will be made in accordance with 104.02.

Payment for cleaning existing pipes will be made at the contract unit price per cleaned linear foot.

Payment for concrete collars will be made at the contract unit price per each.

Payment for special shoring and bracing will be made at the contract unit price per square foot of wall area.

Payment will be made under:

Item No.	Pay Item	Pay Unit
701-01	Cross Drain Pipe	Linear Foot
701-02	Cross Drain Pipe Arch	Linear Foot
701-03	Storm Drain Pipe	Linear Foot
701-04	Storm Drain Pipe Arch	Linear Foot
701-05	Side Drain Pipe	Linear Foot
701-06	Side Drain Pipe Arch	Linear Foot
701-07	Yard Drain Pipe	Linear Foot
701-08	Relaying Pipe	Linear Foot
701-09	Pipe Fittings	Each
701-10	Reinforced Concrete Pipe (Extension)	Linear Foot
701-11	Reinforced Concrete Pipe Arch (Extension)	Linear Foot
701-12	Corrugated Metal Pipe (Extension)	Linear Foot
701-13	Corrugated Metal Pipe Arch (Extension)	Linear Foot
701-14	Cleaning Existing Pipes	Linear Foot
701-15	Concrete Collar	Each
701-16	Plastic Pipe (Extension)	Linear Foot
701-17	Trench Excavation Safety Protection (Depth >5 feet)	Linear Foot
701-18	Special Shoring and Bracing (Depth >5 feet)	Square Foot

Section 702

Manholes, Junction Boxes, Catch Basins, and End Treatments

702.01 DESCRIPTION. Construct, install, and adjust manholes, junction boxes, catch basins, culvert end treatments, and safety ends in accordance with these specifications and in conformity with lines and grades shown on the plans or established.

702.02 MATERIALS. Materials shall comply with the following sections and subsections:

Cast-in-Place Concrete (Class M)	901
Portland Cement	1001.01
Mortar Sand	1003.08.1
Sewer Brick	1018.12.1
Asphaltic Varnish	1008.03
Reinforcing Steel	1009.01
Precast Reinforced Concrete Drainage Units	1016
Frames, Grates, and Covers for Manholes, Catch Basins, and Junction Boxes	1013.05, 1013.06
Geotextile Fabric	1019

The contractor may furnish structures of either cast-in-place concrete or precast concrete units.

Use mortar complying with 1001.03. Use mortar within 30 minutes after mixing or as recommended by the manufacturer.

702.03 QUALITY ASSURANCE. Manufacturing plants will be inspected periodically for compliance with specified manufacturing methods. Material samples will be randomly obtained for laboratory testing for verification of manufacturing lots.

Materials will be subject to inspection at any time during the work.

702.04 CONSTRUCTION REQUIREMENTS. Construct all cast-in-place structures in dry or dewatered areas, unless otherwise directed. Provide dewatering, shoring and bracing needed to comply with OSHA requirements at no cost to the Department. Remove logs, stumps, and other undesirable material.

702.04.1 Manholes, Junction Boxes, and Catch Basins:

Concrete construction shall conform to Section 805. Joints shall be full mortar joints no more than 1/2 inch wide. When specified, plaster outside faces of structures with 1/2 inch thick cement-sand mortar. Cure exposed surfaces of concrete and masonry in accordance with 805.10 for at least 48 hours.

Cast precast concrete units with the specified number and size of pipe openings required for the drainage system; however, if additional pipe is required during construction for which no openings have been supplied, make such openings, provided any damaged units are replaced or satisfactorily repaired. Set precast units to established grade within $\pm 1/2$ inch. Seal joints for sectional precast units with flexible plastic gasket material complying with 1016.01.1 and install to form a watertight seal. Wrap the joints of precast units with geotextile fabric a minimum of 18 inches on each side of the joint. Lap the ends of the fabric at least 10 inches. Secure the edges and ends of the cloth.

Set metal frames in a full mortar bed. Conduit sections shall be flush on the inside of structure wall and project outside sufficiently for proper connection with the next conduit section. Fit masonry neatly and tightly around conduit.

When grade adjustments of existing structures are specified, remove the frames, covers, and gratings and reconstruct the walls as required. Clean the frames and reset at required elevation. Thoroughly clean metal parts and place in good repair. In lieu of resetting structures, structures may be adjusted by means of approved metal adjustment rings.

Clean new structures of silt, debris or other foreign matter. Coat non-galvanized metal parts of new or adjusted structures with asphaltic varnish meeting the requirements of 1008.03 or jet black metal work paint satisfactory to the engineer.

Backfill the structure in accordance with 701.08.

Dispose of excavated material not satisfactory for backfill and surplus material in accordance with 202.02.

702.04.2 Culvert End Treatments: Construct culvert end treatments to control erosion at the ends of cross drains and side drains in accordance with these specifications, the plans, and as directed. Submit designs other than those shown on the plans for approval.

702.04.2.1 Concrete Toe Wall Placement: Cast-in-place toe walls shall conform to 805.05 and plan details.

702.04.2.2 Geotextile Fabric Placement: Place geotextile fabric in accordance with 712.03.1.

702.04.2.3 Sacked Concrete (Wet-Batched) Placement:

Revetment: Wet-batched sacked concrete revetments shall conform to the requirements of Section 712. Begin placement of sacked concrete at the toe of the revetment and progress to the end of the pipe. Comply with the compressive strength requirements of Section 901 for Class R concrete.

Toe Wall: Stack sacks as indicated on the plans.

702.04.2.4 Sacked Concrete (Dry-Batched) Placement:

Revetment: Dry-batched sacked concrete revetments shall conform to the requirements of Section 712. Begin placement at the toe of the revetment and progress to the end of the pipe. Submit a certificate of compliance from the supplier of the dry-batched revetment with each shipment showing the proportions of cement and sand used (or other approved aggregates). Mix the contents of the package with water as required to produce a slump of 2 to 5 inches. Comply with the compressive strength requirements of Section 901 for Class R concrete.

Toe Wall: Stack sacks as indicated on the plans.

702.04.2.5 Stone Placement: Stone revetment shall conform to the requirements of Section 712.

702.04.3 Culvert Safety Ends: Furnish and install safety ends on cross drains and side drains in accordance with these specifications, the plans, and as directed. Submit designs other than those shown on the plans for approval.

Fabricate and place reinforcing steel in accordance with Section 806.

Cast-in-place or precast concrete shall comply with Section 805.

Bolt pipe runners in place as shown on the plans. Cast bolts into the plastic concrete or place in approximately 1-inch diameter holes and epoxy in place using an Approved Materials List anchor system as directed.

702.04.4 Frames, Grates, and Covers for Manholes, Catch Basins, and Junction Boxes: Metal units shall comply with the following requirements:

1. Gray and ductile iron castings shall comply with 1013.06.1.
2. Steel castings shall comply with 1013.05.
3. Structural steel shall comply with 1013.01 and rivet steel shall comply with 1013.02.
4. Galvanizing shall comply with ASTM A123.

702.05 MEASUREMENT. Measure new and adjusted junction boxes, manholes, catch basins, culvert end treatments, and safety ends per each. Excavation and backfill required for installation of these units will not be measured for payment. Dewatering, shoring and bracing needed to meet OSHA requirements are considered incidental to the work will not be measured for payment.

702.06 PAYMENT. Payment for new and adjusted junction boxes, manholes, catch basins, culvert end treatments and safety ends will be made at the contract unit price per each which will include all materials, tools, equipment, labor and incidentals necessary to complete the work.

The concrete in cast-in-place manholes, junction boxes, catch basins, and culvert end treatments and safety ends will be identified by lots and will be subject to pay adjustments in accordance with Table 901-5 and Note 1 therein. Acceptance for each precast concrete manhole, junction box, and catch basin lot will be in accordance with the requirements of Standard Plan PC-01. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

Payment will be made under:

Item No.	Pay Item	Pay Unit
702-01	Junction Boxes	Each
702-02	Manholes	Each
702-03	Catch Basins	Each
702-04	Adjusting _____	Each
702-05	Cross Drain End Treatment	Each
702-06	Side Drain End Treatment	Each
702-07	Cross Drain Safety End	Each
702-08	Side Drain Safety End	Each

Section 703 Underdrain Systems

703.01 DESCRIPTION. Construct pipe underdrain systems in accordance with these specifications and in conformity with lines and grades shown on the plans or established.

703.02 MATERIALS. Materials shall comply with the following sections and subsections:

Asphalt Concrete	502
Portland Cement Concrete (Class M)	901
Aggregate Backfill (Size 3) (Crushed or Uncrushed)	1003.07
Granular Material (Backfill)	1003.09
Perforated and Non-perforated Underdrain Plastic Pipe	1006.01
Perforated Bituminous Coated Corrugated Steel Pipe	1007.03
Perforated Corrugated Aluminum Pipe	1007.06
Reinforcing Steel	1009.01
Precast Concrete Headwalls	1016.06
Hardware Cloth Screen	1018.05
Geotextile Fabric	1019.01
Geocomposite Drains	1019.02

Furnish including plastic pipe when an item for “Shoulder Outlet Underdrains” in the contract.

When including an item for “Perforated Pipe Underdrains” in the contract, furnish any of the perforated plastic pipe types, unless otherwise specified.

When including an item for “Non-perforated Pipe Underdrains” in the contract, furnish any of the non-perforated plastic pipe types, unless otherwise specified.

At the Department’s discretion, pipe plants will be inspected periodically for compliance with specified manufacturing methods. Material samples will be obtained for laboratory testing for acceptance of manufacturing lots.

703.03 CONSTRUCTION REQUIREMENTS.

703.03.1 Plastic Pipe Shoulder Underdrains: Install plastic pipe underdrains, aggregate backfill, and shoulder base replacement and surfacing immediately following trenching operations. When permitting

traffic on the roadway, conduct operations so that no trench will be open at the end of the day. Perform operations in such a manner that existing pavement, shoulder surfacing, and base course outside the limits of underdrain trenches are not damaged.

703.03.1.1 Trenching: When existing surfaced shoulders are not to be overlaid with asphalt concrete under the current contract, cut existing shoulder surfacing full depth along the edges of the proposed trench prior to beginning trenching operations. Excess excavated materials may be spread on embankment slopes when permitted. Dispose of removed materials considered unacceptable for spreading on slopes in accordance with 202.02.

703.03.1.2 Geotextile Fabric: Line completed trenches for perforated plastic pipe with geotextile fabric. Splice adjoining sheets of fabric by lapping a minimum of 18 inches and satisfactorily securing. Sewn or heat-bonded splices may be used. Place a sufficient width of fabric in the trench to permit the cloth to lap over the top of the trench for the full width of trench. During placement of geotextile fabric, pipe and backfill, take care to avoid damaging geotextile fabric. Satisfactorily repair or replace any damaged geotextile fabric at no direct pay.

703.03.1.3 Plastic Pipe Installation: Place plastic pipe under-drain in the trench immediately adjacent to the pavement or shoulder edge as shown on the plans. Fittings and materials necessary to make splices of the plastic pipe under-drain and to make connections of the plastic pipe under-drain to the non-perforated outlet pipe shall be from the same manufacturer as the pipe. Fittings shall be designed to prevent soil or aggregate intrusion into the under-drain or outlet piping. When terminating the under-drain without an outlet, provide a fitting or use other approved methods to prevent soil or aggregate intrusion into the end of the under-drain.

703.03.1.4 Aggregate Backfill: After pipe installation, backfill the trench without displacement or damage to the pipe. Uniformly compact aggregate backfill for perforated pipe with approved vibratory equipment to the satisfaction of the engineer. Place aggregate backfill in lifts no greater than 10 inches of uncompacted thickness. Leave the backfilled and compacted trench in a condition ready to receive surfacing. Lap the geotextile fabric over the full width of the trench at the top of the final backfill and secure by an approved method.

703.03.1.5 Replacement of Base Course and Surfacing: Use asphalt concrete for replacement of removed shoulder base course and surfacing as shown on the plans and construct in accordance with Section 510.

703.03.2 Shoulder Outlet Underdrain: Install the non-perforated plastic pipe, backfill, and replacement of shoulder base and surfacing immediately behind trenching operations. When permitting traffic on the roadway, conduct operations so that no trench will be open at the end of the day. Perform operations in such a manner that the existing pavement, shoulder surfacing, and base course outside the limits of the trenches are not damaged.

703.03.2.1 Trenching: When existing surfaced shoulders are not to be overlaid with asphalt concrete under the current contract, cut existing shoulder surfacing full depth along the edges of the proposed trench prior to beginning trenching operations. When permitted, spread excess excavated materials on embankment slopes. Dispose of removed materials considered unacceptable for spreading on slopes outside the right-of-way in accordance with 202.02.

703.03.2.2 Non-perforated Plastic Pipe Installation: Place non-perforated plastic pipe in the trench and connect to plastic pipe in accordance with manufacturer's recommendations. The pipe shall comply with the requirements of 1006.02.

703.03.2.3 Backfill: After pipe installation, backfill the trench without displacing or damaging the pipe. Use excavated trench material that meets the requirements for granular material as backfill. When requiring additional material, provide granular material at no direct pay. Place the backfill material in lifts no greater than 6 inches of uncompacted material. Uniformly compact backfill material by approved methods to the satisfaction of the engineer. Leave the backfilled and compacted trench in a condition ready to receive surfacing.

703.03.2.4 Replacement of Base Course and Surfacing: Use asphalt concrete for replacement of removed shoulder base course and surfacing as shown on the plans and construct in accordance with Section 510.

703.03.2.5 Headwalls: Portland cement concrete headwalls for non-perforated pipe shall be cast-in-place or precast constructed in accordance with Section 702. Furnish each outlet pipe with a rodent screen as shown on the plans.

703.03.3 Perforated or Non-perforated Pipe Under-drain: Use perforated or non-perforated pipe under-drain as shown on the plans to drain wet areas. Install the under-drains and backfill immediately following trenching operations.

703.03.3.1 Trenching: Excavate the trenches to the specified dimensions and grade or as directed. Unless otherwise specified, place the bedding material layer a minimum of 3 inches thick and compact in the bottom of the trench for its full width and length. Dispose of excess excavated material in accordance with 202.02.

703.03.3.2 Under-drain Pipe: Embed under-drain pipe firmly in the bedding material and join securely with appropriate coupling fittings or bands. When specified, wrap perforated pipe with geotextile fabric in accordance with plan details or as directed. Cap upgrade ends of pipe to prevent soil intrusion.

703.03.3.3 Backfill: Place specified backfill as shown on the plans or as directed.

703.03.4 Geocomposite Wall Drains: Before structural backfilling, place geocomposite wall drains against the structure as shown on the plans. Place the drains to accomplish drainage of the backfill without soil intrusion into the drainage product core or outlet piping. Place and compact the backfill in accordance with Section 802 without displacing or damaging the geocomposite wall drain.

Use fittings and materials from the same manufacturer to make splices and connections of the drainage product core to the outlet piping. When the sides of the product are terminated, fold the fabric under to prevent soil intrusion into the end of the drainage product. Overlap the fabric a minimum of 6 inches at all seams.

703.04 MEASUREMENT.

703.04.1 Shoulder Under-drains: Shoulder under-drains will be measured by the linear foot along the pavement or shoulder edge. Required excavation, geotextile fabric, restoration of shoulder base course and surfacing, and disposal of excavated materials will not be measured for payment.

703.04.2 Shoulder Outlet Under-drains: Shoulder outlet under-drains will be measured per each outlet under-drain installation. Required excavation, plastic pipe and fittings, backfill, replacement of shoulder base course and surfacing, concrete headwalls, rodent screens, and disposal of excavated materials will not be measured for payment.

703.04.3 Perforated or Non-perforated Pipe Under-drains: Perforated and non-perforated pipe under-drains will be measured by the linear foot of under-drain pipe. Required excavation, bedding, backfill, and geotextile fabric will not be measured for payment.

703.04.4 Geocomposite Wall Drains: Geocomposite wall drains will be measured by the square yard of geocomposite wall drain.

703.05 PAYMENT. Payment for under-drains will be made at the contract unit prices, which includes all labor, materials, equipment, tools, and incidentals necessary to complete the work.

Pay adjustments for portland cement concrete in accordance with Section 901 will not apply.

Payment will be made under:

Item No.	Pay Item	Pay Unit
703-01	Shoulder Under-drains	Linear Foot
703-02	Shoulder Outlet Under-drains	Each
703-03	Perforated Pipe Under-drains	Linear Foot
703-04	Non-perforated Pipe Under-drains	Linear Foot
703-05	Geocomposite Wall Drains	Square Yard

Section 704 Guardrail

704.01 DESCRIPTION. Furnish and construct highway guardrail in accordance with these specifications, plan details, the manufacturer's recommended procedures, and other requirements as directed by the engineer.

704.02 MATERIALS. Materials shall comply with the following sections and subsections.

Portland Cement Concrete (Class A1)	901
Reinforcing Steel	1009
Metal Beam Guardrail	1010.09
Guardrail Posts and Blockout	1010.10
Guardrail Hardware	1010.11
Wire Rope and Fittings for Highway Guardrail	1010.12

Welding shall comply with Section 815.

704.03 GENERAL CONSTRUCTION REQUIREMENTS.

704.03.1 Posts: Align posts and set plumb. When driving of posts is permitted, do not damage posts. Backfill post holes with acceptable material placed and compacted as directed. When posts are to be placed within existing surfaced areas, replace surface material as shown on the plans.

704.03.2 Rail Elements: Erect rail elements in a manner resulting in a smooth, continuous installation. Tighten all bolts, except adjustment bolts. Furnish bolts of sufficient length to extend beyond nuts. Field drill or punch holes for special details when approved. Repair damaged galvanized surfaces and drilled holes in accordance with 811.08.

704.03.3 Anchor Blocks: Reinforced concrete blocks for anchoring guardrail to existing bridge ends shall meet the requirements of Sections 805 and 806. Use Class A1 concrete complying with Section 901. Remove portions of existing bridge railings and drill holes into existing railings when required without damaging the remaining railings. Satisfactorily repair damage to the existing bridge due to operations at no additional cost to the Department. Dispose of removed materials of in accordance with 202.02.

704.03.4 Guardrail End Treatments: All guardrail end treatments shall have been successfully crash tested in compliance with the crash test requirements of the *National Cooperative Highway Research Program (NCHRP) Report 350* or the *AASHTO Manual for Assessing Safety Hardware (MASH)* at a Test Level 3 (TL-3) unless noted otherwise on the plans. Do not use end treatment systems not in compliance with this requirement on any Department project.

The contractor shall select the end treatment system from the Approved Materials List unless noted otherwise on the plans, but shall not use a combination of such end treatment systems on the same project. The contractor shall submit the selected system to the Project Engineer, which includes the system name, system drawings, the manufacturer of the end treatment system, and all necessary documentation to substantiate that the end treatment is in compliance with the NCHRP 350 or MASH requirement for review. The selected system shall not be installed until the system submittal has been reviewed by the Project Engineer.

The contractor shall install all components of the guard rail end treatment system such as posts, blocks, and hardware in accordance with the drawings and the manufacturer's recommendations. Under no circumstances shall any component of the guard rail end treatment system be modified without written approval.

All end treatments shall bear a label indicating the manufacturer and exact product name of the end treatment along with its assigned NCHRP or MASH test level. This label shall resist weathering and shall be permanently affixed to the railing in such a way as to be readily visible.

Furnish all end treatments with retroreflective sheeting at the terminal end as shown on the plans.

704.04 MEASUREMENT. Quantities of guardrail, anchor sections, end treatments, and transitions for payment will be the design quantities in linear feet shown on the plans and adjustments thereto. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if plan errors are proven, or if design changes are made.

Design quantities of single faced guardrail are based on plan length along the face of rail between end posts, exclusive of openings, and plan length of end sections. Design quantities of double faced guardrail are based on plan length between end posts along centerline of posts, exclusive of openings, and plan length of end sections. Design quantities of trailing end and anchor sections are based on plan length along the face of rail.

Guardrail anchor blocks and end treatments will be measured per each unit furnished and installed.

704.05 PAYMENT. Payment for guardrail, anchor sections, anchor blocks, end treatments, and transitions will be made at the contract unit prices per linear foot, which include drilling of holes in existing concrete for reinforcing steel dowels, concrete, and reinforcing steel and all labor, materials, equipment, tools, and incidentals necessary to complete the work.

Payment adjustments for portland cement concrete in accordance with Section 901 will not apply.

Payment will be made under:

Item No.	Pay Item	Pay Unit
704-01	Guardrail	Linear Foot
704-02	Guardrail (Double Faced)	Linear Foot
704-03	Blocked Out Guard Rail	Linear Foot
704-04	Blocked Out Guard Rail (Double Faced)	Linear Foot
704-05	Guardrail Anchor Sections (Trailing End)	Linear Foot
704-06	Guardrail Bridge Attachments	Linear Foot
704-07	Guardrail Transitions	Linear Foot
704-08	Guardrail Anchor Sections (Turndown)	Linear Foot
704-09	Guardrail Anchor Blocks	Each
704-10	Guardrail End Treatment	Each

Section 705 Fences

705.01 DESCRIPTION. Construct fences and gates in accordance with these specifications and in conformity with lines and grades shown on the plans or established by the engineer.

705.02 MATERIALS. Materials shall comply with the following section and subsections:

Portland Cement Concrete (Class R)	901
Barbed Wire	1010.01
Woven Wire	1010.02
Posts and Braces for Field and Line Type Fence	1010.03
Staples and Nails	1010.04
Metal Fasteners for Steel Posts	1010.05
Gates for Field and Line Type Fence	1010.06
Chain Link Fence, Gates and Appurtenances	1010.07
Timber Preservatives	1014.03
Ground Rod Assemblies	1010.08

Use the same type chain link fencing throughout the project. Use the same type, shape, and treatment of posts throughout a section of fence.

705.03 GENERAL CONSTRUCTION REQUIREMENTS. Conform to Section 201 when clearing and grubbing for fence installation.

Confine operations to the area adjacent to right-of-way lines and within the right-of-way.

Where breaks in a run of fencing are required, and at intersections with existing fences, make appropriate adjustment in post spacing for the type closure indicated.

Place wood posts with small end up. When posts, braces, or anchors are to be embedded in concrete, install temporary braces as required to hold posts in proper position until concrete has set sufficiently to hold posts. Do not install fencing material on posts or place strain on bracing set in concrete for 72 hours after concrete has been placed. Set tops of posts to required grade and alignment. Cutting of wood post tops will be allowed only when approved. Treat cut ends with 2 applications of the same type preservative used for post treatment. Stretch wire taut.

Install ground rods along each segment of new or rebuilt fence, regardless of type fence post used, at maximum 500-foot intervals. Ensure that ground rods and connections conform to plan details.

705.04 REBUILT FENCE. When specified, take down, move back, and rebuild existing fence. Rebuild fence in the same manner as specified for new fence. Rebuilt ornamental fence, picket fence, or other special type fence shall be equal in all respects to existing fence.

705.05 GATES. Gates of a design different from that shown on the plans may be furnished with prior approval. Gates shall be of rigid construction, and after erection, gates shall not show sag or warp.

705.06 CHAIN LINK FENCE AND GATES.

705.06.1 Concrete Post Anchorage: Anchor posts in Class R concrete footings. Portable mixing of concrete in accordance with 901.10.6 will be permitted for small quantities of concrete.

Extend tops of footings slightly above ground and steel trowel to a smooth finish sloped to drain away from posts. Center posts, braces, and other units in footings.

Perform concrete operations in accordance with Section 901. Consolidate concrete by tamping or vibrating. Satisfactorily dispose of excess excavation from footings.

705.06.2 Fence Erection: Place pull posts no more than 200 feet apart in straight runs and at each vertical angle greater than 20 degrees. Place corner posts at each horizontal angle greater than 20 degrees. Provide corner and pull posts with a horizontal brace and tie rod on each side of posts. Connect the horizontal brace and tie rod to adjacent line posts.

Before placing fabric, permanently position posts, firmly set anchorages, and satisfactorily secure top rail or tension wires to posts. Secure ends of fabric by stretcher bars threaded through loops of fabric and secure to posts by clamps with bolts and nuts.

Place fabric by securing one end and applying sufficient tension to remove all slack before making attachments elsewhere. Assure that degree of tensioning is commensurate with air temperatures at time of installation to prevent undue sagging or tensioning of fabric due to changing temperatures. Fasten fabric to line posts at approximately equal spaces and to top rail (or top tension wire) and bottom tension wire with tie wires or bands as specified.

705.06.3 Gate Erection: Gate installation shall include gate frames, stretcher bars, filler fabric, latches, stops, locking device, padlocks, hinges, gate posts with braces, tie rods, turnbuckles, caps, and other fittings as specified or required for complete installation.

Clamps for attaching hardware shall be tightened. Bottom of gates shall clear the ground at least 3 inches at all points in its swing. Grade the area if necessary to meet this requirement. Provide stops with latches or other approved means for holding the gate open and place to prevent damage to gate or fence by over-swing. Unless otherwise directed, provide stops at the centerline of fence to arrest the swing of a closed gate.

705.06.4 Repair of Protective Coatings: After completion of the fence and gate installation, satisfactorily repair all damaged protective coatings in accordance with 811.08.

705.07 MEASUREMENT.

705.07.1 New Fence and Gates: The new fence will be measured by the linear foot between outside of end posts for each continuous run of fence, exclusive of gates. Gates for new fences will be measured per each for single swinging gates and per double gate for double swinging gates.

705.07.2 Rebuilt Fence: Rebuilt fences will be measured by the linear foot between outside of end posts for each continuous run of fences, including gates.

705.07.3 Intersecting Fences: Sections of new fences required for connections of existing intersecting fences to new or rebuilt fences will be included in the measurement of the new or rebuilt fences.

705.07.4 Ground Rod: Ground rod placement will not be measured for payment.

705.08 PAYMENT. Payment for fences and gates will be made at the contract unit prices, which will include all labor, materials, tools, equipment, and incidentals, including hardware necessary to complete the work. Payment adjustments for portland cement concrete in accordance with Section 901 will not apply.

Payment will be made under:

Item No.	Pay Item	Pay Unit
705-01	Barbed Wire Fence	Linear Foot
705-02	Combination Mesh and Barbed Wire Fence	Linear Foot
705-03	Single Swinging Walk Gates	Each
705-04	Single Swinging Driveway Gates	Each
705-05	Double Swinging Driveway Gates	Double Gate
705-06	Chain Link Fence	Linear Foot
705-07	Single Gates for Chain Link Fence	Each
705-08	Double Gates for Chain Link Fence	Double Gate
705-09	Rebuilt Fence	Linear Foot

Section 706

Concrete Walks, Drives, and Incidental Paving

706.01 DESCRIPTION. Furnish and construct portland cement concrete walks, handicapped curb ramps, drives and incidental paving slabs in accordance with these specifications and in conformity with lines, grades, and dimensions shown on the plans or established.

706.02 MATERIALS. Materials shall comply with the following sections or subsections:

Portland Cement Concrete (Class M)	901
Joint Filler	1005.01.3
Reinforcing Steel	1009.01
Curing Materials	1011.01

706.03 CONSTRUCTION REQUIREMENTS.

706.03.1 Excavation: Excavate to required depth and width. Shape the top of the subgrade and compact to a firm, even surface conforming to the section shown on the plans. Remove unsuitable material and dispose of in accordance with 202.02 and replace with approved material at no direct pay.

706.03.2 Forms: Forms shall be of wood or metal and shall extend the full depth of concrete. Forms shall be straight, clean, and of sufficient strength to resist the pressure of concrete. Brace forms to ensure that forms remain in horizontal and vertical alignment until their removal.

Concrete may be placed by slip-form methods. Place slip-formed concrete with an approved machine designed to spread, vibrate, consolidate, and finish concrete in one pass of the machine with a minimum of hand finishing. Rigidly hold sliding forms together to prevent spreading of forms. After the passing of the side forms, there shall be no noticeable slumping of concrete.

706.03.3 Subgrade: Thoroughly moisten the subgrade immediately prior to placing concrete.

706.03.4 Placing and Finishing: Place the concrete on the subgrade, strike-off to required thickness, and tamp sufficiently to bring the mortar to the surface. Finish the surface with a wood float or steel trowel

followed by brushing to a slightly rough finish. Round joints and edges with an edging tool having a 1/4 inch radius.

706.03.5 Joints:

706.03.5.1 Expansion Joints: Fill expansion joints with 1/2 inch thick preformed expansion joint filler. Install expansion joints at maximum 100-foot intervals, and between intersecting paving and any fixed structure, such as a building, bridge, or curbing, and between intersecting paving and the handicapped curb ramps. Extend expansion joint material for the full width and depth of paving.

706.03.5.2 Weakened Plane: Form weakened planes by a jointing tool or other acceptable means. Extend weakened planes into concrete for at least one-quarter of the depth. Weakened planes shall be approximately 1/8 inch wide.

706.03.5.2.1 Walks: Space weakened planes for walks equal to the width of the walk.

706.03.5.2.2 Drives: Form a longitudinal weakened plane along the centerline of drives more than 16 feet wide. Form transverse weakened planes at not more than 16-foot intervals.

706.03.5.2.3 Incidental Paving: Form weakened planes for incidental paving at intervals not exceeding 30 times the thickness of the concrete in length or width. Construct joints in incidental paving placed adjacent to jointed concrete to match existing joints, with intermediate joints formed as necessary not to exceed the maximum joint spacing.

706.03.5.3 Construction Joints: Form construction joints around manholes, utility poles, etc., extending into paving. Install 1/4 inch thick preformed expansion joint filler into these joints.

706.03.5.4 Tie-ins: Make tie-ins of existing concrete by full depth sawing at no direct pay.

706.03.6 Curing: Cure concrete in accordance with 601.03.10.

706.03.7 Detectable Warning Surface for Handicap Ramps and At-Grade Sidewalk Intersections: When sidewalks intersect with roadways, equip the sidewalk with a detectable warning system consisting of raised truncated domes as a transition between the sidewalk and the street as required by the Americans With Disabilities Act, 28 CFR § Part 36, ADA Standards for Accessible Design. Install detectable warnings (truncated domes) on the ramp surface over the full width of the ramp throat for a distance of 24 inches in the direction of travel from the back of the curb. Also install detectable warnings (truncated domes) on at-grade sidewalks intersecting with roadways for a distance of 36 inches in the direction of

travel from the end of the sidewalk. Detectable warning surfaces may be added to at-grade sidewalks intersecting with driveways at the discretion of the design section or Project Engineer. Lay out truncated domes on a square grid in order to allow enough space for wheelchairs to roll between the domes.

Light reflectance of the truncated domes and the underlying surface shall meet the 70 percent contrast requirement of ADAAG.

706.04 MEASUREMENT. Quantities of concrete walks, drives, and incidental paving slabs for payment will be the design quantities as specified on the plans and adjustments thereto. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if design errors are proven or if design changes are made. Design areas are based on the horizontal dimensions shown on the plans. Excavation, backfill, reinforcing steel, and joint materials will not be measured for payment.

Handicapped curb ramps, including the detectable surface warning system, will be measured per each.

Detectable surface warning systems for at-grade sidewalk intersection will not be measured for payment.

706.05 PAYMENT. Payment for concrete walks, drives, and incidental paving will be made on a lot basis at the contract unit price per square yard, adjusted in accordance with the following provisions. Payment for each lot will be made in accordance with table 901-5. Size, sampling, and testing of each concrete lot shall be in accordance with the materials sampling manual.

Payment for handicapped curb ramps, including the detectable surface warning system, will be made at the contract unit price per each and shall include, but not be limited to, curb transitions, detectable warning system, gutter, landing, and base.

Payment will be made under:

Item No.	Pay Item	Pay Unit
706-01	Concrete Walk	Square Yard
706-02	Concrete Drive	Square Yard
706-03	Incidental Concrete Paving	Square Yard
706-04	Handicapped Curb Ramps	Each

Section 707 Curbs and Gutters

707.01 DESCRIPTION. Furnish and construct curbs and gutters in accordance with these specifications and in conformity with lines, grades, dimensions, and typical sections shown on the plans or established.

707.02 MATERIALS. Materials shall comply with the following sections and subsections:

Usable Soil	203.06.1
Asphalt Concrete	502
Portland Cement Concrete (Class A1, B, D)	901
Asphalt Cement	1002
Aggregates	1003
Joint Fillers	1005.01
Joint Sealant	1005.02
Joint Seals	1005.03
Curing Materials	1011.01
Form Release Agent	1018.06

707.02.1 Concrete Curbs and Gutters: Use the same type of concrete for curbs and gutters as used throughout the project, unless shown otherwise on the plans.

707.02.2 Asphalt Concrete Curbs: Use Asphalt Concrete (Level A) mixtures for asphalt concrete curbs in accordance with Section 502.

707.03 SUBGRADE. Shape the subgrade and compact to a firm, even surface. When possible, shape the subgrade and compact at the same time and in the same manner as the subgrade for the pavement. Remove unsuitable material and replace with approved material at no direct pay.

707.04 CONCRETE FORMS. Use forms for combination curb and gutter conforming to 601.03.1.8 and 601.03.5. Forms for other curbs or gutters shall be wood or metal, straight, and of sufficient strength to resist pressure of the concrete without deforming. Clean forms and coat with form release agent before concrete is placed against them. Do not use forms that

are excessively worn, bent, or broken. An approved mechanical curb forming machine conforming to 707.06.3 may be used without forms.

707.05 CONCRETE JOINTS. Form joints in integral curbing to correspond with transverse joints in the pavement slab. Extend joints under and through the curb; finish and fill with the specified filler.

Form other types of curbing with 1/4 inch joints at maximum intervals of 20 feet. Form by using steel plates 1/4 inch thick, cut to section, and set vertically in forms until concrete has set sufficiently to permit removal of plates.

Tie-ins of existing concrete curbs and gutters shall be made by full depth sawing at no direct pay.

707.06 PLACING CONCRETE.

707.06.1 Integral Types: After concrete pavement has been struck off, clamp the curb forms or otherwise securely fasten in place on the slab form. Place concrete for curbing and thoroughly tamp within 30 minutes after pavement has been finished. Spade or sufficiently vibrate concrete to eliminate voids and tamp to bring mortar to the surface. Finish the concrete smooth and even with a wooden float. Round edges to the specified radius with an approved finishing tool. Take care to ensure that the pavement and curb are constructed monolithically.

Integral type curb may be placed after completion of pavement, provided steel reinforcement is placed in the pavement of the size, type, and spacing shown on the plans at no direct pay.

707.06.2 Non-Integral Types: Place concrete on the prepared subgrade, strike off, and consolidate to required thickness. Spade or sufficiently vibrate concrete to eliminate voids and tamp to bring mortar to the surface. Finish smooth and even with a wooden float. Round edges to the specified radius.

707.06.3 Slip-formed Concrete: Slip-formed concrete shall have uniform consistency. Place with an approved extrusion machine designed to spread, consolidate, and finish concrete in one pass of the machine with minimum hand finishing. Rigidly hold sliding forms together to prevent spreading of forms. After the passing of the forms there shall be no noticeable slumping of concrete. Finished concrete shall be free from voids. Perform any additional finishing required immediately after placement.

When slip-formed methods are used, concrete for curbs and gutters shall have no more than a 1-1/2 inch slump.

707.06.4 Tolerances: Do not exceed the theoretical grade of combination curb and gutter nor be more than 1/2 inch low.

707.07 FINISHING. Remove forms within 24 hours after concrete has been placed. Fill honeycombed areas and other minor defects with mortar, complying with 1001.03. Plastering will not be permitted on faces of curb or gutter. Remove and replace rejected curb or gutter. Finish the top and face of curb or gutter prior to initial set with a wood float, brush, and water.

707.08 ASPHALT CONCRETE CURB. Place asphalt concrete curb with an approved extruding machine. Prior to placing curb, apply asphalt tack coat complying with Section 504.

707.09 CURING CONCRETE CURB OR GUTTERS. After finishing, cure curb or gutter in accordance with 601.03.10.

707.10 BACKFILLING. After curb or gutter has set sufficiently, backfill adjacent to curb or gutter with usable soil complying with 203.06.1 compacted to the density of surrounding soil.

707.11 MEASUREMENT.

Quantities of curbs and/or gutters for payment will be the design lengths as specified on the plans and adjustments thereto. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if design errors are proven, or if design changes are made. Excavation, backfill, joint materials, asphalt tack coat, and steel tie bars will not be measured for payment. When combination curb and gutter is specified, gutters required at catch basins will be included in design quantities for combination curb and gutter.

707.12 PAYMENT. Payment for curbs and/or gutters will be made at the contract unit price per linear foot, subject to the following provisions:

707.12.1 Asphalt Concrete Mixtures: Asphalt concrete curbs will be subject to the payment adjustment provisions of Section 502. Asphalt cement shall comply with the requirements of Section 1002. The Materials and Testing Section will provide the payment adjustment percentage for properties of asphalt cement.

707.12.2 Portland Cement Concrete: The portland cement concrete in the curbs and/or gutters will be identified by lots and shall be subject to payment adjustments per linear foot in accordance with Table 901-5. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

Payment will be made under:

Item No.	Pay Item	Pay Unit
707-01	Concrete Curb	Linear Foot
707-02	Concrete Gutter	Linear Foot
707-03	Combination Concrete Curb and Gutter	Linear Foot
707-04	Asphalt Concrete Curb	Linear Foot

Section 708

Right-of-Way Monuments

708.01 DESCRIPTION. Install contractor furnished right-of-way monuments and right-of-way monument witness posts at various locations in accordance with these specifications, the project right-of-way map, the plan details, or as directed.

708.02 MATERIALS.

708.02.1 Right-of-Way Monuments: Right-of-way monuments shall be the type shown on the plans or an approved equal. Substitutions must be approved by the Location and Survey Section Administrator.

Furnish steel stakes, 3/4 inch x 3/4 inch x 2 feet, with stainless steel identification caps as shown on the plans.

708.02.2 Right-of-Way Monument Witness Posts: Witness posts shall be standard 6 feet in length as shown on the plans or an approved equal. Substitutions must be approved by the Location and Survey Section Administrator. The standard DOTD decal logo as shown on the plans shall be attached to each post by the supplier.

708.03 GENERAL CONSTRUCTION REQUIREMENTS. Position and set right-of-way monuments by or under the responsible charge of a Louisiana licensed professional land surveyor. Prepare a reproducible final plat reflecting the surveyor's location of the monuments in accordance with the right-of-way map on standard size Department plan sheet(s). Submit the final plat to the project engineer for forwarding to the Location and Survey Section Administrator. Record the final plat in the appropriate parish courthouse(s) and provide a copy of the filing receipt(s) to the project engineer. Also provide a copy of the final plat to the appropriate parish engineer(s) and Planning Commission(s), if applicable.

708.04 MEASUREMENT. Right-of-way monuments will be measured per each. Right-of-way monument witness posts will be measured per each.

708.05 PAYMENT. Payment for right-of-way monuments and right-of-way monument witness posts will be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
708-01	Right-of-Way Monument	Each
708-02	Right-of-Way Monument Witness Post	Each

Section 709

Steel Cattle Guards

709.01 DESCRIPTION. Construct, furnish, and install welded steel cattle guards at the locations shown on the plans and conforming to plan details and these specifications.

Cattle guards of types different from those shown on the plans may be furnished with prior approval.

709.02 MATERIALS. Materials shall comply with the following sections and subsections:

Concrete (Class M)	901
Steel Pipe (Wingwalls)	1007.11
Reinforcing Steel	1009.01
Bolts, Nuts and Washers	1010.11
Treated Timber	1014

Use the minimum size steel specified and fabricate in accordance with Section 809. Pipe wings shall be 2-inch diameter standard strength steel pipe. Paint steel in accordance with Section 811. Galvanized pipe will not require painting. Repair damaged galvanized steel in accordance with 811.08.

709.03 CONSTRUCTION REQUIREMENTS. Extend excavation a minimum of 12 inches outside neat lines of concrete walls or footings. Deposit backfill in layers not exceeding 6 inches compacted thickness and compact each layer to the density of adjacent soil with mechanical tampers. When placing the cattle guard in the roadway, the compaction requirements shall conform to 203.07.

Place concrete and reinforcing steel in accordance with Sections 805 and 806.

709.04 MEASUREMENT. Steel cattle guards will be measured per each unit. Excavation, backfill, concrete, and reinforcing steel will not be measured for payment.

709.05 PAYMENT. Payment for steel cattle guards will be made at the contract unit price per each. The concrete placed in cattle guards will be identified by lots and shall be subject to pay adjustments in accordance with Table 901-5 and Note 1 therein. Size, sampling, and testing of each concrete lot shall be in accordance with the materials sampling manual.

Payment will be made under:

Item No.	Pay Item	Pay Unit
709-01	Steel Cattle Guard	Each

Section 710 Flowable Fill

710.01 DESCRIPTION. Furnish, place, and consolidate a controlled low strength flowable fill as an alternative to compacted soil. Applications for this material include, but are not limited to, general backfilling of drainage structures, entrenchments across pavements, encasements, beddings, void filling, and other uses as shown on the plans or as approved by the engineer. The flowable fill shall be a cementitious mixture of portland cement, fly ash (depending on application and mix design), fine aggregate, water, entrained air, and appropriate admixtures for the particular application.

710.02 MATERIALS. Materials shall comply with the following sections and subsections:

Portland Cement	1001.01
Fine Aggregate	1003.08.1
Admixtures	1011.02
Water	1018.01
Fly Ash	1001.04

Design and proportion flowable fill in accordance with Table 710-1. Trial batching will be required for excavatable and non-excavatable mixes to ensure appropriate job mix consistency and adherence to Table 710-1 properties.

Use excavatable fill unless noted otherwise on the plans.

**Table 710-1
Flowable Fill Mix Design¹**

Material	Excavatable	Non-Excavatable
Portland Cement	75 - 100 lb/cu yd	75 - 150 lb/cu yd
Fly Ash	0 - 150 lb/cu yd	150 - 600 lb/cu yd
Water ²	—	—
Air ³	10 - 35%	5 - 20%
Concrete Sand	Proportioned to yield 1 cu yd	Proportioned to yield 1 cu yd
Unit Weight (wet) ³	90 - 110 lb/cu ft	100 - 125 lb/cu ft
28-Day Compressive Strength ³	Maximum 100 psi	Minimum 125 psi

¹ Mix designs shall yield 1.0 cubic yard absolute volume.

² Mix designs shall produce a consistency that will result in a flowable self-leveling product at the time of placement and conform to the requirements of 710.02.

³ The requirements for percent air, compressive strength and unit weight are for laboratory designs only and are not intended for jobsite acceptance requirements unless otherwise directed by the project engineer. For early opening to traffic and expedited placement circumstances, the maximum or minimum required strength shall be attained in the desired time frame.

710.03 CONSTRUCTION REQUIREMENTS. Before placement, provide temporary end dams or soil berms as directed by the engineer to confine the flowable fill. Place flowable fill to the lines and grades shown on the plans or as directed. Where flotation or misalignment may occur due to hydrostatic pressure, assure correct alignment and placement of the encased structure by using straps, soil anchors, or other approved means of restraint. Protect flowable fill from freezing for 36 hours after placement. Place flowable fill by chute, pumping or other methods approved by the engineer. Due to flowable fill's liquid condition, take into account the hydrostatic pressure on adjacent structures on deep fills where multiple lifts may be required. While in a liquid state, flowable fill in deep excavations is in a quick condition, and shall be protected until hardening occurs. For early opening to traffic and expedited placement circumstances, perform trial batches to verify compressive strength for the required time frame before placing under load. Flowable fill will not require field sampling or testing

other than the approved trial batch mix design, unless otherwise directed by the project engineer.

710.04 MEASUREMENT. Flowable fill will be measured by the cubic yard by batch tickets as adjusted by the project engineer.

710.05 PAYMENT. Payment for flowable fill will be made at the contract unit price per cubic yard.

Payment will be made under:

Item No.	Pay Item	Pay Unit
710-01	Flowable Fill	Cubic Yard

Section 711

Riprap

711.01 DESCRIPTION. Furnish and place riprap in accordance with these specifications and in conformity to lines, grades, and thickness shown on the plans or as directed.

711.02 MATERIALS. Furnish stone or recycled concrete riprap from an approved source. Stone riprap shall be listed in the Approved Materials List. Stone riprap shall not disintegrate upon exposure to the elements or be easily broken from handling, and shall be reasonably free from earth and other foreign materials. When tested in accordance with AASHTO T 85, the solid weight of stone shall be at least 155 pounds per cubic foot (based on bulk specific gravity). The least dimension of any individual stone shall be at least one-third its maximum dimension. Each shipment of stone shall be reasonably well graded within the specified limits.

Recycled concrete may be used as riprap unless otherwise indicated in 711.02.1, provided its solid weight is at least 140 pounds per cubic foot (based on bulk specific gravity) and free of protruding reinforcement.

Stockpiles of recycled concrete shall be source approved prior to use and kept separate from other materials. Stockpiles shall be uniform and free of soil, debris, excessive amounts of asphalt materials, and foreign matter. Once a stockpile has been approved as an acceptable source of material, do not add material without further approval.

Visually inspect riprap at the source, project site, or both to control gradation.

Any difference of opinion between the engineer and contractor will be resolved by checking the gradation of two random truckloads (or equivalent size samples). Furnish equipment, labor, and a sorting site at no direct pay.

711.02.1 Riprap: Riprap shall be reasonably well graded and in compliance with Table 711-1.

**Table 711-1
Riprap**

Riprap Class ¹	Stone Size, lb	Spherical Diameter, foot ²	Percent of Stone Smaller Than
2 lb	10	0.51	100
	4	0.38	40-100
	2	0.30	15-50
	0.75	0.22	0-15
10 lb	50	0.88	100
	20	0.65	50-100
	10	0.51	15-50
	5	0.41	0-15
30 lb	140	1.24	100
	60	0.94	42-100
	30	0.74	15-50
	10	0.51	0-15
55 lb ³	275	1.50	100
	110	1.11	42-100
	55	0.88	15-50
	20	0.63	0-15
130 lb ³	650	2.00	100
	260	1.46	45-100
	130	1.17	15-50
	40	0.79	0-15
250 lb ³	1250	2.50	100
	500	1.83	45-100
	250	1.46	15-50
	80	1.00	0-15
440 lb ³	2200	3.00	100
	900	2.23	40-100
	440	1.76	14-50
	130	1.17	0-15
1000 lb ³	5000	4.00	100
	2000	2.91	45-100
	1000	2.31	10-50
	300	1.55	0-15

¹ The stone size used to define the Riprap Class is the minimum median stone size for the stone class. The minimum thickness of a riprap layer shall be no less than the spherical diameter of the maximum stone size in the Riprap Class.

² Spherical diameters of riprap classes up to 30 lb are based on a solid stone weight of 140 lb/cu ft. Spherical diameters of riprap classes above 30 lb are based on a solid stone weight of 155 lb/cu ft.

³ Recycled portland cement concrete shall not be used in these riprap classes.

711.02.2 Geotextile Fabric: Geotextile Fabric shall comply with 1019.01.

711.03 CONSTRUCTION REQUIREMENTS.

711.03.1 Riprap: Grade slopes or areas on which riprap is to be placed to the required section. Place riprap on the prepared slope or area in a manner which will produce a reasonably well-graded mass of stone with a minimum practicable percentage of voids. Place the entire mass of stone in conformance with the lines, grades, and thickness in one operation without displacing underlying material. Placing of riprap in layers, or dumping into chutes, or by similar methods likely to cause segregation will not be permitted.

When placement in water currents is required, make drift checks and place riprap in such manner as to compensate for drift. Furnish necessary facilities, equipment, and personnel for checking riprap depth and distribution.

711.03.2 Filter Stone: When specified, place filter stone on the prepared slope or area before placement of riprap. When filter stone is placed underwater, free dumping will not be permitted. Use controlled methods for underwater placement using bottom dump buckets or wire rope baskets lowered through the water to the point of placement. If placement in strong water currents is required, place riprap promptly after placement of filter stone. Unless shown otherwise on the plans or directed, filter stone shall be Riprap Class 10 lb or less.

711.03.3 Geotextile Fabric: When specified, place geotextile fabric on the prepared slope or area in accordance with 203.11.3 before placement of riprap. Take care not to damage the geotextile fabric when placing riprap. Do not place riprap by rolling riprap down slope, or dropping riprap from extreme heights, or by similar methods likely to damage geotextile fabric. Repair damaged geotextile fabric in accordance with 203.11.3 or replace as directed.

711.04 MEASUREMENT. Riprap and filter stone may be measured on a square yard, cubic yard, or weight basis as specified.

When measured on a square yard basis, the quantity measured will be that actually placed to the limiting dimensions shown on the plans or as directed by the engineer. When measured on a cubic yard basis, measurement will be made in vehicles at the point of delivery on the project in accordance with 109.01.

When measured on a weight basis, the pay unit will be per ton (2000 pounds). When riprap is delivered by vehicles or railroad cars, measurement will be based on certified weight tickets furnished by the contractor. When riprap is delivered by barge, measurement will be made by calculation from barge displacement, based on water weighing 62.4 pounds per cubic foot.

Geotextile fabric will be measured by the square yard of covered area in place.

No measurement will be made for excavation or backfilling.

711.05 PAYMENT. Payment for riprap and geotextile fabric will be made at the contract unit prices. Filter stone will be paid for as riprap.

Payment will be made under:

Item No.	Pay Item	Pay Unit
711-01	Riprap	Square Yard
711-02	Riprap	Cubic Yard
711-03	Riprap	Ton
711-04	Geotextile Fabric	Square Yard

Section 712 Revetments

712.01 DESCRIPTION. Furnish and construct revetments for protection of embankment slopes, stream channels, culvert end treatments, and other areas. Revetments shall be constructed in accordance with these specifications and in conformity with the details shown on the plans or as directed.

When including an item for Flexible Revetments in the contract, the contractor has the option of furnishing revetments of stone, recycled portland cement concrete, wet-batched sacked concrete, dry-batched prepackaged sacked concrete, or cabled articulated concrete block mattress.

When including an item for Stone Revetment in the contract, the contractor has the option of furnishing revetments of either stone or recycled portland cement concrete.

When including an item for Sacked Concrete Revetment in the contract, the contractor has the option of furnishing revetments of either wet-batched sacked concrete or dry-batched prepackaged sacked concrete.

Use the same type revetment at each location. Except for cast-in-place revetment, place revetments on geotextile fabric.

712.02 MATERIALS.

712.02.1 Concrete: Concrete for cast-in-place revetment shall be Class R complying with Section 901.

712.02.2 Geotextile Fabric: Geotextile fabric shall comply with 1019.01.

712.02.3 Wet-Batched Sacked Concrete: Sacks shall comply with 1018.07. Concrete shall be Class R concrete complying with Section 901. Concrete shall be wet-batched prior to placement in sacks. Add mixing water to concrete as required to produce a slump of 4 inches to 6 inches. Immediately place the sacked concrete in the revetment after batching.

712.02.4 Stone and Recycled Portland Cement Concrete: Stone and recycled portland cement concrete shall comply with Section 711 Riprap Class 30 lb.

712.02.5 Dry-Batched Prepackaged Sacked Concrete: Use a prepackaged an Approved Materials List concrete product consisting of one

part cement and a maximum of 5 parts sand by weight or other approved mix with the same cement content. Dry mix until uniform in color.

712.02.5.1 Cement: Cement shall be in accordance with 901.08.1 and 1001.01.

712.02.5.2 Aggregate: Aggregates shall comply with the gradation requirements of 1003.08.

712.02.5.3 Sacks: Sacks shall comply with 1018.07 and shall be capable of holding the concrete mixture without leakage during handling.

712.02.5.4 Water: Water shall be from an approved source in accordance with 1018.01.

712.02.6 Usable Soil: Usable soil shall be in accordance with 203.06.1.

712.02.7 Cabled Articulated Concrete Block Mattress: Cabled articulated concrete block mattresses shall consist of interlocking cellular concrete blocks connected with cables to bind the individual blocks into mattresses. The dimensions of the finished mattress shall be as shown on the plans or as directed by the engineer. Size and arrange holes for cable penetrations to minimize exposure of cables to potential environmental degradation. Do not pass cables through open areas within the dimensions of individual blocks. Geotextile fabric, as specified in 712.02.2, may be glued to the bottom of the mattress in lieu of placing the geotextile in the trench prior to placement.

712.02.7.1 Cellular Concrete Blocks: The cellular concrete blocks shall be interlocking, and capable of articulation when formed into mattresses. Furnish open or closed cell blocks as shown on the plans. Ensure that concrete used to make the blocks meets the requirements of Section 901 and has a compressive strength of 4000 psi at 28 days. Use concrete aggregates meeting the requirements of 1003.08 and listed on the Approved Materials List.

712.02.7.2 Cable: Use galvanized steel or continuous filament polyester fiber cable to connect the blocks to form a mattress. Ensure that the cable has adequate tensile strength to lift and handle the mattress safely. Permanent deformation of the cable and mattress due to elongation and elasticity of the cable during handling and placement shall be negligible.

712.03 CONSTRUCTION REQUIREMENTS. Construct revetments in dry or dewatered areas, unless otherwise directed. Remove logs, stumps, and other undesirable material from areas on which revetments are to be placed. Provide usable soil to bring areas to grade and compact to the density

of surrounding ground to the engineer's satisfaction before final grading. Grade the revetment areas to required sections.

712.03.1 Geotextile Fabric Placement: Bury ends of geotextile fabric for anchorage as shown on the plans. Lap adjacent strips of geotextile fabric at least 18 inches. Pin the laps at maximum 5-foot intervals. Do not damage geotextile fabric during revetment placement. Repair damaged fabric in accordance with 203.11.3 or replace at no direct pay.

712.03.2 Concrete Cast-in-Place Revetment: Before concrete placement, place preformed 1/4 inch thick expansion joint filler complying with 1005.01.1 around piles, columns, or other structural elements as directed.

Commence placing concrete revetment for slope protection at the toe of revetment and progress upslope. Place revetment for stream channels and other relatively level areas as directed.

After placement, cure the revetment surface in accordance with 601.03.10.

712.03.3 Wet-Batched Sacked Concrete Placement: Uniformly fill sacks to approximately 3/4 cubic foot. Fold the open end under the bag during placement. Place sacks of wet-batched concrete in one layer in contact with adjacent sacks and tamp into position by approved methods. Begin placement of sacked concrete at the revetment toe and progress upslope. Place sacked concrete revetment for stream channels and other relatively level areas as directed.

712.03.4 Dry-Batched Prepackaged Concrete Placement: Uniformly fill sacks to approximately 3/4 cubic foot and seal the ends by tying, stitching, or other approved methods. Tightly pack the filled sacks against each other. Begin placement at the revetment toe and progress upslope with staggered joints. At the end of each day's operations and upon completion at a location, saturate the sacks and contents with water. The quantity of water required shall be as directed at no direct pay. The compressive strength shall comply with Section 901 for Class R concrete.

712.03.5 Stone Placement: Construct toe and end walls by placing stone in the trench lined with geotextile fabric. Begin placement of stone at the bottom of the slope in a layer having the specified average thickness. Place stone by approved methods. A tolerance of 2 inches above or below the specified thickness will be allowed. Openings between stones exposing more than 4 square inches of geotextile fabric will not be permitted.

712.03.6 Cabled Articulated Concrete Block Mattress Placement: Sufficiently excavate the area in which the mattress is to be

placed to ensure that the mattress is resting on the bottom of the trench. Excavate the trench to an elevation 6 inches below the grade line shown on the plans. The mattress placement direction shall be as shown on the plans or as directed by the engineer. Where requiring more than one width or length of mattress, bind adjacent mattresses together according to plan details to the satisfaction of the engineer.

712.04 MEASUREMENT. Revetments will be measured by the square yard of surface area to be re-vetted as shown on the plans and as directed. Site preparation, geotextile fabric, and expansion joint filler will not be measured for payment. Excavation, cables, and ties for cabled articulated concrete block mattress will not be measured for payment.

712.05 PAYMENT. Payment for all revetments will be made at the contract unit price per square yard, which includes furnishing and installing all materials as shown on the plan details and in accordance with this section. Payment for concrete cast-in-place revetment, wet, and dry batched sacked concrete revetment, will be made on a lot basis at the contract unit price per square yard, adjusted in accordance with table 901-5. Size, sampling, and testing of each concrete lot shall be in accordance with the materials sampling manual. Payment for cabled articulated concrete block mattress will be made per square yard.

Payment will be made under:

Item No.	Pay Item	Pay Unit
712-01	Concrete Cast-in-Place Revetment	Square Yard
712-02	Sacked Concrete Revetment	Square Yard
712-03	Stone Revetment	Square Yard
712-04	Flexible Revetment	Square Yard
712-05	Cabled Articulated Concrete Block Mattress	Square Yard

Section 713

Temporary Traffic Control

713.01 DESCRIPTION. Furnish, install, maintain, and remove temporary construction barricades, precast concrete barriers, lights, signals, pavement markings, and signs; provide flaggers; and comply with all other requirements regarding the protection of the work, workers, and safety of the public. Unless otherwise noted in the plans or special provisions, this work also provides for traffic control management in compliance with the *Manual On Uniform Traffic Control Devices* (MUTCD), including the installation, inspection, maintenance, and removal of all traffic control devices relative to work on the project. Signs, barricades, barriers, channelizing devices, pavement markings, or any other temporary traffic control measures shall comply with plan details, *Temporary Traffic Control Standards*, the MUTCD, and these specifications.

Signs, barricades, barriers, channelizing devices, pavement markings, and arrangements thereof, as shown on the plans, are minimum requirements. Furnish and install appropriate signs for special conditions as directed. Requirements for proper signs, barricades, barriers, channelizing devices, or other safety precautions promulgated by the contractor's insurers are not negated by these specifications. These specifications shall not be construed to relieve the contractor of responsibilities for the safety of the public, for liability in connection therewith, or compliance with state and local laws or ordinances.

Assign one or more authorized Traffic Control Supervisors (TCS) to provide traffic control management for the project. If assigning more than one TCS, then submit a weekly schedule identifying who will be in charge of providing traffic control management on a daily basis to the engineer. The TCS shall have a set of all contract documents relating to traffic control (and traffic staging if applicable), a current copy of the MUTCD, and a current copy of *Temporary Traffic Control Standards* readily available at all times.

If a subcontractor provides traffic control management, the subcontractor's TCS shall meet all the requirements set forth herein.

The contractor may assign one or more Traffic Control Technicians (TCT) to assist the TCS in inspection and maintenance of Traffic Control Devices.

713.02 MATERIALS. Materials for temporary signs, barricades, barriers, and related devices shall comply with the following sections and subsections:

Portland Cement Concrete	901
Reinforcing Steel	1009.01
Backing Material	1015.04.2
Reflective Sheeting	1015.05
Temporary Pavement Markings	1015.08
Raised Pavement Markers & Adhesive	1015.09
Thermoplastic Pavement Markings	1015.10
Traffic Paint	1015.12
Barricade Warning Lights	1018.13

713.02.1 Temporary Pavement Markings: Temporary pavement markings shall be a minimum of 4 inches wide.

713.02.2 Reflective Sheeting: Reflective sheeting requirements for temporary signs, barricades, channelizing devices, drums, and cones shall comply with the following:

713.02.2.1 Temporary Signs and Barricades: On the mainline of freeways and expressways, fabricate the initial advanced warning construction sign using DOTD Type X (Fluorescent Orange) reflective sheeting. Reflective sheeting for all other temporary signs and barricades shall comply with the requirements of ASTM D 4956, Type III.

713.02.2.2 Vertical Panels: Reflective sheeting for vertical panels used to channelize or divide traffic shall meet the requirements of ASTM D 4956, Type III.

713.02.2.3 Drums and Supercones: Reflective sheeting for drums and supercones shall meet the requirements of ASTM D 4956, Type III, and the Supplementary Requirement S2 for Reboundable Sheeting as specified in 1015.05.6.

713.02.2.4 Traffic Cones: Reflective sheeting for traffic cones shall meet the requirements of ASTM D4956, Type III or VI.

713.03 FABRICATION. Fabricate temporary signs, barricades, and related devices according to 729.04. Label back of signs with name of fabricator, date fabricated and the department project number. Fabricate precast concrete barriers according to Section 805.

713.04 TEMPORARY SIGNS AND BARRICADES.

713.04.1 General: When work is in progress, furnish and install temporary signs, barricades, and related devices on portions of the work covered by the Notice to Proceed or when operations are suspended. During such times that temporary signs, barricades, and related devices are not in place, maintain required traffic control devices. Do not begin construction work until signs, barricades, and other traffic control devices have been erected and approved.

The contractor's Traffic Control Supervisor (TCS) shall coordinate with the engineer before removing or covering any signs that conflict with temporary traffic control signs.

When placing signs, coordinate with the engineer in removing Departmental signs, so that appropriate signs are in place at all times.

Signing shall remain in place and be maintained by the contractor, supplemented by additional signs as required, throughout the period of work. When erecting previously used signs on a project, the engineer must inspect and approve these signs before erection. Remove all signs with reduced retroreflectivity or excessive color fading from the work zone. In case of a dispute over a rejected used sign, the engineer may take such measurements or review retroreflectivity and color data obtained by the contractor to determine if the sign meets minimum standards for new materials. Replace signs that do not meet the minimum standards for new materials at no direct pay.

Rejected signs will be marked on the back "NOT FOR USE ON STATE PROJECTS."

Remove signs placed by the contractor according to the Traffic Control Plan. The Department will ensure that all permanent highway signs are in place upon completion and prior to final acceptance of the project.

On projects where constructing the surface course with asphalt concrete or portland cement concrete, install permanent striping and raised pavement markers (when required) prior to removal of barricades.

Upon removal, signs, barricades, and related devices furnished and placed by the contractor shall remain the contractor's property.

713.04.2 Advance Warning Area: When specified, provide Type C arrow boards for temporary traffic control at locations shown on the plans or as directed.

713.04.3 Sign Supports: Mount signs a minimum of 5 feet above the higher of the roadway or the ground clearance. In urban areas, mount the signs a minimum of 7 feet above the roadway.

713.05 PORTABLE CHANGEABLE MESSAGE SIGNS. Furnish, operate, and maintain solar powered portable changeable message signs at all locations designated on the plans or as directed.

The portable changeable message sign shall be in good operational condition when delivered to the job site. The engineer will inspect the signs; if they are found to be in good operational condition with all working parts functioning, the signs will be approved for use on the project.

The message sign shall consist of three separate lines. Each line shall consist of eight characters. Each character shall nominally be 18 inches in height. The width shall be adequate to meet the below legibility requirements. Each character shall be a 5 x 7 LED module or hybrid LED disk. Characters shall be separated at a distance such that the legibility requirements are maintained.

All internally illuminated portions of the sign shall be amber in color. Externally illuminated surfaces meant for message display shall be fluorescent yellow. Non-illuminated surfaces on the front panel shall be flat black in color.

The sign shall be clearly visible under all conditions and all lanes of travel from a distance of 1000 feet perpendicular to the sign center. The sign shall maintain this legibility throughout the entire project. The contractor shall be responsible for maintaining this minimum legibility. Determination of legibility distance shall rest solely with the engineer.

Use the portable changeable message sign in conjunction with other traffic signs and devices in accordance with the plans, project specifications, and as directed by the engineer. Messages shall be approved by the engineer.

Store the signs in an approved secure storage area when not in use. Perform all maintenance operations recommended by the manufacturer and keep adequate records of such operations.

Keep the signs clean and in good repair at all times.

713.06 TEMPORARY PRECAST CONCRETE BARRIERS. Barrier units shall be furnished by the contractor unless specified otherwise. Each barrier unit shall be 15 feet in length.

When the barrier units are furnished by the Department, the units will be furnished at no cost to the contractor. The contractor shall load the barrier units at the location specified, deliver the units to the construction site, and place them as required.

The contractor shall relocate barrier units as required during construction.

Furnish connecting pins and plastic reflectors at no additional cost to the Department. Reflectors shall have 7.0 square inches minimum reflective

area. Install a maximum of 15 feet apart (each side) and in accordance with the manufacturer's recommendations. Replace damaged pins or reflectors as directed by the engineer.

After completion of the work, barrier units furnished by the Department shall be removed, transported by the contractor to the location specified, and unloaded as directed. All costs of loading, transporting, and unloading the barrier units shall be included in the contract price for this item. Barrier units furnished by the contractor shall, upon removal, remain the contractor's property. Satisfactorily repair or replace damaged barrier units at no direct pay.

713.07 PAVEMENT MARKINGS. Color, width, and type of temporary pavement markings shall be in accordance with Table 713-1 and the MUTCD. Temporary pavement markings shall be in place by the end of each day's operation.

Apply temporary striping tape by approved methods to the satisfaction of the engineer. Apply thermoplastic pavement markings in accordance with 732.03. Apply painted traffic striping in accordance with Section 737.

Table 713-1
Temporary Pavement Marking^{1, 2, 3}

		Two-lane Highways	Undivided Multilane Highways	Divided Multilane Highways
S H O R T	All ADT's with time <7 days	Lane lines 4-ft tape on 40-ft centers; with no passing zone markings. "Do Not Pass" and "Pass With Care" signs as required	Lane lines 4-ft tape on 40-ft centers; dbl yellow centerline	Lane lines 4-ft tape on 40-ft centers
	All ADT's with time >7 days and ≤ 30 days	Lane lines 4-ft tape on 40-ft centers with no passing zone markings and no edgelines. "Do Not Pass" and "Pass With Care" signs as required	Lane lines 4-ft tape on 40-ft centers; dbl yellow centerline and edgelines	Lane lines 4-ft tape on 40-ft centers and edgelines
L O N G	All ADT's with time >30 days	Standard 10-ft lane lines, no-passing zone markings; when pavement width is ≥22 ft , edge lines	Standard 10-ft lane lines, centerlines, edge lines	Standard 10-ft lane lines, centerlines, edge lines

¹ No-passing zones shall be delineated as indicated whenever a project is open to traffic.

² On all Asphalt Surface Treatments that are open to traffic and used as a final wearing course or as an interlayer, temporary pavement markings (tabs) on 20-foot centers shall be used in lieu of the 4-foot tape on 40-foot centers.

³ A \$150 per day penalty will be assessed the contractor if Table 713-1 is not adhered to.

713.07.1 Short-term Pavement Markings: Provide short-term pavement markings on all pavement surfaces under traffic.

Install temporary striping tape a minimum of 4 feet long on a maximum of 40-foot centers on centerlines of two-lane highways and lane lines of multilane highways. When short-term pavement markings require no-

passing zone markings or double yellow centerlines on undivided multilane highways, use any of the temporary pavement markings listed in 713.02.

Removal of short-term pavement markings only required on the final surface.

713.07.2 Long-term Pavement Markings: Provide long-term pavement markings on all surfaces not covered by an additional surface within two weeks. Long-term pavement markings shall include, but are not limited to, standard lane and centerline markings, edge lines, no passing zone markings on two-lane highways, stop bars, and legend and symbol markings as shown on the permanent pavement marking details. Layout work for exact location of markings will only be required on the final wearing surface.

These markings include all of the pavement markings listed in 713.02.

Long-term markings do not include the installation of raised pavement markers.

713.07.3 Final Surface: On the final surface of portland cement concrete pavement or asphalt concrete pavement, place temporary markings with sufficient accuracy to avoid conflict with permanent striping. Temporary pavement markings on the final surface shall be any of the pavement markings listed in 713.02.

Place permanent markings over traffic paint on final surfaces provided the temporary markings have been placed in the final configuration and the painted lines are not flaking or showing signs of deterioration.

When required, remove temporary pavement markings in accordance with the requirements for the type of permanent marking being used. No objectionable staining of pavement surface as a result of the removal procedure will be allowed.

713.07.4 Temporary Reflectorized Raised Pavement Markers: When required, install temporary reflectorized raised pavement markers in accordance with Section 731.

713.07.5 Pavement Markings for Asphalt Surface Treatment: The type of markings shall be in accordance with Table 713-1. Put short-term temporary pavement markings in place at the end of each day's operation. Put long-term temporary pavement markings in place as soon as practical after expiration of the four-day maintenance period following the asphalt surface treatment operation. On the final wearing course, place permanent markings within two weeks following completion of the long-term temporary pavement markings.

When used on the final wearing course, painted traffic striping shall be in accordance with Section 737.

Install temporary raised markers on centerlines of two-lane highways and lane lines of multilane highways in accordance with 1015.08.3. “No passing zone” markings shall be any of the temporary pavement markings listed in 713.02.

Install the temporary raised pavement markers in accordance with the manufacturers’ recommendations or as directed by the engineer. Place temporary raised markers consisting of flexible reflective tabs at 20-foot intervals on the centerline of the roadway. Install the markers so that the reflective faces of the markers are perpendicular to a line parallel to the roadway centerline.

If directed by the engineer, remove the temporary raised pavement markers after permanent striping has been accomplished. Repair damage to the pavement surface at no direct pay.

713.08 PORTABLE WORK ZONE TRAFFIC CONTROL DEVICES.

All Category I, II, and III portable work zone traffic control devices, as described below, shall be crashworthy as determined by evaluations through the National Cooperative Highway Research Program (NCHRP) 350 for Test Level 3 (TL-3) or the American Association of State Transportation Officials (AASHTO) *Manual for Assessing Safety Hardware (MASH)*.

713.08.1 Category I Devices: Category I devices are low-mass, single-piece traffic cones, tubular markers, single-piece drums, and flexible delineators. By definition, they are considered crashworthy devices meeting NCHRP Report 350 or MASH criteria. Drum and light combinations with Type A or C warning lights and vandal resistant fastener hardware are included as Category I devices. In lieu of testing for crashworthiness, acceptance of Category I devices for compliance with NCHRP 350 or MASH will be allowed based on self-certification by the supplier. The supplier shall certify that the product is crashworthy in accordance with the evaluation criteria of NCHRP 350 or MASH. This certification may be a one-page affidavit signed by the supplier, with supporting documentation kept on file to be furnished if requested.

713.08.2 Category II Devices: Category II devices include other low mass traffic control devices such as portable barricades either with or without lights or signs, portable sign stands, temporary sign posts, portable vertical panel assemblies, and drums with lights not meeting the drum and light combination requirements for Category I. Individual crash testing is required for Category II devices. FHWA letters of approval shall serve as verification that these devices comply with the crash testing requirements of NCHRP Report 350 or MASH. Provide for the engineer a listing of all the

Category II devices to be used on the project prior to installation including a reference to the FHWA Work Zone letter number for each device. Also certify that each device has been crash tested and meets the NCHRP 350 or MASH requirements.

713.08.3 Category III Devices: Category III devices include massive devices such as temporary concrete barriers, water filled barriers, and temporary attenuators. Individual crash testing is required for Category III devices. FHWA letters of approval shall serve as verification that these devices comply with the crash testing requirements of NCHRP Report 350 or MASH. Provide for the engineer a listing of all the Category III devices to be used on the project prior to installation including a reference to the FHWA Work Zone letter number for each device. Also certify that each device has been crash tested and meets the NCHRP 350 or MASH requirements.

713.09 TRAFFIC CONTROL MANAGEMENT.

713.09.1 Authorization: Prior to commencing work requiring traffic control management, submit to the engineer proof of the Traffic Control Supervisor's (TCS) and Traffic Control Technician's (TCT) current authorizations.

713.09.1.1 Traffic Control Supervisor (TCS) Authorization: The Department will accept the TCS authorization of other approved agencies or firms only if all of the following minimum TCS requirements are met:

1. Successful completion of a work zone traffic control supervisor course approved by the Department.
2. Passing a written examination on the work zone traffic control supervisor course.
3. A minimum of one year full-time field experience, verified by the agency or firm, in work zone traffic control. This experience may be verified by the Department at its discretion.
4. A TCS refresher course is required every 4 years.

713.09.1.2 Traffic Control Technician (TCT) Authorization:

The Department will accept the TCT authorization of other approved agencies or firms only if all of the following minimum requirements are met:

1. Successful completion of a work zone traffic control technician course approved by the Department.
2. Passing a written examination on the work zone traffic control technician course.

3. A TCT refresher course is required every 4 years.

713.09.2 Traffic Control Supervisor (TCS) Duties: The TCS shall be responsible for traffic control management. The TCS shall be available to the engineer to address traffic control management issues as needed. The following is a listing of the TCS's primary duties:

1. Personally provide traffic control management and supervision services at the project site. The TCS may have other assigned duties, but shall be readily available at all times to perform TCS duties as required in the contract. A minimum of one TCT or TCS shall be required on site during working hours, except the following where a TCS shall be onsite at all times during working hours:

- freeways, expressways, and interstates
- multilane roads with posted speeds of 45 mph and greater
- other roadways with ADT equal to and greater than 25,000.

2. Be responsible for observing and evaluating both the daytime and nighttime performance of all traffic control devices installed on the project, in accordance with the Traffic Control Plan (TCP). Ensure that the devices are performing effectively as planned for both safety and traffic operations purposes. Do this inspection upon the initial installation of the devices and when any changes are made. This is in addition to the inspection of traffic control required in 713.09.5.

3. Be responsible for revisions requested by the contractor to the traffic control plan established in the contract and submit the new traffic control plan in accordance with 713.09.3.

4. Be responsible for the training of flagging personnel. This training will ensure that all flagging done on the project is in compliance with the MUTCD Part VI and Louisiana Work Zone Traffic Control Details. Flaggers shall be re-qualified every 4 years.

5. Coordinate all traffic control operations for the duration of the contract, including those of subcontractors, utility companies, and suppliers, to ensure that all traffic control is in place and fully operational prior to the commencement of any work. The Department recognizes that the contractor does not have direct control over the traffic control operations of the utility companies. The coordination provided by the TCS when dealing with utility companies is specifically for the purpose of coordinating concurrent utility traffic control with any other construction traffic control to avoid conflicts.

6. Coordinate, in writing, all project activities with the appropriate law enforcement, fire control agencies, and other appropriate public agencies as determined at the pre-construction conference by the engineer. Also invite the above agencies to the pre-construction conference.

7. The Department, in collaboration with the TCS, will prepare and submit statements concerning road closures, delays, and other project activities to the news media on a weekly basis or more often as needed. Submit news releases to the engineer for review and approval prior to the Department's submittal to the news media.

8. Notify the engineer, or designee, immediately of all vehicular accidents and/or incidents related to the project traffic control. Document the time and date of notification in the traffic control diary. Also monitor and document queues that occur as necessary.

9. Attend the pre-construction conference and all project meetings.

10. Assume responsibility for the maintenance, cleanliness, replacement, and removal of traffic control devices of the existing traffic control plan during working and non-working hours.

713.09.3 Traffic Control Plan Revisions: Make requests for revision in the traffic control plan in writing to the engineer a minimum of 14 calendar days in advance of the needed revision. If the requested revision falls within the scope of the existing contract drawings, the engineer may approve the revision. If the engineer determines that the requested revision is outside the scope of the contract drawings, the contractor will be required to submit a change order request. The change order drawings shall conform to the following:

1. Letter size original contract drawings. Submit change order drawings on high quality, white 8 1/2 x 11 inch letter size paper. The drawings may be hand drafted or computer drafted and arranged in landscape format on the page. The text and drawings must be legible after reproduction on standard reproduction equipment. Left, bottom, and right hand margins shall be at least 1/2 inch and the top margin shall be 1 inch.

2. Full size original contract drawings. Submit change order drawings on high quality, 4-mil, double-matte film using a plotting or reproduction process that fuses the graphics to ensure durability. Repeated handling and friction due to stacking of plans shall not smear, flake or rub off the graphics. Improper plotter settings and plotter wear may cause inconsistent durability of the drawings. Test samples of the submitted drawings for durability. Advance samples of matte films may be submitted for approval; however, the contract plans will be tested separately. Failures will result in rejection of the submittal. Drawing sizes shall comply with 801.05.2.2.1.

3. Lettering on change order drawings shall be of adequate size to facilitate a 50 percent reduction of plans. Make additions or changes with a permanent type of waterproof ink made for this purpose. If revised cross-sections are required, plot the cross-sections on standard cross-section

sheets. As a minimum, draw the ground line, centerline elevation, and station numbers in ink; the remaining information may be drawn in pencil.

Regardless of size, identify all required change order drawings and documents with the DOTD project title and project number. Sign and seal all plans and calculations by a Louisiana licensed civil engineer.

All plans submitted by the contractor shall conform to these specifications and standards. The DOTD Chief Engineer may reject any plans not conforming to these standards.

Revisions to the TCP that are determined to be outside the scope of the original contract drawings must be approved by the DOTD District Traffic Engineering Division prior to implementation of the requested revision. In some cases on high traffic routes or high priority projects, the revisions must be approved by the HQ Traffic Operations Engineer.

713.09.4 Traffic Control Diary: The TCS shall maintain a project traffic control diary using the Department's Site Manager Program. As a requirement of 713.09.2.8, keep the traffic control diary current on a daily basis and electronically sign each daily entry. A date stamp is required on each diary, so it is imperative to complete these diaries in a timely manner. Completion and maintaining of the daily diaries in accordance with the plans and specifications is subject to the LA R.S. 14:133 "Filing or Maintaining False Public Records." Photographs and videotapes may be used to supplement the written text.

Make the traffic control diary available at all times for inspection by the engineer. Review the diary with the engineer on a weekly basis and submit a copy to the engineer on a monthly basis. Failure to complete the diary on a daily basis or make the diary available for review shall result in a deduction from payments for the work of \$150 per calendar day as stipulated damages for each day the diary is not completed or maintained. On days when the Department's Site Manager Program is unavailable, either due to location or operation, the TCS shall make arrangements with the approval of the Project Engineer to submit the traffic control diaries daily. Failure to submit the monthly copy of the diary to the engineer shall result in the withholding of the next partial payment until the past due diaries are submitted. Submitted diaries that indicate that contemporary daily record keeping has not been maintained, as determined by the engineer, the Department's Work Zone Engineer, or the Department's Statewide Traffic Control Specialist shall result in a deduction of \$150 for each such deficiency as stipulated damages from payments for the work. The lack of a weekly review by the engineer shall not relieve the contractor from the assessment of stipulated damages for its failure to maintain a daily traffic control diary. The traffic control

diary is part of pay item 713 and shall become the property of the Department at the completion of the project.

The contractor, with the approval of the engineer, the Department's Work Zone Engineer, or the Department's Statewide Traffic Control Specialist, may cease the requirement for a traffic control diary when:

1. The project has been partially accepted and/or no remaining work exists on the project site that impacts the travelling public or,
2. When all signs and barricades are removed at the conclusion of the project.

When referring to the daily completion of the diary, it is meant that the TCS shall complete the diary by the end of the following day except as follows:

1. If the contractor does not work on Saturday, the Friday and Saturday diaries shall be entered into SiteManager no later than Monday morning at 9:00 am.
2. If the contractor works on Saturday, the Friday diary shall be entered by the end of the day Saturday, but the Saturday diary shall be entered no later than Monday at 9:00 am. The Sunday diary shall still be entered by the end of the day Monday.

713.09.5 Inspection of Traffic Control: The TCS shall be responsible for the inspection of all traffic control devices every calendar day that traffic control devices are in use. This inspection may be delegated to the TCT, except for the conditions described in 713.09.2.1 above, where the TCS shall conduct the inspections himself. Regardless, the TCS shall be stationed within one hour of the jobsite. Use the *Quality Guidelines for Work Zone Traffic Control Devices* standard by the American Traffic Safety Services Association (ATSSA) to evaluate the condition of the traffic control devices to determine if they are acceptable for use. Provide for the immediate repair, cleaning, or replacement of any traffic control devices not functioning as required to ensure the safety of the motorist and construction personnel and/or not meeting the ATSSA standard.

Conduct inspection of the traffic control devices by the TCS at the beginning and end of each workday, and as scheduled or directed by the engineer during the workday. Inspect the traffic control devices by the TCS on weekends, holidays, or other non-work days at least once per day. Inspect traffic control devices by the TCS at least once a week during nighttime periods and the same night after any modifications or changes have been made in the traffic control devices.

713.09.6 Failure to Comply: The engineer, the Department's Work Zone Engineer, or the Department's Statewide Traffic Control Specialist may suspend all or part of the contractor's operation(s) for failure to comply with the approved "Traffic Control Plan" or failure to correct unsafe traffic conditions within a reasonable period of time after such notification is given to the contractor in writing. If major traffic control deficiencies require immediate corrective action for the safety of the travelling public, the engineer, the Department's Work Zone Engineer, or the Department's Statewide Traffic Control Specialist may completely suspend the contractor's operations. This suspension can either be spoken or written, but if spoken, shall be followed up in writing as soon as practical. The Department reserves the right to revoke or de-certify the TCS for gross neglect of these duties. At this point, the TCS shall retake a Department approved TCS course and shall be subject to a 90-day probationary period at the discretion of the Department.

In the event that the contractor does not take appropriate action to bring the deficient traffic control into compliance with the approved traffic control plan or to correct the unsafe traffic conditions, the Department may proceed with the corrective action using its own forces, and such costs will be deducted from payments owed to the contractor.

If the contractor's operations are suspended, the normal assessment of contract time will not cease for the period required to correct these unsafe conditions and traffic control deficiencies. The contractor will not be relieved of the responsibility to provide traffic control safety to the traveling public when a project is under full or partial project suspension. When a project is under suspension due to the contractor's failure to comply with this section, or when the contract is under stipulated damages, continue to provide traffic control management. No additional measurement or payment will be made. If suspensions or partial suspensions are requested by the contractor, the additional traffic control management costs will be at no expense to the Department.

713.09.7 Engineer Modifications: The provisions included in the plans and specifications for handling and controlling traffic during construction may be changed by the engineer, with the approval of the DOTD District Traffic Operations Engineer, due to actual field conditions encountered. Such changes will be made by written instruction to the contractor and be considered an amendment of the plans and specifications as of the date of the change.

713.10 NIGHTTIME CONSTRUCTION OPERATIONS.

713.10.1 Description: This work consists of furnishing, installing, operating, maintaining, moving, and removing portable light towers and equipment-mounted fixtures for nighttime construction operations. Nighttime construction operations are defined as work performed after sunset and before sunrise.

713.10.2 Equipment Requirements: Materials and equipment shall be in good operating condition and in compliance with applicable OSHA, NEC, and NEMA codes.

The contractor shall furnish, to the engineer, two light meters capable of measuring the level of illuminance. These light meters will be used by the engineer to check the adequacy of illumination throughout the nighttime construction operations. The light meters will become the property of the contractor after final acceptance.

Suitable brackets and hardware shall be provided to mount lighting fixtures on equipment and machinery. Mountings shall be designed so that light fixtures can be positioned as necessary to reduce glare and provide the required illumination. Mounting brackets and fixtures shall not interfere with the equipment operator or any overhead structures and shall be securely connected to the fixtures to ensure minimum vibration.

Equipment-mounted systems shall be attached to construction equipment to provide Level II and Level III illuminance. Equipment mounted lighting shall be designed and positioned to be operated independently of general illumination.

Portable systems may consist of ground-mounted, trailer-mounted, or equipment mounted light towers. Portable light towers shall be sturdy and free-standing without the aid of guy wires or bracing. Towers shall be capable of being moved as necessary to keep pace with the construction operation. Extreme caution shall be used when moving portable light towers in the vicinity of overhead utilities. Portable lighting systems shall be positioned to minimize the risk of being impacted by traffic on the roadway or by construction equipment.

Conventional vehicle headlights shall not be permitted as the sole means of illumination while working. All motorized vehicles shall be equipped with conventional vehicle headlights to permit safe movement in non-illuminated areas. Use of strobe lights on vehicles and equipment is prohibited. Use of flashing lights shall be kept to a minimum to prevent motorist distraction. Flashing lights shall not be used behind barrier protection systems.

Switches shall be provided to adequately control the various lights. All wiring shall be weatherproof and installed according to local, state, federal, and OSHA requirements. Ground fault circuit interrupters shall be provided for electrical outlets used for electrical tools and extension cords. The contractor shall provide sufficient fuel, spare lamps, generators, and qualified personnel to ensure that all required lights operate continuously during nighttime construction operations. In the event of any failure of the lighting system, the construction operation shall be discontinued until the required level of illumination is restored. In residential areas, generator systems shall be selected to comply with local noise ordinances. A supply of emergency flares shall be maintained by the contractor for use in the event of emergency or unanticipated situations.

713.10.3 Illumination Requirements: All operations that are performed during nighttime hours shall be properly illuminated to allow for the safe performance and inspection of the work.

Work area is defined as a minimum of 50 feet ahead and behind the employee, where work is to be performed. A minimum of 5 foot-candles (54 lux) shall be maintained throughout the work area during nighttime construction operations, and during the setup and removal of lane or roadway closures.

Lighting shall be adequate to meet the required level of illuminance and uniformity over the work area as follows:

713.10.3.1 Level I (5 foot-candles, 54 lux): This level of illuminance shall be provided for all work areas of general construction operations, such as excavation and embankment; cleaning and sweeping; landscaping; planting and seeding. Stockpiles shall also be illuminated to Level I to enhance safety and improve work efficiency.

713.10.3.2 Level II (10 foot-candles, 108 lux): This level of illuminance is required for areas on or around construction equipment such as that used for drainage installations, striping, base course construction, milling, asphalt paving operations, and concrete placement and removal. This level is necessary for safe operation of equipment and for obtaining an acceptable level of accuracy.

713.10.3.3 Level III (20 foot-candles, 215 lux): This level of illuminance is required for tasks requiring a higher level of visual performance or for tasks with a higher level of difficulty. Such tasks include, pavement or structural crack filling, joint repair, joint cleaning, joint sealing, pavement patching and repairs, saw-cutting, installation of signal equipment or other electrical/mechanical equipment, and other tasks involving fine details or intricate parts and equipment.

713.10.4 Glare Control: All lighting provided under this item shall be designed, installed, and operated to avoid glare interference with roadway traffic or discomfort for residences adjoining the roadway. The contractor shall locate, aim, and adjust the lights to provide the required level of illuminance and uniformity in the work area without the creation of objectionable glare. The engineer shall determine when glare exceeds acceptable levels, either for traffic or adjoining residences. The contractor shall provide shields, visors, or louvers on luminaries as necessary to reduce objectionable levels of glare.

At a minimum, the following requirements shall be met to avoid objectionable glare to oncoming traffic:

1. Tower-mounted luminaries shall generally be aimed either parallel or perpendicular to the roadway.

2. All luminaries shall be aimed such that the center of the beam axis is no greater than 60 degrees from the vertical.

3. Luminous intensity of any luminary shall not exceed 20,000 candelas at an angle of 72 degrees from the vertical.

713.10.5 Operational Requirements: Thirty days prior to the start of night time operations, the contractor shall submit a lighting plan to the engineer for acceptance. The contractor shall select appropriate lighting systems and design a lighting plan to achieve the required illuminance levels.

The lighting plan shall include location of lights necessary for every aspect of work; description of light equipment to be used; description of power source; attachment and mounting details for lights to be attached to equipment; technical details pertaining to the lighting fixtures; details on hoods, louvers, shields, or other glare control methods; and lighting calculations confirming that the illumination requirements will be met by the layout plan.

Lighting inspection will include (1) light meter measurements to determine illumination levels, (2) subjective observation of the lighting setup to evaluate glare potential for drivers and workers, and (3) a physical check of the lighting equipment to ensure that it complies with the specification requirements included in the contractor's lighting plan.

Prior to the first night of operation, the engineer will check the adequacy of the installed lighting using a light meter. A summary of these measurements will be noted in the inspection records to provide a basis for comparing subsequent measurements. If the required illuminance levels are not met, the contractor shall make the necessary adjustments before any work proceeds.

Operational checks shall be made when construction phasing changes and lighting plan changes are required to accommodate different phases of construction. Periodic checks will be made throughout the duration of nighttime operations. If the required illuminance levels are not met, the contractor shall make the necessary adjustments to the lighting plan before work continues.

During construction operations, in the event of any failure of the lighting system, the operations shall be discontinued until the required level of illumination is restored.

713.11 MEASUREMENT.

713.11. 1 Temporary Signs and Barricades: When the contract does not include a pay item for “Temporary Signs and Barricades,” the provision of temporary construction signs, barricades, and related devices will be considered by the Department to be for the convenience of the contractor and will not be measured for payment.

When including a pay item for “Temporary Signs and Barricades” in the contract, the furnishing, erecting, maintaining, and subsequent removing of temporary construction signs, barricades, and related devices will be measured on a lump sum basis.

Flashing arrow boards will not be measured for separate payment, but will be included in the contract lump sum price for Temporary Signs and Barricades.

713.11.2 Temporary Pavement Markings: When the contract does not include a pay item for Temporary Pavement Markings, provision of these markings will be considered by the Department to be for the convenience of the contractor and will not be measured for payment. When the contract includes an item for Temporary Pavement Markings, these markings’ acceptable furnishing, placing, maintenance, and subsequent removal will be measured by the linear foot or mile, as specified.

When measuring by the linear foot of striping, measurement will be made for the material placed. Gaps will be excluded.

When measuring by the mile of single strip per roadway per application, no deduction will be made for the standard design gaps in broken line striping; however, deductions will be made for the length of other gaps or omitted sections.

Temporary pavement legends and symbols will be measured per each legend or symbol.

Temporary reflectorized raised pavement markers will be measured per each marker furnished, placed, and accepted. Removal of temporary reflectorized raised pavement markers will not be measured for payment.

713.11.3 Temporary Precast Concrete Barriers: When the contract does not include a pay item for Temporary Precast Concrete Barriers, the provision of these barriers will be considered by the Department to be for the convenience of the contractor and will not be measured for payment.

Temporary Precast Concrete Barriers furnished by the contractor will be measured per each unit installed, which includes construction, delivery, furnishing, installing, maintaining, and removing each unit from the jobsite a single time. Temporary Precast Concrete Barriers (Department furnished) will be measured per each unit installed which includes collecting from the location specified, transporting, and delivering to the project site, and all costs of handling, maintaining, and returning each unit to the location specified or as directed.

Further movements of barriers for subsequent construction phases will be measured per movement of each barrier.

713.11.4 Traffic Control Management: Traffic control management will not be measured for payment.

713.11.5 Nighttime Construction Operations: Nighttime construction operations will not be measured for payment.

713.12 PAYMENT. Payment for temporary construction signs, barricades, and related devices will be at the contract lump sum price in accordance with the payment schedule of Table 713-2.

**Table 713-2
Payment Schedule
Temporary Signs, Barricades and Related Devices**

Percent of Total Contract Amount Earned	Allowable Percent of Lump Sum Price for Temporary Signs and Barricades
Initial Erection	40
25	60
50	80
75	95
100	100

Payment for temporary pavement markings will be made at the respective contract unit prices. Payment for temporary precast concrete barriers will be made at the contract unit price per each. The concrete in temporary precast barriers furnished by the contractor will be identified by lots and shall be subject to pay adjustments in accordance with Table 901-6 and Note 1 therein. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

Payment for additional movements of temporary concrete barriers will be made per movement of each barrier when required in the plans and directed by the engineer.

Payment for portable changeable message signs will be made at the contract unit price per each during the life of the contract.

Payment will be made under:

Item No.	Pay Item	Pay Unit
713-01	Temporary Signs and Barricades	Lump Sum
713-02	Temporary Pavement Markings	Linear Foot
713-03	Temporary Pavement Markings (Broken Line)	Mile
713-04	Temporary Pavement Markings (Solid Line)	Mile
713-05	Temporary Pavement Legends and Symbols	Each
713-06	Temporary Reflectorized Raised Pavement Markers	Each
713-07	Temporary Precast Concrete Barrier (Contractor Furnished)	Each
713-08	Temporary Precast Concrete Barrier (Department Furnished)	Each
713-09	Temporary Portable Barrier	Each
713-10	Temporary Precast Concrete Barrier Movement	Each
713-11	Portable Changeable Message Signs	Each

Section 714 Sodding

714.01 DESCRIPTION. Furnish, haul, plant, roll, water, and maintain live grass sod at locations shown on the plans or as directed.

714.02 MATERIALS. Use approved sod consisting of either field grown grass or nursery grown grass delivered in rolls or slabs.

Field grown sod shall be Bermuda grass, carpet grass, or other approved grass native to the sodded area.

Nursery grown sod shall be Centipede, Tifway Bermuda, Nomow Bermuda, Common Bermuda, or St. Augustine grass.

Fertilizer shall comply with 1004.01 and agricultural lime shall comply with 1004.02.

Sod shall be free from noxious weeds or other vegetation. Obtain water from any source. Do not use brackish, chemically contaminated, or oily water.

714.03 GENERAL CONSTRUCTION REQUIREMENTS. Cut sod with approved sod cutters. Mow the designated area when necessary. Cut sod to a minimum soil depth of 1½ inches for field grown grass and 1 inch for nursery grown grass. Cut to a uniform width and in convenient lengths for handling. Retain soil on roots of sod when excavating, hauling, and planting. Obtain the services of an established soil testing entity to coordinate soil sampling, perform testing and analyses, and prepare recommendations for materials and procedures to be used during the pre-planting phase of new turf establishment. When practical, perform soil testing early enough to permit agricultural lime or other additives (if required) to be applied sufficiently in advance of planting so that the soil pH adjustment will occur before planting. Test and analyze samples to determine pH and fertility conditions. Use the test results and recommendations to determine the quantities of agricultural lime and fertilizer required for pre-planting applications. Furnish a copy of the test report with recommendations to the engineer. Testing will be at no direct pay. Consider probable time of application when making agricultural lime recommendations.

Do not use sod cut more than 48 hours before placing unless authorized. Inferior appearing sod will not be accepted.

Watering required in connection with digging, storing, or hauling sod will be at no direct pay.

714.04 HANDLING SOD. Place slab sod flat, grass side up on pallets containing no more than 50 square yards of slab sod. Cover the sod and haul to the planting site with soil intact. Off-load sod and place as close as practical to the planting site.

714.05 PLANTING. Pulverize areas to receive sod to a depth of at least 3 inches then level the surface and clear the area of weeds, grass, stones, and other debris. If required, add lime when the area is being pulverized. Broadcast approximately 90 percent of the fertilizer over the area to receive sod, and broadcast the remaining 10 percent over sod after placing and rolling. Upon delivery to the planting site, transfer sod onto the surface soil. Water sod and/or areas to be sodded as directed. Place sod with no space between edges. Stagger slab and roll edges to avoid a continuous seam along the line of flow. Along the edges of such staggered areas, do not offset individual strips less than 6 inches. Pull by hand all slab edges that do not fit closely together without stretching or tearing. Peg when necessary. When directed, top dress the sod surface with sand to smooth-out uneven spots.

714.06 ROLLING. Roll sod after planting with smooth drum sod rollers. Where rolling is impractical, tamp sod by approved hand methods.

714.07 WATERING. Watering shall be the responsibility of the contractor unless otherwise noted. Keep all sodded areas thoroughly watered for a minimum of 60 calendar days after installation. Water shall not contain elements toxic to the plant life. Water immediately after completing each day of sod installation. Water every day, preferably in the morning. After the first week, reduce watering to every other day, tapering off to just twice a week by the third week. Do not drive watering trucks over newly installed turf areas. All watering will be at no direct pay.

714.08 PERIOD OF ESTABLISHMENT – SODDING. The sod establishment period to obtain a healthy stand of grass plants shall begin on the first day that sod is placed under the contract and shall end 60 calendar days after the last day of the sodding operation. Provide a written calendar time period for the sod establishment period. When there is more than one

sod establishment period, describe the boundaries of the sodded area covered for each period. Modify the sod establishment period for inclement weather, shut down periods, or for separate completion dates of areas.

If applying a pesticide becomes necessary to remove a pest or disease, submit a pesticide treatment plan to the engineer for approval by the District Roadside Development Coordinator. The contractor will be responsible for the application of any approved chemicals.

714.09 SATISFACTORY STAND OF GRASS PLANTS. The Department will evaluate sod for species and health. All sod must be moist and growing at the time of acceptance. A satisfactory stand of sod from the sodding operation shall be living sod, uniform in color and leaf texture. Bare spots shall not exceed 2 inches square. Joints between sod pieces shall be tight and free from weeds and other undesirable growth.

Repair or reinstall unsatisfactory areas of sod and repair eroded areas. If at the end of the establishment period, the growth or stand of the sod is unacceptable, the sod will be rejected.

714.10 MEASUREMENT. Sodding will be measured by the square yard along the surface of completed sodding.

714.11 PAYMENT. Payment for sodding will be made at the contract unit price per square yard, which includes all labor, materials, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
714-01	Sodding	Square Yard

Section 715 Topsoil

715.01 DESCRIPTION. Furnish and place topsoil on areas designated on the plans or as directed.

During the pre-planting phase, obtain the services of an established soil testing entity to coordinate soil sampling, perform testing and analyses, and prepare recommendations for materials and procedures to be used. When practicable, perform soil testing early enough to permit agricultural lime or other additives (if required) to be applied sufficiently in advance of planting so that the soil pH adjustment will occur before planting. Test and analyze samples to determine pH and fertility conditions. Use the test results and recommendations to determine the quantities of agricultural lime and fertilizer required for pre-planting applications. Provide a copy of the test report with recommendations to the engineer. Testing will be at no direct pay. When making agricultural lime recommendations, consider probable time of application.

715.02 MATERIALS.

715.02.1 Topsoil: When available, the topsoil shall be the existing surface soil stripped and stockpiled. When requiring additional topsoil beyond the available topsoil from the stripping operation, deliver topsoil and amend as recommended by soil tests. Provide soil tests prior to delivery of topsoil to the site. Determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

Test delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil for particle size, pH, organic content, textural class, chemical composition, and soluble salts. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash, or other material over 1½ inches diameter. Topsoil shall be free from viable plants and plant parts. Topsoil shall also be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. Topsoil shall have a minimum PI of 4, a maximum PI of 12, a pH of 5.5 to 8.0, a minimum organic content of 2 percent, and shall be capable of supporting adequate vegetation.

715.02.2 Soil Amendments: Deliver soil amendments to be blended with the topsoil to the site either in the original, unopened containers bearing the manufacturer's chemical analysis or in bulk. Provide a chemical analysis for bulk deliveries.

Existing topsoil meeting the above requirements within construction limits may be used in accordance with 106.02. If adding agricultural lime or organic matter to a soil to bring topsoil into conformance with these specifications, it shall be at no direct pay.

715.03 CONSTRUCTION REQUIREMENTS. Scarify areas to receive topsoil as directed. Uniformly spread topsoil over the areas to a depth of 6 inches and roll to a uniform surface with a culti-packer or other suitable equipment.

715.04 MEASUREMENT. Topsoil will be measured by the cubic yard in approved hauling vehicles at the point of delivery in accordance with 109.01, which includes testing and the test report.

Preparation of the areas to receive topsoil will not be measured for payment. Agricultural lime treatment of areas to receive topsoil will be measured in accordance with 718.04.2.

715.05 PAYMENT. Payment for topsoil will be made at the contract unit price per cubic yard, which includes testing and test reports as well as all labor, materials, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
715-01	Topsoil	Cubic Yard

Section 716

Vegetative and Fiber Mulch

716.01 DESCRIPTION. Furnish and place an approved vegetative or fiber mulch with a tacking agent on seeded areas to promote seed germination and growth while temporarily protecting the soil from erosion.

716.02 MATERIALS. Mulching materials and tacking agents shall comply with 1004.04. Notify the engineer at least 7 calendar days in advance of commencing operations so that the mulch can be inspected and approved prior to use.

Deliver vegetative and fiber mulch in bales or bags of uniform size. Store mulching materials in accordance with 106.09. Protect mulch stockpiles from the weather.

716.03 GENERAL CONSTRUCTION REQUIREMENTS. Mulching shall follow seeding operations within 48 hours. Do not spray mulch on structures. Remove all stains on structures and roadway appurtenances resulting from the mulch or the tacking agent; leave the surface in acceptable condition. During windy conditions, make adjustments in operations to ensure uniform spreading.

Repair damage to seeded areas and re-seed at no direct pay.

716.03.1 Tacked Vegetative Mulch: Distribute vegetative mulch uniformly over the seeded area by blowing it simultaneously with an approved tacking agent. Space jet nozzles in the muzzle of the blower to provide a uniform coating of the mulch as it blows through the nozzles.

The tacked vegetative mulch shall be loose enough to allow air to circulate, but compact enough to partially shade the ground and reduce the impact of rainfall on the soil surface. Begin mulching at the top of the slopes and extend downward. Use blower pipe extensions where slopes cannot be reached by the blower.

716.03.2 Fiber Mulch: The application equipment shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix the fiber mulch, water, and any tacking agent that is part of the fiber mulch system. Keep the fibers in uniform suspension throughout the mixing and distribution cycles. The slurry distribution lines shall be large enough to prevent stoppage. Hydraulic spray nozzles in the discharge line shall provide uniform distribution of the slurry.

716.04 SPREADING RATES.

716.04.1 Tacked Vegetative Mulch: Apply vegetative mulch at a rate of 1¹/₂ to 2 tons of mulch per acre simultaneously with the tacking agent. Final application rates for the tacking agent shall be in accordance with the application rate shown in the Approved Materials List for the particular type of vegetative mulch being used.

716.04.2 Fiber Mulch: Apply fiber mulch as a slurry in accordance with the manufacturer's recommendations. The application rate of the tacking agent, if not pre-blended with the fibers by the manufacturer, shall be in accordance with the application rate shown in the Approved Materials List for the particular type of fiber being used.

716.05 MANUAL SPREADING. In order to prevent defacing structures, manually spread mulch around structures. When performing manual spreading, place mulch in a shredded condition and then spray the tacking agent over the mulch at the specified rate.

716.06 MEASUREMENT. Vegetative mulch and fiber mulch products will be measured for payment by the ton of mulch material used. The weight of vegetative mulch to be used in determining spread rates of mulch and tacking agents will be the product of the number of bales or bags used and the average weight per bale or bag as determined on scales provided by the contractor which have been certified by a qualified independent scale service or the Weights and Measures Division, Louisiana Department of Agriculture and Forestry.

Quantities of tacking agents used with vegetative mulch will be measured by the pound and be determined by marked container count.

Tacking agents used with fiber mulch are considered part of the system and shall be included in the unit cost for the system.

716.07 PAYMENT. Payment for vegetative mulch and fiber mulch products will be made at the contract unit prices per ton and includes all materials including tacking agents, labor, equipment, and other incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
716-01	Mulch	Ton

Section 717 Seeding

717.01 DESCRIPTION. Prepare seed beds, furnish, and sow grass seed on the areas designated on the plans or as directed. Unless otherwise specified, apply seed either mechanically in a dry condition under this section or with hydro-seeding equipment in accordance with Section 739. Obtain the services of an established soil testing entity to coordinate soil sampling, perform testing and analyses, and prepare recommendations for materials and procedures to be used during the pre-planting phase of new turf establishment. When practical, perform soil testing early enough to permit agricultural lime or other additives (if required) to be applied sufficiently in advance of planting so that the soil pH adjustment will occur before planting. Test and analyze samples to determine pH and fertility conditions. Use the test results and recommendations to determine the quantities of agricultural lime and fertilizer required for pre-planting applications. Provide a copy of the test report with recommendations to the engineer. Testing will be at no direct pay. Consider probable time of application when making agricultural lime recommendations.

717.02 MATERIALS. Materials for seeding shall comply with the following sections and subsections:

Topsoil	715
Fertilizer	1004.01
Agricultural Lime	1004.02
Seed	1004.03

Obtain water from any source. Do not use brackish, chemically contaminated, or oily water.

717.03 SOIL AREAS. Select seed on the basis of five general soil areas as follows:

1. Alluvial soils of Mississippi and Red River bottoms.
2. Mississippi terraces and loess hill soils.
3. Coastal plain soils (rolling, hilly, and flatwoods areas in the central, northern, and eastern parts of the state).
4. Coastal prairie soils.
5. Ouachita River bottom.

717.04 PREPARATION OF SEED BED. Prepare seed beds by disking, harrowing, or other approved methods. On slopes of 3-horizontal-to-1 vertical and flatter, till the soil to a minimum of 4 inches depth. On slopes between 3-horizontal-to-1 vertical and 1-horizontal-to-1 vertical, till the soil to a minimum of 2 inches depth by scarifying with heavy rakes or other methods. Use rototillers where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no soil tillage is required. Maintain drainage patterns as indicated on the plans. Completely pulverize areas compacted by construction operations by tillage. Conform to topsoil requirements in Section 715 for soil used for repair of surface erosion or grade deficiencies. Apply the pH adjuster, fertilizer, and soil conditioner during this procedure. The prepared surface shall be a maximum 1 inch below the adjoining grade of any surfaced area. Blend new surfaces to existing areas. Lightly rake the completed surfaces to remove debris.

717.04.1 Lawn Area Debris: Remove debris and stones greater than 5/8 inch in any dimension from surfaces designated on the plans as lawn areas, or as directed by the engineer.

717.04.2 Field Area Debris: Remove debris and stones greater than 2 inches in any dimension from the surface.

717.04.3 Protection: Protect prepared surface areas from compaction or damage by vehicular or pedestrian traffic and surface erosion.

717.05 PERMANENT SEEDING. Plant seed within the dates shown in Table 717-1, unless otherwise permitted in writing.

717.06 TEMPORARY SEEDING. During construction, place temporary seeding as directed. Temporary seeding may be any of the types given in Table 717-1. Annual rye grass or clover is the only acceptable seeding types for winter cover.

Use of a hydro-seeder will be allowed in accordance with Section 739.

717.07 WATERING. When necessary due to dry conditions, periodically water seeded areas until final acceptance at no direct pay.

717.08 SEED ESTABLISHMENT PERIOD. The seed establishment period shall begin on the first day of seeding work under the contract and shall end 3 months after the last day of the seeding operation. The contractor shall provide a written calendar time period for the seed establishment

period. When there is more than one seed establishment period, the boundaries of each seeded area covered by each period shall be described. The seed establishment period may be modified for inclement weather, shut down periods, or for separate completion dates of areas as approved by the engineer.

Bermuda turf will be considered to be established and completed when the areas to be turfed have produced Bermuda grass stems or runners which overlap adjacent Bermuda grass growth over a minimum of 85 percent of the entire area and no spots greater than 4 square feet are void of Bermuda grass. This will be determined by the engineer in random sampling on a square yard basis.

Acceptance of the entire turfed area will be based on the engineer's visual inspection and determination of the required coverage. Acceptance will be based on coverage by Bermuda grass only. Dying or dead turf and eroded areas will not be accepted. Correct deficient areas at no direct pay. Partial areas will not be accepted unless determined by the engineer to be in the best interest of the Department.

717.09 MEASUREMENT. Seeding will be measured by the pound.

717.10 PAYMENT. Payment for temporary and permanent seeding will be made at the contract unit price per pound, which includes all labor, materials, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
717-01	Seeding	Pound

**Table 717-1
Seeding**

Type	Seed Mixtures ¹	lbs/acre	Soil Area ²	Planting Dates
A	Hulled Bermuda	30	1,2,3,4,5	Mar-Sep
B	Hulled Bermuda Crimson Clover ³	20 25	1,2,3,5	Feb-Mar
C	Kentucky 31 Fescue Unhulled Bermuda	25 20	1,2,3,4,5	Sep-Feb
D	Unhulled Bermuda Crimson Clover ³	20 40	1,2,3,4,5	Sep-Feb
E	Pensacola Bahia ⁴	25	1,2,3,5	Mar-Sep
F	Ball Clover Unhulled Bermuda	25 20	1,2,3,4,5	Feb-Mar
G	Vetch (Common) Unhulled Bermuda	40 20	1,2,3,4,5	Sep-Oct
H ⁵	Browntop Millet Hulled Bermuda Pensacola Bahia	6 20 15	1,2,3,4,5	Mar-Jul
I	Annual Rye	30	1,2,3,4,5	Sep-Jan ⁶

¹ Only Hulled Bermuda or Unhulled Bermuda shall be planted in rest areas.

² See 717.03.

³ Inoculated prior to planting with proper bacterial culture.

⁴ Type E shall be used only upon the approval of the Roadside Development Specialist.

⁵ This planting mixture is to be used in the Kisatchie National Forest areas only.

⁶ Annual Rye grass shall not be planted before September 20. Annual Rye grass may be planted as late as January 15 if climatic conditions and soil temperatures will allow germination.

Section 718 Fertilizer and Agricultural Lime

718.01 DESCRIPTION. Furnish and apply commercial fertilizer and agricultural lime on the areas designated on the plans or as directed.

718.02 MATERIALS.

718.02.1 Fertilizer: Fertilizer shall be an approved brand complying with 1004.01. Fertilizer shall be either 8-8-8, 12-12-12, 13-13-13, or 16-16-16. Deliver fertilizer in sack or bulk.

Fertilizer tablets shall be an approved brand complying with the requirements of 1004.01. Deliver the fertilizer tablets in sealed waterproof containers.

718.02.2 Agricultural Lime: Agricultural lime shall comply with 1004.02. Deliver either in sacks or bulk.

718.03 APPLICATION.

718.03.1 Commercial Fertilizer: Uniformly broadcast fertilizer over areas to be fertilized by either hand or machine methods. The rate of fertilizer application shall be as shown in Table 718-1.

**Table 718-1
Fertilizer Application Rates**

Type Fertilizer	Pounds Per Acre
8-8-8	1000
12-12-12	667
13-13-13	615
16-16-16	500

Other balanced fertilizer may be used at the inverse proportional rate. After surface dressing, thoroughly incorporate fertilizer into the soil by light disking, harrowing, or roto-tilling. When dressing the surface by hand, the fertilizer may be applied before final raking and leveling.

718.03.2 Agricultural Lime: Uniformly spread agricultural lime at a minimum rate of 2 tons per acre with a spreader. Apply lime prior to seeding, topsoil placement, and slab sodding. Lime may be applied in conjunction with fertilizer. After lime application, disk the areas and harrow

or roto-till to incorporate lime or lime-fertilizer into the top 3 inches to 6 inches of soil.

718.03.3 Hydro-seeding: If using hydro-seeding methods, fertilizer and lime may be included in the seeding slurry. When specified by the manufacturer, water soluble, liquid fertilizer, or liquid lime will be allowed for hydro-seeding product applications. Hydro-seeding will be measured for payment under Section 739.

718.04 MEASUREMENT.

718.04.1 Fertilizer: Fertilizer will be measured by the pound. The estimated quantity shown on the plans is based on Type 8-8-8 fertilizer. If other types of fertilizer are used, the measured quantities will be multiplied by the factors of Table 718-2 to determine pay quantities.

**Table 718-2
Fertilizer Factors**

Type	Factor
12-12-12	1.5
13-13-13	1.625
16-16-16	2.0

When using other balanced fertilizers, the factor will be determined by dividing the type of fertilizer by eight.

718.04.2 Agricultural Lime: Agricultural lime will be measured by the ton.

718.05 PAYMENT. Payment for fertilizer will be made at the contract unit price per pound. Payment for agricultural lime will be made at the contract unit price per ton.

The contract unit prices for fertilizer and agricultural lime will include all labor, materials, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
718-01	Fertilizer	Pound
718-02	Agricultural Lime	Ton

Section 719 Landscaping

719.01 DESCRIPTION. Furnish and plant various plant materials in accordance with the plans and the specifications.

719.02 LANDSCAPE CONTRACTOR REQUIREMENTS. Conduct landscaping operations in accordance with Section 107, the requirements of the Louisiana Horticulture Law and Regulations, and this section. The landscape contractor shall have in his possession, and maintain in good standing, a Landscape Horticulturalist license, a Landscape Irrigation Contractor license, and a Category 6 Pesticide Applicators license obtained through the Louisiana Department of Agriculture and Forestry. The landscape horticulturalist shall conduct his operations in accordance with Section 107 of the *Louisiana Standard Specifications for Roads and Bridges*, and the requirements of the Louisiana Horticulture Law and Regulations. If landscape maintenance, irrigation maintenance and/or herbicide/chemical application will be performed by the contractor's sub-contractor, proof of insurance and required Louisiana licensing procedures shall be followed.

719.03 MATERIALS. Materials for landscaping shall comply with the following sections and subsections, and the following requirements:

Mortar Sand	1003.08.1
Fertilizer	1004.01
Agricultural Lime	1004.02
Mycorrhizal Inoculant	1004.06
Water Management Gel	1005.05

Obtain water from any source. Do not use brackish, chemically contaminated, or oily water.

Individual plant varieties, species, and size will be indicated on the plans.

719.03.1 Pine Bark for Bed Preparation and Backfilling: Furnish pulverized and well-rotted ground pine bark for use in preparing backfill soil and the soil in bed areas.

719.03.2 Backfill Soil: Prepare backfill soil as follows:

- 5 parts topsoil
- 3 parts pine bark for bed preparation and backfilling
- 1 part sand
- 1 part manure
- Water Management Gel
- Mycorrhizal Inoculant

Add water management gel and mycorrhizal inoculant at the manufacturer's recommended rate for individual trees or plants at the time of planting.

Remove all clods, stones, roots, gravel, and other debris from the excavated soil. Mix backfill soil with excavated soil from individual planting holes at a rate of three parts backfill soil to one part excavated soil. Use this mixture to backfill individual planting holes.

Add fertilizer in accordance with Section 718 except as specified herein.

719.03.3 Water Management Gel: Furnish and place water management gel in accordance with 1004.05.

719.03.4 Mycorrhizal Inoculant: Furnish and place mycorrhizal inoculant in accordance with 1004.06.

719.03.5 Topsoil: If shown on the plans, furnish and place topsoil in accordance with Section 715.

719.03.6 Top Dressing Mulch: The top dressing mulch furnished and placed shall be pine bark, pine straw, hardwood mulch, or cypress bark.

When specifying pine bark mulch, use mulch consisting of 1/2-inch minimum size chipped pine bark. Reject excessively "green" and/or decomposed pine bark.

719.03.7 Fertilizer Tablets: Furnish and place fertilizer tablets in accordance with 1004.01.

719.04 QUALITY AND EXTENT OF WORK. The engineer will notify the Department's Landscape Architect before work begins to coordinate the planting operation with the landscape contractor. Plant in accordance with accepted landscaping practices. Approved plant materials shall be container

grown or balled and burlapped. Transport, plant, fertilize, prune, water, and maintain as necessary to ensure healthy plant growth.

719.05 PLANT MATERIALS. Plants will be subject to approval at the project site before planting. Trees and other plant materials will be inspected by the Department's Landscape Architect, with the landscape contractor present. Enhancement projects require approval from the entity's consultant. Remove all rejected plant material from the site and locate acceptable plant material from other nursery sources at no direct pay.

719.05.1 State and Federal Regulations: Plant materials shall be free from injurious insect pests and plant diseases, and be subject to regulations of Federal and State Departments of Agriculture. Shipments of plants shall comply with nursery inspection and plant quarantine regulations of the states of origin and destination. Obtain proper certificates for movement of nursery stock intrastate and interstate; comply with all other requirements before and during movement or shipment of plants. A copy of the Certificate of Inspection shall accompany each delivery.

719.05.2 Plant Names: Scientific and common plant names shall comply with the current edition of *Hortus third*. Plants shall be true to name and legibly tagged. Make no substitutions for the types, species, quantities, or sizes of materials specified without prior written permission. Present sufficient evidence that the specified plants cannot be obtained and that the substituted plants are essentially equal to the plants specified.

719.05.3 Grading Standards: Grade plants in accordance with the latest edition of *American Standards for Nursery Stock*, as published by the American Nursery and Landscape Association, unless otherwise specified.

719.05.4 Plant List: A complete list of plants will be shown on the plans including botanical name, common name, quantity, height, caliper, etc. Sizes of stock shown are the minimum acceptable sizes.

719.05.5 Quality and Source of Plants: Furnish nursery grown plants, unless written permission is obtained to use selected native stock. This permission will be granted only if native stock is better suited or superior in quality to plants obtained from a nursery.

Furnish plants and trees that equal or exceed the measurements specified in the Plant List. Measure before pruning, with branches in normal position. Dimensions for height and spread refer to the main body of the plant and not from branch tip to branch tip. The determining measurements for trees shall be caliper and/or height as described in the Plant List. Measure caliper of

the trunk 6 inches above the ground level for sizes up to and including 4 inches. If the caliper at 6 inches above the ground level exceeds 4 inches, the caliper should be measured at 12 inches above the ground. Trees shall have a habit of growth which is normal for the species. Furnish plants that are healthy, vigorous, and free from insects, diseases, and injuries. Do not trim or cut leaders or main branches of trees.

719.05.6 Balled and Burlapped Plants: Balled and burlapped plants shall be dug with firm, natural balls of soil of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Furnish balls that are firmly wrapped with burlap or similar material and bound with twine, cord, or wire. Water balled and burlapped plants prior to transportation and keep moist until planted.

719.05.7 Container Grown Plants: Reject container grown stock which has become pot bound or in which the plant is out of proportion (larger) to the size of the container. Furnish stock with a fibrous, cohesive root system. Do not remove container grown plants from the container until just before planting and take care to prevent root system damage. Water container grown plants prior to transportation and keep moist until planted.

719.05.8 Handling and Storage: Protect balled and burlapped plants from drying out by covering the root system with mulch, wood chips, or suitable materials; water the root system and foliage as necessary. Protect plants from drying winds and sun as directed.

Lift plants from the bottom only, not by stems or trunks. Plants will be rejected if the root ball is cracked or loosened.

719.05.9 Delivery and Receipt of Plant Materials: Notify the engineer at least 48 hours before delivery of plant materials to the project. Provide an invoice for each shipment showing plant sizes and varieties in the shipment.

719.05.10 Inspection: Plant materials shall be subject to inspection and approval at any time during the life of the contract. Plants will be rejected for any of the following reasons:

1. Excessive abrasions of bark;
2. Dried out root system;
3. Excessive dead wood;
4. Dried up wood;
5. Excessive sun scald injuries;
6. Undeveloped and weak top or roots;
7. Crooked or one-sided development of tops;
8. No straight leaders on trees normally having them;

9. Broken or removed leaders;
10. Untrue types or sizes;
11. Not complying with federal and state laws or regulations bearing on inspection and certificates;
12. Excessively damaged soil of root balls;
13. Root balls dug from loose soil which will not properly ball;
14. Excessive circling roots in container grown stock; or
15. Dead plants and plants otherwise not complying with these specifications.

Replace rejected material with new plant material of the same kind at no direct pay.

719.06 CONSTRUCTION METHODS.

719.06.1 Seasonal Operations: Unless otherwise directed by the engineer in writing, the planting season is between November 1 and April 15.

Suspend work when the ambient temperature falls below 32°F, excessive wind velocity, frozen or saturated ground, or continuation of prevailing weather would likely cause unsatisfactory results. Complete planting as early as practical in the planting season.

When the only landscape work on the project consists of shrub planting at dead-end road installations, perform planting at any time during the year, provided the ambient air temperature is above 32°F and weather and ground conditions are suitable for planting. Provide container grown plants at dead end road installations.

719.06.2 Pruning: If necessary, prune plant material on the project in accordance with the plan details.

Limit pruning to the removal of injured twigs and branches or as directed. Leave the normal shape of the plant intact unless otherwise directed by the Department's Landscape Architect. Selective pruning may be required on trees of special type or character at no direct pay.

719.06.3 Soil Testing: Obtain the services of an established soil testing entity to coordinate soil sampling, perform testing and analyses, and prepare recommendations for materials and procedures to be used during the pre-planting phase. When practical, perform soil testing early enough to permit agricultural lime or other additives (if required) to be applied sufficiently in advance of planting so that the soil pH adjustment will occur before planting. Test and analyze samples to determine pH and fertility conditions. Use the test results and recommendations to determine the quantities of agricultural lime and fertilizer required for pre-planting

applications. Consider probable time of application when recommending agricultural lime. Furnish a copy of the test report with recommendations to the engineer. Testing will be at no direct pay.

719.06.4 Location of Plants: Locate plants in accordance with plans or as directed by the engineer or landscape architect.

719.06.5 Setting Individual Plants Not in Beds: Dig the planting-hole three times the width of the root ball of the plant. Make the sides of the planting-hole slope away from the center of the hole so as to resemble a shallow bowl. Loosen any smooth sides and hardpan to a depth as required below the bottom of the hole or to such depth that any moisture is allowed to move freely. Build a mound in the center of the plant hole with excavated material for the plant to sit on. Set plants plumb and at such level that, after settlement, a normal relationship of the root crown of the plant with the ground surface will be established. Plant trees so that the trunk flare is partially visible. Removing soil from the top of the root ball to find the trunk may be required. Place each plant in the center of the planting hole. When plants are set, tamp backfill soil under and around the base of each root mass to fill all voids. Plant in backfill soil complying with 719.03.2. Thoroughly settle backfill by watering and tamping to minimize settling and leaning of plant material. Stake plants 6 feet tall and greater in accordance with applicable nursery practices or as shown on any details provided. Locate all staking materials within the saucer. The cost of staking is included in the cost of the individual plants not in a bed. Maintain all plant material in a vertical position for the contract period. On balled and burlapped stock, prior to backfilling, cut and remove all wire or cord from the root balls and stems. Remove the burlap from the root ball and plant hole. On container grown stock, remove the container, scarify, and spread circling roots horizontally before backfilling. Backfill soil, mulch, and staking are included in the cost of individual plants not in beds. Notify the engineer in writing of any problems before installing the trees.

After planting has been completed, form a saucer using excavated material around each plant as shown in the planting details. Extend saucers to the limits of the planting holes for trees and shrubs. No saucers are required in areas of bed preparation. Shrubs in lines or groups may share a common saucer around their perimeter.

719.06.6 Setting Individual Plants (Bed Preparation Mulch Beds): A mulch bed surrounds individual plants planted in a mass. A mulch bed does not contain bed preparation materials from Table 719-1. The bed shape shall be approved by the engineer. All grass and weeds shall be

removed mechanically or by chemical means and all debris shall be removed from the area. Soil shall be loosened and lumps broken to a minimum depth of 6 inches within the mulch bed area. After individual plantings have been completed, a saucer shall be formed using excavated material around each plant as shown in the planting details or they may share a common saucer around their perimeter. The area shall be treated with an approved pre-emergence herbicide in accordance with the manufacturer's recommendations and a trench shall be created around the perimeter in an aesthetically pleasing form separating the grass and bed areas prior to placing mulch. The cost of the top dress mulch used in a mulch bed is paid under the top dressing mulch item.

719.06.7 Fertilizer: Furnish and place either granular or tablet commercial fertilizer at the specified rate in accordance with this section and 718.03.1. Mix fertilizer with backfill soil before backfilling. Equally place the recommended amount of fertilizer tablets in the upper 2 inches of backfill soil, 2 inches from the root ball, or in accordance with the manufacturer's recommendations.

Use fertilizer tablets in individual plant holes, separate from bed areas. After the tree or shrub has been placed, apply the manufacturer's prescribed amount and spacing of tablets for the specified plant size.

719.06.8 Agricultural Lime: Furnish and place agricultural lime in accordance with Section 718 to adjust the soil pH.

719.06.9 Backfilling: Take care in placing backfill along the sides and over the root mass of plants. Place backfill to three-quarters the depth of the ball on the sides and water uniformly on the sides of the root mass to allow settlement of the plant. Straighten, raise, or replant plants that settle or lean before or after watering.

Spread excavated material not used as backfill or for saucers on areas of the project as directed or dispose of in accordance with 202.02.

719.06.10 Water: Furnish and apply water in sufficient quantities for proper irrigation of the plants at no direct pay.

719.06.11 Bed Preparation: The bed shape shall be approved by the engineer. Remove grass, weeds, sticks, roots, stones, and other debris from the planting bed. Treat the planting bed with an approved pre-emergence herbicide in accordance with the manufacturer's recommendations. Roto-till the planting bed to the specified depth and add the materials of Table 719-1. Mix water management gel and mycorrhizal inoculant into the top 4 inches of soil at the rate recommended by the manufacturer prior to planting or seeding. Spread the bed preparation

material over the bed area, then rake or roto-till into the soil to produce a uniformly mixed layer.

**Table 719-1
Bed Preparation Material**

Material	Per 1000 Sq Ft
Mortar Sand	3 cubic yards
Peat Moss	3 cubic yards
Manure	3 cubic yards
Pine Bark	7 cubic yards
Fertilizer 8-8-8 (Or Other Balanced Equivalent At Proportional Rates)	25 pounds
Mycorrhizal Inoculant	per manufacturer
Water Management Gel	per manufacturer

Create a trench around the entire bed. Build all beds as “raised” beds. Rake beds smooth and remove dirt lumps, stones, sticks, grass, and other foreign matter. Finish grades of bed trenches next to walks or buildings shall be from 1 to 2 inches below finish grade of adjoining surfaces unless otherwise shown on the plans or as directed.

719.06.12 Mulching: Place mulch uniformly to the specified depth on and within the planting saucers and bed areas, then water. Avoid placing mulch directly against the trunks of trees and the stems of shrubs. Do not mulch individual plants not in beds more than 3 inches deep.

719.06.13 Weeding: Remove weeds from bed areas, the planting basin of each plant and groups of plants, and the saucer. Mow for a radial distance of 5 feet around individual plants not in beds. Cut the grass in the 10-foot circle to a satisfactory height. Use selective herbicides when approved by the District Roadside Development Coordinator. Contact-type herbicides shall be compatible with plant material. Weed as directed to maintain a neat appearance throughout the period of establishment and replacement.

719.07 PERIOD OF ESTABLISHMENT AND REPLACEMENT.

Upon completion of planting, and provided that all plants are in place, living, and conforming to these specifications, this portion of the contract will be given provisional acceptance.

719.07.1 Period of Establishment: Care for planted and mulched areas for a period of establishment, which shall be one full growing season, after provisional acceptance is made. A full growing season shall begin April 16 and extend one full year until April 15 of the next year. Complete planting any time during the planting season specified in 719.06.1. If planting is completed prior to April 16, the growing season shall begin at provisional acceptance and extend to April 15 of the following year. Any extension of the planting season past April 15 shall result in an extension of the period of establishment to October 31 of the following year. During this period of establishment, preserve plants in a healthy, growing condition. Such plant establishment work shall include cultivation, weeding, watering, pruning, controlling insects, pests, disease, and other work determined necessary by the engineer to ensure healthy plant growth.

Contact the engineer every week and outline activities which will be performed on the project. Failure to contact the engineer weekly and perform activities will result in a 1 percent reduction of the landscape contract amount, for each week of noncompliance before final payment. Weed in the vicinity of plants, place mulch, and water the plants as required. During the period of establishment, maintain a neat and clean appearance of planting areas.

719.07.2 Replacement: Remove and replace plants that show signs of failure to grow at any time, or which are so injured or damaged as to render them unsuitable for the purpose intended, as determined by the engineer after consultation with the Department's Landscape Architect. Unless otherwise directed by the engineer, replace unsuitable plants within 15 calendar days after the engineer marks or otherwise indicates that the plants shall be replaced. Failure to comply in the time allotted will result in having the costs of these replacement plants deducted from the contract amount upon final payment, but the contractor shall remain liable for the original contract specifications.

When replacing plants, comply with the spacing and size requirements originally specified for the plants being replaced. Use the same species for replacement ground cover plants as originally specified for the ground cover being replaced. Other replacement plants shall be the same species as the plants being replaced unless the engineer, after consultation with the Department's Landscape Architect, approves the substitution of alternative species of plants in accordance with the provisions in this subsection.

Furnish and install replacement plants at no cost to the Department.

719.07.3 Semifinal Inspection: A semifinal inspection by the contractor and the engineer will be held two weeks prior to the end of the period of establishment to determine the acceptability of plants. Perform replacement planting, as required, in accordance with 719.06 and 719.07.2.

Replace unsatisfactory plants in kind, quantity, and size with live, healthy plants installed as originally specified. Use substitute varieties of plants only when approved. Only these replacements made at this time will not require a period of establishment. All plants that must be replaced at the semifinal inspection will be replaced at the contractor's expense.

Upon completion of plant replacements and prior to final acceptance of the project, weed around plants and remove discarded materials, rubbish, and equipment from areas of the right-of-way affected by operations. Remove staking from trees unless otherwise directed by engineer.

719.07.4 Final Acceptance: Final inspection of plant material will be held approximately two weeks after replacement planting has been completed. Final acceptance will be made if all plants are in place, alive, and in conformance with plans and specifications.

Replace plants that are unsatisfactory at the time of final inspection of the project in kind, quantity, and size with live, healthy plants installed as originally specified. Use substitute varieties of plants only when approved. These replacement plantings shall be made at no cost to the Department.

719.08 MEASUREMENT. Furnishing and planting the various types and sizes of plant materials will be measured per each. No measurement for payment will be made for plant hole preparation, backfill material, fertilizer tablets, water, staking, plant maintenance, or plant replacement of individual trees and shrubs either inside or outside of bed areas.

Bed preparation and top dressing mulch will be measured by the square yard.

When including an item for "Landscaping" in the contract, the furnishing and planting of all required plant materials under the contract will be measured on a lump sum basis.

719.09 PAYMENT. Payment for furnishing and planting the various types and sizes of plant materials will be made at the contract unit price per each.

Payment for bed preparation and top dressing mulch will be made at the contract unit prices per square yard. Payment for mulch required for individual tree and shrub planting will be included in the contract unit price

for the plant and not as top dressing mulch. When including an item for “Landscaping” in the contract, payment will be made at the contract lump sum price.

Partial payment during the period of establishment will be limited to 75 percent of the contract price upon provisional acceptance. Midway through the period of establishment, if the project engineer’s records show that plants have been properly maintained and replacement plantings have been completed, 15 percent of the contract price for landscaping items will be paid, minus any reduction in accordance with 719.07.2. At final acceptance, if the project engineer’s records show that plants have been properly maintained and replacement plantings have been completed, the remaining 10 percent of the contract price for landscaping items will be paid, minus any reduction in accordance with 719.07.1 and 719.07.2.

Payment for adjustment of pH will be made in accordance with 109.04.

Payment includes all labor, materials, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
719-01	Plants	Each
719-02	Top Dressing Mulch	Square Yard
719-03	Bed Preparation	Square Yard
719-04	Landscaping	Lump Sum

Section 720

Erosion Control Systems

720.01 DESCRIPTION. Furnish and place erosion control systems in accordance with plan requirements for use as soil retention blankets on slopes or as flexible channel liners in ditches.

720.02 MATERIALS.

720.02.1 General: Erosion control systems shall comply with 1018.15. The manufacturer's installation plan and hardware (staples, stakes, etc.) are considered part of the system and shall be the same as that used during the evaluation for source approval.

Use the type of erosion control system shown on the plans. A higher grade system may be substituted for a lower grade system within the same application (slope protection or flexible channel liners), if there is no additional cost to the Department.

720.02.2 Acceptance: Pretested lots of erosion control systems will be accepted based on a Certificate of Delivery showing DOTD Lot Numbers and laboratory numbers representing the pretested material, including hardware. Sample erosion control systems that are not accompanied by a Certificate of Delivery in accordance with DOTD S613. Sample installation hardware, additives such as tackifiers, and any other component of the system not covered above at the rate of one item per type per size or one quart per manufacturer's lot in accordance with DOTD S601. Submit all samples to the Materials and Testing Section. Furnish a copy of the approved installation plan with each shipment to the project.

720.02.3 Packaging: Package materials so as to maintain the quality of the product throughout handling. Identify each package with the manufacturer's name, product name, manufacturer's lot number, by the DOTD Lot Number corresponding to that shown on the Certificate of Delivery.

720.03 EQUIPMENT. Furnish and maintain equipment necessary to satisfactorily perform the work. Equipment for hydraulically applying fiber mulch shall be equipped to eject the thoroughly wet mulch material at a uniform rate equal to the manufacturer's recommendations or as designated by the plans to provide the mulch coverage specified.

720.04 CONSTRUCTION REQUIREMENTS. Install erosion control systems in accordance with the approved installation plan, no later than 48 hours after completion of seeding or sodding operations. Install all staples flush to the ground, penetrating all layers of overlapped or adjacent rows.

720.04.1 Slope Protection: Construct slopes to the required grade, fertilize, and seed prior to application of erosion control systems. At the time of coverage, the area to be covered shall be free of ruts, clods, stones, roots, or other foreign matter that will prevent close contact of the blanket with the soil. Place rolled products or mats with netting only on one side with the netting exposed and the fibers in contact with the soil.

720.04.2 Flexible Channel Liners: Prepare channel slopes in accordance with 720.04.1. Place flexible channel liners beginning at the downstream end and proceeding in an upstream direction.

720.05 MAINTENANCE. Maintain the areas on which erosion control systems have been placed until final acceptance of the project. This shall consist of the repair of damage by erosion, wind, fire or other cause. Repair such areas to reestablish the condition that existed prior to placing the erosion control systems at no direct pay. Repair may include fertilizing, seeding, mulching, or sodding as required.

720.06 MEASUREMENT. Erosion control systems, including hardware, will be measured by the square yard of surface area covered.

720.07 PAYMENT. Payment for erosion control systems will be made at the contract unit price per square yard and includes all materials, labor, equipment, and other incidentals necessary to complete the work. Required burial of ends and edges, overlaps, and hardware will not be measured for payment.

Payment will be made under:

Item No.	Pay Item	Pay Unit
720-01	Erosion Control System	Square Yard

Section 721

Mowing, Trimming, and Debris Collection

721.01 DESCRIPTION. Mow grass and weeds; trim overhanging branches, vegetation, and trees; and collect and remove trimmings and debris within the highway right-of-way or as directed. Mowing shall be coordinated with existing mowing contracts for areas that are adjacent to the construction area if possible.

721.02 EQUIPMENT. Rotary mowers will normally be utilized in the mowing of the right-of-way; however, sickle bar mowers, side mounts, flail, or boom mowers may be used to mow around bridges, culverts, sign posts, mailboxes, delineators, guardrails, wet areas and ditches, etc., as approved by the engineer. Other types of grass-cutting equipment may be used, provided they have been approved by the engineer prior to use. Equip all rotary mowers with safety chains to prevent damage to property by flying debris from under the mower. Maximum cutting widths for rigid frame rotary mowers shall be 9 feet. Hand trimming will be required in some areas.

Shield mowers to prevent flying debris from the cutter blades in accordance with OSHA 29 CFR § Part 1928.57. Equip all vehicles and equipment used in performance of the work with amber flashing lights. Equip tractors with two fender mounted amber flashing lights, two red flags mounted on each side of the rollover protective structure (ROPS) cage, a plainly visible rear mounted slow moving vehicle emblem, and working headlights.

Keep all mowers in good operating condition and maintain to provide a clean sharp cut at all times. All equipment will be inspected by the engineer for safety devices and suitability for the work prior to being placed in operation. Properly maintain all safety devices and keep functioning at all times.

721.03 GENERAL CONSTRUCTION REQUIREMENTS.

721.03.1 Debris Collection: Pick up and properly dispose of all trash and debris ahead of the mowing operation. Clean all grassed areas, ditches, paved roadside shoulders, fences, and under overhead bridges within the project limits. Pick up all trash uncovered by the mowing operations within 48 hours. Remove trash and debris picked up and piled or bagged on the

roadside from the right-of-way by the end of the same work day. Do not pile bagged trash and debris on travel lanes or paved shoulders.

721.03.2 Mowing Operations: Furnish sufficient number and types of equipment best suited to perform the work. Adjust mowers for a cutting height of approximately 5 inches. Provide a safety vehicle equipped with warning lights to follow mowers, along with personnel and equipment to do the trimming. Trim directly behind the mower at a safe distance.

721.03.3 Mowable Areas: Mowable areas are defined as all of the grassed or vegetated areas of the right-of-way, extending from right-of-way line to right-of-way line or tree line to tree line or fence line to fence line as applicable, including but not limited to, banks of natural waterways, swale ditches, V-ditches, ditch bottoms, and slopes. Mowable areas also include areas under bridges and around guardrails, sign posts, delineators, curbs, culvert ends, trees, shrubs, plants, culvert head walls, bridge abutments, bridge or overpass columns and piling, and fences where mowing is required on both sides due to the presence of service roads, swale ditches, V-ditches, and slopes or other facilities. These areas may not be accessible to standard mowing equipment and may require hand trimming or specialized mowing equipment such as boom or side mount mowers.

Mowable vegetation is defined as any trees, vegetation, brush, etc., which is 2 inches in diameter or less measured 5 inches above the ground.

721.03.3.1 Divided and Undivided Highway and Frontage Roads: Mow all mowable areas within the right-of-way. Remove or cutback all overhanging vegetation or trees, regardless of size, which may hinder or prohibit mowing to the tree line or right-of-way line at no direct pay. Remove trimmings from the right-of-way or chip. Disperse chips to not interfere with drainage.

721.03.3.2 Right-of-Way Line: Include a mowable area strip approximately 7 feet wide along the fence line or right-of way line, if applicable and terrain permits. Remove all overhanging vegetation or fallen trees, regardless of size, which may hinder or prohibit mowing of this strip at no direct pay.

721.03.3.3 Natural Waterways Or Canals Crossing The Right-Of-Way: Cut all vegetation (weeds, grasses, vines, and trees) on the waterway banks (slopes), canal bottoms, in the median, beneath the interstate bridges, and in the right-of-way to the tree line or right-of-way fence line to within 5 inches of the ground by any means chosen except that all non-mowable vegetation shall be removed to ground level. Mowing of this area may require specialized equipment such as weed trimmers and boom or slope

mowers. There will be no additional payment for this work if the area involved is included in the mowable acreage listed elsewhere.

721.03.3.4 Catch Basins and Gutters: Perform the mowing operation without buildup of grass clippings on catch basins and in gutters. If the mowing operation deposits grass clippings on catch basins and in gutters, remove such clippings from the entrance to the catch basin by hand or other methods acceptable to the engineer.

Mow as close as practical to all fixed objects exercising extreme care not to damage trees, plants, shrubs, delineators, catch basins, or other appurtenances which are part of the facility.

721.03.4 Hand Trimming: Hand trim around fixed objects such as sign posts, curbs, delineators, culvert ends, trees, shrubs, plants, guardrails, culvert head walls, bridge abutments, bridge or overpass columns and piling, and fences where mowing is required on both sides due to the presence of service roads or other facilities, etc. as directed by the engineer. Trim behind the mowing operation by no later than 24 hours.

721.03.5 Use of Herbicides: Herbicides may be used around signs, guardrails, culvert ends, bridges revetments, ditches, laterals, fences, etc., to reduce the volume of hand trimming. General spraying of herbicides to control vegetation and spraying around shrubs, bushes and trees will not be allowed except as otherwise provided in these specifications. Remove vegetation treated with herbicides by manual or mechanical means to ground level after the manufacturer's suggested time period for the herbicide to affect the plant growth. Prior to the use of any herbicides, obtain the approval of the District's Roadside Development Coordinator for use, type, and rate of application of any herbicide.

The contractor shall have in his possession, and maintain in good standing, a category 6 Pesticide Applicators license obtained through the Louisiana Department of Agriculture and Forestry. The contractor shall conduct his operations in accordance with Section 107 and the requirements of the Louisiana Horticulture Law and Regulations.

721.03.6 Inaccessible Areas: Mowing will not be permitted when, in the opinion of the engineer, soil and weather conditions are such that the right-of-way will be damaged. However, provide specialized equipment such as boom or slope mowers to mow areas not accessible to standard mowing equipment. Use caution to assure that mud is not tracked onto the road surface.

Skip the following areas when mowing:

1. Swamp areas or areas having ponded water.

2. Areas with large rocks or other obstructions that might damage the mowers.

3. Shoulder edge when shoulder material has been left in a windrow.

721.03.7 Safety Requirements: Conduct mowing operations in a manner that regards the safety and convenience of the public as a prime importance. All equipment and traffic control devices shall be in accordance with the MUTCD and these specifications.

721.04 MEASUREMENT. Mowing will be measured by the cycle and will include all labor, equipment, materials, and incidentals required to complete the work. Trimming and debris collection will not be measured for payment.

721.05 PAYMENT. Payment for mowing will be made at the contract unit price per cycle.

Payment will be made under:

Item No.	Pay Item	Pay Unit
721-01	Mowing	Cycle

Section 722

Field Laboratories

722.01 DESCRIPTION. Furnish laboratory buildings at the project sites for soils and aggregates testing.

These laboratories are to be provided exclusively for the use of Department personnel involved in the Department's Quality Assurance Program.

722.02 GENERAL REQUIREMENTS. Field laboratories shall be weather tight and constructed of wood, metal, masonry, or other approved materials for the purpose of housing the personnel, testing equipment, records, and reports as necessary for the Quality Assurance Program.

Each laboratory shall have a minimum floor space of 160 square feet, or other approved size, that provides sufficient space with a minimum ceiling height of 7 feet. The laboratory shall have at least one outside door and have sufficient windows. The laboratory buildings shall have electric lighting and power outlets as directed. Provide fume hoods with electric exhaust fans of such size and location as to ensure continuous removal of hazardous fumes and air borne particles during testing operations. Secure the building and contents by suitable lock and catches. Afford the engineer access to the laboratory at all times and provide him or her with a set of keys as necessary.

Laboratory buildings shall be constructed, furnished, maintained, and located as approved. Provide suitable desks, chairs, and file cabinets for personnel using these facilities. Construct sturdy work benches along at least one wall, or as directed, to provide sufficient work area for the types of tests being conducted. Laboratory buildings shall be heated and air conditioned, and with sanitary facilities. Provide a telephone for Departmental use.

The laboratories may be used for successive phases of a project without additional compensation.

722.03 PROJECT SITE LABORATORY. Field laboratory buildings at the project site shall be movable types which can be placed near construction areas. Move the building to various locations on the project as directed.

722.04 EQUIPPED PROJECT SITE LABORATORY. Furnish, install, and maintain the following equipment in satisfactory condition, as needed, for soils and aggregates testing throughout the life of the project:

1. An automatic soil compaction hammer capable of compacting both standard and modified proctors, with arrangement for both 12-inch and 18-inch drops and 4-inch and 6-inch molds and adjustable hammer weights from 5.5 to 10 pounds. The specifications for the hammer shall be in accordance with TR 415, Field Moisture-Density Relationships, and TR 418, Moisture-Density Relationships as specified for each mold diameter. The equipment shall include two molds of each size.

2. A compaction block or pedestal composed of portland cement concrete shall be furnished for use with the automatic compaction hammer. The block shall weigh a minimum of 200 pounds. The hammer shall be secured to the block.

3. An electronic scale capable of measuring in both English and metric units having a capacity of 30 pounds or more with a sensitivity of 0.1 pounds.

4. An electronic scale capable of measuring in metric units having a capacity of 2 kilograms or more with a sensitivity of 0.1 grams.

5. Two electric or gas hot plates and drying pans. An open flame hot plate shall be equipped with suitable shield to disperse heat evenly and to prevent direct contact of the flame with the drying pan. The hot plates shall be of sufficient size to accommodate the drying pans.

6. A stable internet connection with sufficient bandwidth to handle electronic communications and data file transfers between the site laboratory and the Department's server applications.

The automatic soil compaction hammer and scales noted above shall be calibrated by an independent laboratory on an annual basis and will be verified by the engineer.

722.05 MEASUREMENT. Project site laboratories furnished, equipped, satisfactorily maintained, moved as directed, and subsequently removed from the project will be measured per each building.

722.06 PAYMENT. Payment for project site laboratories will be made at the contract unit price per each under:

Item No.	Pay Item	Pay Unit
722-01	Project Site Laboratory	Each
722-02	Project Site Laboratory (Equipped)	Each

Section 723

Granular Material

723.01 DESCRIPTION. Furnish and place granular material in accordance with these specifications and in conformity with the lines, grades, and typical sections shown on the plans or as directed.

723.02 MATERIALS. Granular material shall comply with 1003.09.

723.03 CONSTRUCTION REQUIREMENTS. Place, properly shape, and uniformly compact granular materials by approved methods to a minimum of 95 percent of maximum dry density. Maximum dry density will be determined in accordance with DOTD TR 415 or TR 418 and in-place density will be determined in accordance with DOTD TR 401. Do not displace granular materials during subsequent operations.

723.04 DIMENSIONAL TOLERANCES. When specifying net section measurement, the thickness and width of completed granular material courses will be checked for acceptance in accordance with DOTD TR 602. Correct areas with thickness and width deficiencies in excess of the following tolerances to plan dimensions by furnishing, placing, shaping and compacting additional materials as required at no direct pay.

723.04.1 Thickness: Under thickness shall not exceed 3/4 inch. Over thickness will be at no additional cost to the Department.

723.04.2 Width: Under width shall not exceed 6 inches. Over width will be at no additional cost to the Department.

723.05 MEASUREMENT.

723.05.1 Net Section: The net section quantities of granular material for payment will be the design volumes as specified in the plans and adjustments thereto. Design quantities are based on the horizontal dimensions and the compacted thickness of the granular material shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if plan errors are proven, or if design changes are necessary.

723.05.2 Vehicular Measurement: Vehicular measurement of granular material will be by the cubic yard in approved hauling vehicles at the point of delivery in accordance with 109.01.

723.06 PAYMENT. Payment for granular material will be made at the contract unit price per cubic yard.

Payment will be made under:

Item No.	Pay Item	Pay Unit
723-01	Granular Material (Net Section)	Cubic Yard
723-02	Granular Material (Vehicular Measurement)	Cubic Yard

Section 724 Rumble Strips

724.01 DESCRIPTION. Construct rumble strips in accordance with the details shown in the plans and as directed.

724.02 MATERIALS. Vacant

724.03 CONSTRUCTION REQUIREMENTS. Before the construction of any rumble strips, demonstrate to the engineer that the equipment to be used can achieve a depression having well defined edges without snagging or tearing the finished pavement.

Provide a relatively smooth cut and a smooth interior finish with no more than 1/16 inch between peaks and valleys. Provide a uniform and consistent alignment of each cut in relation to the roadway throughout the project. Before opening the adjacent lane to traffic, ensure that all debris generated by a grinding process is removed and disposed of daily by vacuum or a method approved by the engineer. Do not use the debris generated by a grinding process in recycled asphalt.

When rumble strips do not meet the requirements of the contract documents, restore any pavement to the satisfaction of the engineer at no additional cost to the Department.

724.04 MEASUREMENT. The quantity of Rumble Strips (Centerline or Shoulder/Edge) to be paid for will be the plan quantity in miles, constructed and accepted. The plan quantity will be determined based on the roadway length. No deduction will be made for gaps.

The quantity of Rumble Strips (Intersection) to be paid for will be the plan quantity per each set as shown on the plans constructed and accepted.

The set would be three rumble clusters in one lane.

Acceptance measurements will be performed by the Department on a random basis to ensure conformance.

724.05 PAYMENT. Payment for Rumble Strips (Centerline) and Rumble Strips (Shoulder/Edge) will be made at the contract unit prices per mile. Payment for Rumble Strips (Intersection) will be made at the contract unit price per each set as shown on the plans. Payment will be full compensation for all labor, materials, equipment, tools, and incidentals necessary to

complete the work, including cleaning and preparing of surfaces, disposal of all debris, and protection of traffic.

Payment will be made under:

Item No.	Pay Item	Pay Unit
724-01	Rumble Strips (Centerline)	Mile
724-02	Rumble Strips (Shoulder/Edge)	Mile
724-03	Rumble Strips (Intersection)	Each

Section 725

Temporary Detour Roads

725.01 DESCRIPTION. Furnish construct, maintain, and subsequently remove temporary detour roads.

Plan details and specified materials for temporary detour roads indicate minimum requirements. Other approved designs and materials may be used at the option of the contractor.

725.02 MATERIALS. Materials for detour roads, except low profile runarounds, shall comply with applicable sections of these specifications.

Temporary culvert pipe shall be one of the types listed in Section 701. Temporary fencing shall be of a type acceptable to the engineer.

Temporary pavement markings shall comply with 1015.08.

725.03 CONSTRUCTION REQUIREMENTS.

725.03.1 General: Perform all necessary additional clearing and grubbing, and provide all necessary temporary fencing and culverts for detours. Place construction signs, warning devices, and pavement markings for detours in accordance with Section 713 prior to opening to traffic. Maintain detours in a satisfactory condition.

725.03.2 Detour Roads: Furnish all embankment material for detours and compact embankments by approved methods to the satisfaction of the engineer. When embankment is placed against slopes of existing embankments, remove from such slopes all grass, weeds, trash, brush, and other objectionable material and construct slopes to form steps as directed.

Perform base and wearing surface construction in accordance with applicable sections of these specifications.

Place temporary pavement markings complying with Section 713 on detours surfaced with asphalt concrete or portland cement concrete. Place these markings before the detour is opened to traffic. Remove existing markings in tie-in areas. Include temporary pavement markings to make tie-ins to existing striping in the cost of these markings.

725.03.3 Low Profile Runaround: Surface low profile runaround type detour roads with approved aggregate. Place aggregate surfacing to a minimum depth of 4 inches and a minimum width of 20 feet. Obtain the

engineer's approval of alignment and grade of runaround type detour roads. Provide satisfactory drainage for low profile detours.

725.03.4 Detour Bridging: Construct and remove temporary detour bridging in accordance with Section 817.

725.04 REMOVAL OF DETOURS. Upon completion of permanent construction and diversion of traffic thereto, remove detour roads, temporary fencing and culverts, eliminate construction scars, and seed and fertilize to restore the area to its original condition as directed. When not covered under other items, replace permanent fencing in kind as directed. Remove temporary markings on existing surfaces in accordance with Section 713.

725.05 MEASUREMENT.

725.05.1 Detour Roads: Temporary detour roads will be measured by the square yard of completed detour road surfacing.

725.05.2 Low Profile Runaround: Low profile runarounds will be measured per each runaround.

725.05.3 Incidentals: Additional clearing and grubbing, temporary fencing and culverts, will not be measured for payment.

When the contract does not include items for "Temporary Pavement Markings," these markings will be included in the items for "Temporary Detour Roads."

725.06 PAYMENT. Payment for temporary detour roads furnished, constructed, maintained, and subsequently removed will be made at the contract unit prices under:

Item No.	Pay Item	Pay Unit
725-01	Temporary Detour Roads	Square Yard
725-02	Low Profile Runaround	Each

Section 726 Bedding Material

726.01 DESCRIPTION. Furnish and place aggregate bedding material on geotextile fabric for drainage structures.

726.02 MATERIALS. Materials shall comply with the following subsections:

Plastic Soil Blanket	203.10
Bedding Material	1003.10
Geotextile Fabric	1019.01

726.03 PLACEMENT OF BEDDING. Place geotextile fabric in accordance with plan details prior to placing bedding material. Properly proportion and mix bedding materials prior to placement in the foundation. Take care to prevent damage to geotextile fabric during placement of bedding material. Place, shape, and uniformly compact bedding material to the satisfaction of the engineer.

Overlap or sew adjacent rolls of geotextile fabric. When rolls are overlapped, overlap a minimum of 18 inches, including the ends of the rolls. Assure that the top layer of the fabric is parallel with adjacent rolls and in the direction of bedding materials placement. When rolls are sewn, join adjacent rolls by sewing with thread made of polyester or a material with equivalent strength and durability. When field sewing, employ the J-seam or “Butterfly” seam with the two pieces of geotextile fabric mated together and turned in order to sew through four layers of fabric. Sew with 2 rows of Type 401, two-threaded locking chain stitch. Submit factory seams other than specified to the Materials and Testing Section for approval. When the ground is covered with water or supersaturated soil, sew the fabric.

Remove damaged fabric and replace with new fabric or cover with a second layer of fabric extending two feet in each direction from the damaged area.

Use material excavated below the established grade of the structure or dispose of it in accordance with Section 203.

Place a plastic soil blanket in accordance with 203.10 at structure ends when bedding material is exposed.

726.04 MEASUREMENT. Bedding material, including plastic soil material, completed and accepted, will be measured by the cubic yard (net section). The length and width will be measured horizontally to the theoretical points established by the plans for bedding material. The depth will be as shown on the plans or established by the engineer.

Geotextile fabric will not be measured for payment.

Necessary excavation and disposal of excess excavated materials will not be measured for payment.

726.05 PAYMENT. Payment for bedding material will be made at the contract unit price per cubic yard, which includes all labor, materials, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
726-01	Bedding Material	Cubic Yard

Section 727 Mobilization

727.01 DESCRIPTION.

Mobilization consists of preparatory work and operations, including those necessary for movement of personnel, equipment, supplies, and incidentals to the project site; the establishment of offices, buildings, and other facilities necessary for work on the project; the cost of bonds and any required insurance; and other preconstruction expenses necessary for start of the work, excluding the cost of construction materials.

727.02 MATERIALS. Vacant

727.03 CONSTRUCTION REQUIREMENTS. Vacant

727.04 MEASUREMENT. Mobilization will be measured for payment as a lump sum.

727.05 PAYMENT. When the contract does not include a pay item for mobilization, no direct payment will be made for mobilization.

When the contract contains a pay item for mobilization, payment will be made at the contract lump sum price, subject to the following provisions:

Partial payments for mobilization will be made in accordance with the schedule of Table 727-1 up to a maximum of 10 percent of the original total contract amount, including this item. Payment of any remaining amount will be made upon completion of all work under the contract.

**Table 727-1
Mobilization Payment Schedule**

Percent of Total Contract Amount Earned	Allowable Percent of the Lump Sum Price for Mobilization
1st Partial Estimate	25
10	50
25	75
50	100

No payment adjustments will be made for this item due to changes in the work in accordance with Section 109.

When the contract includes a pay item for field laboratories under Section 722, payment for mobilization will exclude those facilities.

Payment will be made under:

Item No.	Pay Item	Pay Unit
727-01	Mobilization	Lump Sum

Section 728

Jacked or Bored Pipe

728.01 DESCRIPTION. Furnish and install pipe in embankments at the locations shown on the plans by jacking or boring in accordance with these specifications.

728.02 MATERIALS. Pipe materials shall comply with 701.02 and 1018.3. Pipe joints shall comply with 701.06. Corrugated metal pipe to be jacked or bored shall have corrugated bands a minimum of 24 inches wide with four lines of approved gasket material. Secure these bands by a minimum of four galvanized steel rods and lugs in accordance with the plans and as directed.

728.03 CONSTRUCTION REQUIREMENTS. In general, jack pipes 30 inches diameter and greater and bore pipes less than 30 inches diameter. Begin the work at the outfall end of pipe when possible. When the grade at the jacking or boring end is below ground surface, excavate suitable pits or trenches for conducting operations and placing joints of pipe. Provide adequate sheeting and bracing to prevent earth caving.

For pipe with bell joints, if the outside diameter of the pipe bell exceeds the outside diameter of the pipe barrel by more than 1 inch, either case the pipe or pressure grout its full length. Furnish and install an approved type and size casing, in accordance with these specifications. Pressure grout with approved materials placed by approved methods.

The method used shall not weaken or damage the embankment. Provide for approval a plan showing the proposed procedure, including backstop or jacking frame arrangement, pipe guides, position of jacks, and jacking head. Approval of this plan shall not relieve the contractor from responsibility for obtaining the desired result.

728.03.1 Jacking: Provide heavy duty jacks suitable for forcing pipe through the embankment. Apply equal pressure to all jacks and transmit the pressure to the pipe end through a jacking head. Design the jacking head so that pressure is uniformly applied around the ring of the pipe. Provide a backstop or jacking frame to adequately resist pressure of the jacks under load. Set pipe on guides properly fastened together to support the pipe in the

proper direction at correct grade. Provide suitable cushioning material, such as plywood, between sections of concrete pipe.

Excavate material ahead of the pipe and remove through the pipe. Do not extend excavation more than 24 inches beyond the forward end of pipe. When the character of embankment material dictates, reduce the excavation distance to prevent the embankment from being damaged. Dispose of excavated material in accordance with 202.02.

When excavating on the underside of pipe, conform to the contour and grade of the pipe for at least one-third the circumference of pipe. Provide a clearance of not more than 2 inches for the upper half of pipe, tapered to zero at the point where excavation conforms to the contour of pipe.

Construct a steel cutting edge around the forward end of pipe that will transmit pressures uniformly around the ring of the pipe.

Continue jacking without interruption to prevent pipe from becoming firmly set in the embankment.

Do not allow pipe to vary horizontally or vertically by more than 1/4 inch per 10 feet from established line and grade. Any variation shall be regular; no abrupt changes in direction will be permitted. Remove and replace any pipe damaged or misaligned in jacking operations at no direct pay.

728.03.2 Boring: Bore mechanically, using a pilot hole approximately 2 inches in diameter. Extend the pilot hole through the embankment and check for line and grade before boring begins. Maintain the same line and grade variations as specified for jacking. Use the pilot hole as the centerline of the larger diameter hole to be bored.

Use water and other fluids with boring operations only to lubricate cuttings. Jetting will not be permitted.

In unconsolidated soil formations, a gel-forming colloidal drilling fluid consisting of at least 10 percent high-grade bentonite may be used to consolidate cuttings of the bit, seal walls, and provide support of the hole, and furnish lubrication for subsequent removal of cuttings and installation of pipe.

Remedy overcutting in excess of 1 inch by pressure grouting the entire length of the installation.

Join pipe in accordance with Section 701.

728.04 MEASUREMENT. Quantities of jacked or bored pipe for payment will be the design lengths in linear feet as shown on the plans. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if plan errors are proven, or if design changes are made.

Required excavation, sheeting, bracing, falsework, casing, joint materials, and grouting will not be measured for payment.

728.05 PAYMENT. Payment for jacked or bored pipe will be made at the contract unit price per linear foot, which includes all labor, materials, equipment, tools, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
728-01	Jacked or Bored Pipe	Linear Foot

Section 729

Permanent Signs

729.01 DESCRIPTION. Furnish and install traffic signs, dead end road installations, markers and delineators, with accessories, posts, and overhead spans of specified materials, sizes, shapes, weights, and designs.

In general, the work and materials comply with the MUTCD as modified by these specifications or as shown on the plans.

Fabricate signs in an approved plant.

The term “legend” shall mean border strip, letters, numerals, and symbols which convey the message on signs.

729.02 MATERIALS. Other than recycled aluminum sign panels and blanks, all materials shall be new stock conforming to the following:

729.02.1 Sign and Marker Sheeting: Sheeting material for sign panels, delineators, barricades, and other markers shall comply with Section 1015. All permanent signs shall meet the requirements of DOTD Type X.

729.02.2 Ferrous Metal: Ferrous metals shall comply with 1015.02.1. Reinforcing steel shall comply with Section 1009. Ferrous metal, except reinforcing steel, shall be galvanized in accordance with Section 811.

1. U-channel posts shall comply with 1015.02.1.3.

2. Square tubing shall comply with 1015.02.1.4.

729.02.3 Aluminum: Aluminum alloys for structural members shall comply with 1015.02.2. Aluminum sign panels shall comply with 1015.04.1.

729.02.4 Fittings: Structural bolts, nuts, washers, and miscellaneous hardware shall comply with 1015.02.3.

729.02.5 Guard Rail: Guard rail materials for dead end road installations shall comply with Section 1010.

729.02.6 Timber: Treated piling and timber for barricades in dead end road installations shall comply with Section 1014.

729.02.7 Concrete: Concrete shall be Class M complying with Section 901.

729.02.8 Flexible Sign Posts: Flexible posts for small signs, markers, and delineators shall comply with 1015.03.

729.02.9 Silk Screen Paste and Overlay Film: Silk screen paste shall comply with sheeting manufacturer's recommendations and with 1015.07.

729.03 GENERAL REQUIREMENTS.

729.03.1 Sign Face Design and Fabrication: Fabricate signs of Types A, B, D, and E; overhead signs; and sign face overlay panels in accordance with the MUTCD, the *Standard Highway Signs Booklet*, and the signing detail sheets of the plans.

Furnish shop drawings of sign faces for Types D and E, overhead signs, sign overlay panels, and for any non-standard sign faces of Types A and B not provided by the Department. Obtain approval of shop drawings from the Interstate Guide Sign Engineer before sign face fabrication begins.

729.03.2 Sign Mountings and Supports Fabrication: Furnish steel for vertical sign supports and trusses. Furnish steel sign supports for post mountings, and rigid steel or flexible posts for small signs, markers, and delineators. Before beginning work, notify the engineer in writing of proposed signing materials. Use the same signing materials throughout the project.

Fabricate sign mountings according to Section 807. Furnish fabrication and erection drawings of all sign mountings in accordance with 801.03 with the exception of standard roadside installations. Fabrication and erection drawings will be approved only after approval of sign face shop drawings. Do not fabricate sign mountings or construct sign footings before drawings are approved and distributed.

Welding shall comply with Section 809.

729.03.3 Material Sampling and Certification: Material sampling and certification for sign faces, sign mountings, U-channel posts, and square tubing shall be in accordance with the Materials Sampling Manual. Furnish NCHRP 350 or Manual for Assessing Safety Hardware (MASH) compliance documentation.

729.04 FABRICATION OF ALUMINUM SIGN PANELS.

729.04.1 General: Complete metal fabrication including shearing, cutting, and punching of holes prior to surface treatment of metal and application of sheeting. Cut metal panels to size and shape; free of buckles, warps, dents, cockles, burrs, and defects resulting from fabrication. Surface of sign panels shall be flat.

Splice plates joining sign panels shall not extend behind horizontal sills. Flat aluminum panels shall be a nominal 0.080 inch thick. Extruded

aluminum panels shall be 12 inches wide and have a nominal face thickness of 0.125 inches.

The completed product shall have a surface free of cracks, blisters, blemishes, and wrinkles.

729.04.2 Aluminum Surface Treatment: Provide surface treatment as specified herein or in accordance with approved recommendations of the reflective sheeting manufacturer.

729.04.2.1 Degreasing:

1. Vapor Degreasing: Immerse panels in a saturated vapor of organic solvent. Remove trademark printing with lacquer thinner or a controlled alkaline cleaning system.

2. Alkaline Degreasing: Immerse panels in a tank containing alkaline solutions, controlled and titrated to the solution manufacturer's specifications. Immersion time shall depend upon amount of contaminants present and thickness of metal.

729.04.2.2 Etching:

1. Acid Etch: Etch the panels in a 6 to 8 percent phosphoric acid solution at 100°F. Rinse the panels thoroughly with running cold water followed by hot water tank rinse.

2. Alkaline Etch: Etch pre-cleaned aluminum surface in an alkaline etching material controlled by titration, using time, temperature, and concentration specified by solution manufacturer. Rinse thoroughly. Remove smut with an acidic, chromium compound solution specified by solution manufacturer and thoroughly rinse.

729.04.2.3 Drying Panels: Dry panels with a forced hot air drier. Handle panels with clean canvas gloves or other approved methods between cleaning and etching operations and sheeting application. Protect cleaned panels from grease, oil or other contaminants prior to application of reflective sheeting.

729.04.3 Sheeting Application: Apply reflective sheeting in accordance with the approved written recommendations of the sheeting manufacturer. Apply reflective sheeting with no horizontal splices. Apply reflective sheeting directly to extruded panels with no more than two vertical splices per sign and no more than one vertical splice per individual panel. Carefully match sign faces comprised of two or more pieces of reflective sheeting for color at the time of sign fabrication to provide uniform appearance and brilliance, both day and night. Apply legend by one of the following methods:

729.04.3.1 Direct Applied: Legend shall be adhesive coated reflective sheeting as specified in 1015.05. Apply legend to provide a wrinkle-free surface.

729.04.3.2 Screened: Apply legend to sign faces by an approved screening process in accordance with the reflective sheeting manufacturer's recommendations. Completed screen surface shall be uniform in color, have sharp edges, be free of bubbles, show good workmanship, and be free of blemishes, streaks, or spotted areas. Screening on sheeting may be accomplished either before or after application of sheeting to panels.

729.04.3.3 Overlay Film: Apply legend to the sign faces by an approved transparent electronic cuttable overlay film compatible with the reflective sheeting to which it is applied. Apply in accordance with the recommendations of the manufacturer(s) of both the film and the reflective sheeting. Areas covered by film shall have sharp edges, be free of bubbles and blemishes, and show good workmanship.

729.04.4 Packaging: Before being packed, allow signs to dry according to manufacturer's recommendations. Slip sheet signs and pack to ensure arrival at their destination in an undamaged condition. Do not allow packaged signs to become wet during storage or shipment.

729.05 CONSTRUCTION REQUIREMENTS. When requiring removal of existing signs, coordinate sign removal operations as directed with new sign construction to provide for adequate signing to be in place at all times.

729.05.1 Sign Location: Sign support locations will be as shown on the plans or as directed by the engineer. After initial staking, obtain the engineer's approval of sign locations. Sign locations which are obviously improper because of topography, existing appurtenances, or other conflicting conditions will be adjusted to the closest desirable location. Determine post length at the established sign support location. Assure correct orientation, elevation, offset, and leveling of signs.

729.05.2 Sign Positioning:

729.05.2.1 Overhead Signs: Construct signs so that the top edge of the sign face is tilted towards oncoming traffic 3 degrees (approximately 1:20) from vertical and at right angles to the road, unless otherwise directed.

729.05.2.2 Road Edge Signs: Construct road edge signs with sign faces vertical. Place sign faces located less than 30 feet from the edge of travel lane at a 93 degree angle from the center of the travel lane. Place sign faces located 30 feet or more from the edge of the travel lane at an 87 degree angle from the center of the travel lane. Where the lanes divide or

are on curves or grades, orient sign faces to be most effective both day and night avoiding specular reflection.

729.05.2.3 Delineator and Object Marker Assemblies:

Place these assemblies at least 24 inches beyond the outer edge of roadway shoulder, 24 inches beyond the face of curb, or in the line of guard rail.

729.05.2.4 Milepost Assemblies: Place these assemblies at least 6 feet beyond the outer edge of roadway shoulder.

729.05.2.5 Vertical and Horizontal Clearances: Vertical and horizontal clearances shall be in accordance with the MUTCD and as shown on the plans.

729.05.3 Sign Overlay Panels: When specified by the DOTD Sign Inspection Team, existing signs may be overlaid with new sign panels placed over the existing sign face. No partially overlaid signs shall be allowed to remain exposed overnight. Only one overlay shall be placed on a sign. When an overlay is to be placed on an existing overlaid sign, the previous overlay shall be removed prior to placement of the new overlay. Overlay panels shall conform to 729.04. Raised legends shall be removed from the existing sign face prior to placing the overlay panel. The size of the overlay panel shall not exceed the size of existing sign panel by more than 3 inches on any side. Overlay panels shall be attached to the existing sign with rivets complying with Subsection 1015.02. Rivets shall be placed on 12-inch centers (maximum) along the perimeter of panel and at panel splices, and on 24-inch centers (maximum) both vertically and horizontally in interior portions of each panel. Rivets shall be centered horizontally on panels less than 24 inches wide. A 4-inch x 4-inch shim with a nominal 0.080-inch thick aluminum plate shall be placed between existing panel and overlay panel at interior rivet locations. Shims cut from salvaged sign panels may be used. The existing sign panels shall be kept reasonably flat during installation of the overlay panels. Splice arrangement for overlay panels shall conform to the requirements for traffic sign blanks.

729.05.4 Recycled Aluminum Panels and Blanks: Recycled aluminum sign panels will be allowed for installation in accordance with the following requirements.

Recycled sign panels shall be the same alloy and temper required for new sign panels specified in Section 1015. They shall be free of corrosion and white rust and shall meet the required tolerances for flatness and thickness for new sign panels. The process for removing the old reflectorized or non-reflectorized sheeting shall not damage the chromate coating. Smelting, sanding, and chemical stripping processes for recycling will not be allowed.

Recycled signs will be inspected, sampled, and tested in accordance with current Departmental policy, except certified test reports will not be required. Furnish a materials guaranty that the materials conform to the requirements for recycling the sign panels. Each such panel must be labeled on the back as recycled and label shall be legible from the ground.

729.05.5 Excavation and Backfill: The contractor shall perform excavation for sign installation to levels and dimensions shown on the plans, or as directed. Perform excavation and backfill operations in accordance with Section 802.

729.05.6 Footings: Foundation piles, concrete, reinforcing steel, and anchor bolt assemblies shall comply with Sections 804, 805, 806, and 807.

See DOTD Roadside Traffic Sign Standard Details for stub heights.

Drive posts for ground mounted delineator, object marker, and milepost assemblies; no footings will be required.

729.05.7 Bolt Tensioning: Assemble slip plates for breakaway sign posts in the shop with high strength bolts tightened at a minimum bolt tension in accordance with 807.05. After field installation, tighten high strength bolts in the breakaway base connection to the specified minimum bolt tension. The bolt tension in both the slip plate connection and the breakaway base connection will be checked by the engineer. Correct bolt tensioning as required.

729.05.8 Cleaning and Clearing: Prior to erection, clean sign faces to allow adequate visibility of the sign. Any clearing or tree trimming required to provide for full sign visibility shall be in accordance with the plans, 729.08.9, or as directed.

729.05.9 U-Channel Posts: Drive U-channel posts for ground mounted small signs, markers, and delineators vertically to a minimum depth of 3 feet below natural ground using a suitable protective driving cap.

U-channel posts may be spliced where long lengths are required. The upper section shall overlap the lower section by at least 24 inches. The bottom edge of the upper section of the splice shall be a minimum of 24 inches above the ground. Secure the spliced sections with at least four 5/16 inch diameter hex head bolts spaced equally along the splice.

Splicing of U-channel posts will not be allowed when break-away footings are required.

729.05.10 Square Posts: Install square tubing posts with a break away as shown in the DOTD Roadside Traffic Sign Standard Details.

729.06 DEAD END ROAD INSTALLATIONS. Dead end road installations shall be of the specified type and located as shown on the plans. Construct timber barricade type installations in accordance with Section 812 and as follows. Set timber piling in full depth holes and backfill as directed or drive to required depth. Drive steel posts for other type installations with a suitable protective cap. Piles and posts shall be vertical. Construct guard rail in accordance with Section 704.

729.07 ACCEPTANCE OF SIGNS. After the installation of signs is complete, the Department's Sign Inspection Team will perform an inspection to ensure conformance with applicable plans, standards and project specifications. When specular reflection is apparent on any sign, adjust its positioning to eliminate the condition. Follow-up inspections may be conducted prior to acceptance, at the discretion of the Department's Sign Inspection Team.

Clean signs before the time of inspection. Reflective sheeting shall be free of cuts, scratches, breaks, or other defects which might allow moisture to infiltrate and damage reflective cells. Replace or repair nonstandard or otherwise unacceptable signs and traffic control devices as directed. Correct damage that is discovered at the time of the sign inspection.

In lieu of removing and replacing new sign faces that have been rejected, use sign overlay panels or recycled panels complying with 729.05.3 and 1015 to correct the deficiencies at no cost to the Department.

729.08 MEASUREMENT.

729.08.1 Sign Faces and Overlay Panels: Quantities for payment will be the design areas in square feet of sign faces as specified on the plans and adjustments thereto. Design quantities will be adjusted if the engineer makes changes to adjust to field conditions, if plan errors are proven, or if design changes are made. Material used in blanks and backing incidental to the sign face will not be measured for payment. In determining the area of sign faces, no deductions are made for corner radii or mounting holes. The area of octagonal signs and interstate shields is computed as the area of its smallest rectangle or square. The area of triangular signs is computed as the area of the triangle.

729.08.2 Post Mountings: Post sign mountings, including breakaway supports, will be measured per each post.

729.08.3 Overhead Mountings: Overhead sign mountings, including bridge fascia mountings, will be measured per each structure.

729.08.4 Delineator, Object Marker and Milepost Assemblies: Delineator, object marker, and milepost assemblies will be measured per each assembly.

729.08.5 Dead End Road Installations: Dead end road installations will be measured per each installation.

729.08.6 Footings: Concrete footings for overhead sign mountings will be measured per each footing. Footings and aprons for post sign mountings will not be measured for payment.

729.08.7 U-Channel Posts: U-channel posts will be measured per each unit installed when not part of an assembly.

729.08.8 Square Tubing: Square Tubing will be measured per each unit installed when not part of an assembly.

729.08.9 Clearing or Tree Trimming: Any clearing or tree trimming required by this section and not provided for elsewhere in the contract will be included in the contract unit price for signs.

The trimming of significant trees that have been identified under the Department's policy governing the treatment of significant trees within the highway right-of-way, zone of construction or operational influence, shall be performed or supervised by an ISA Certified Arborist with a minimum of five years of experience in arboriculture. All work must be done in compliance with current ANSI Z133 and *International Society of Arboriculture (ISA) Standards*. Documentation must be provided proving that the tree trimmer/climber has a minimum of three years full time experience in tree removal and pruning operations along public roads and near energized wires. Arborist(s) shall maintain an arborist license and insurances during the course of the project in accordance with 107.02 and 719.02. The Department has the right to request a new crew be assigned to perform the work if needed. Significant tree issues arising on construction and/or maintenance projects shall be managed by the District Roadside Development Coordinators, who shall seek the guidance of the Landscape Architectural staff when questions arise.

729.09 PAYMENT.

729.09.1 Sign Faces and Overlay Panels:

New Installation: Payment for sign faces on new sign supports will be made at the contract unit price per square foot, which includes furnishing, fabricating, and constructing the signs, and furnishing necessary attaching devices.

Furnish and Install: Payment for sign faces on existing sign supports will be made at the contract unit price per square foot, which includes

furnishing, fabricating and constructing the signs and furnishing necessary attaching devices.

Install: Payment for install only on existing sign supports will be for labor only. All sign faces and necessary mounting hardware will be provided by the Department. Payment will be made at the contract unit price per square foot.

Relocate: Payment will include dismantling of sign and reinstalling sign on a new sign support. Payment will be made at the contract unit price per square foot.

729.09.2 Post Mountings: Payment for post sign mountings will be made at the contract unit price per each, which includes furnishing, fabricating and constructing the support complete, ready for affixing signs, and includes required excavation, concrete, and reinforcement for footings and aprons, and mounting of signs or remounting of existing signs when required by the plans. Payment for sign layout will be made in accordance with Section 740.

729.09.3 Overhead Mountings: Payment for overhead sign mountings, including bridge fascia mountings, will be made at the contract unit price per each, which includes furnishing, fabricating and erecting the structure complete, ready for affixing signs, and mounting of signs or remounting of existing signs when required by the plans.

729.09.4 Delineator, Object Marker, and Milepost Assemblies: Payment for delineator, object marker, and milepost assemblies will be made at the contract unit prices per each, which includes posts. Concrete pads for milepost (reference location markers) will be paid for under Section 706.

729.09.5 Dead End Road Installations: Payment for dead end road installations will be made at the contract unit price per each, which includes piling, posts, barricades, sign materials, reflectors, and any required guard rail.

729.09.6 Footings: Payment for footings for overhead sign mountings will be made at the contract unit price per each, which includes excavation, piling, concrete, reinforcing steel, anchor bolt assemblies, and backfill. The concrete in footings will be identified by lots and shall be subject to pay adjustments in accordance with Table 901-5 and Note 1 therein. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

729.09.7 U-Channel Posts and Square Tubing: Payment for U-channel posts and square tubing will be made at the contract unit price per each which shall include all labor, equipment, tools, materials, and

incidentals necessary to complete the work, including splicing of posts, and when required removing and remounting of existing signs, and mounting of new signs.

Payment will be made under:

Item No.	Pay Item	Pay Unit
729-01	Sign (Type A)	Square Foot
729-02	Sign (Type B)	Square Foot
729-03	Sign (Type C)	Square Foot
729-04	Sign (Type D)	Square Foot
729-05	Sign (Type E)	Square Foot
729-06	Sign (Overhead Mounted)	Square Foot
729-07	Sign (Overlay Panel)	Square Foot
729-08	Mounting (_____Size Post)	Each
729-09	Mounting (Overhead Truss)(Ground Mounted)	Each
729-10	Mounting (Overhead Truss)(Structure Mounted)	Each
729-11	Mounting (Overhead Cantilever)(Ground Mounted)	Each
729-12	Mounting (Overhead Cantilever)(Structure Mounted)	Each
729-13	Mounting (Bridge Facia Mounted)	Each
729-14	Delineator Assembly (Ground Mounted)	Each
729-15	Delineator Assembly (Structure Mounted)	Each
729-16	Object Marker Assembly	Each
729-17	Milepost Assembly (Ground Mounted)	Each
729-18	Milepost Assembly (Structure Mounted)	Each
729-19	Dead End Road Installation (Type)	Each
729-20	Footings for Overhead Mounting (Type)	Each
729-21	U-Channel Post	Each
729-22	Square Tubing Post	Each

**Section 730
Vacant**

Section 731

Raised Pavement Markers

731.01 DESCRIPTION. Furnish and place raised pavement markers in accordance with the plans.

The contractor shall be responsible for field layout and alignment of raised pavement markers. Existing pavement striping shall generally be used as a guide in determining raised marker locations. The Department will replace obliterated striping prior to installation of raised pavement markers; however, if no striping exists or is obliterated at the time of raised marker installation, the contractor shall determine raised pavement marker locations in accordance with plan details or as directed.

731.02 MATERIALS.

731.02.1 Markers: Markers shall comply with 1015.09. Use the same product throughout the project. Markers shall be the specified class, type, color, size, and shape.

731.02.2 Epoxy Adhesive: Use Type I (Rapid Setting) or Type II (Standard Setting) epoxy resin adhesive system complying with 1017.03. Mix epoxy components and dispense adhesive in accordance with manufacturer's recommendations.

731.02.3 Bituminous Adhesive: Bituminous adhesive shall comply with 1015.09.3.2.

731.03 CONSTRUCTION REQUIREMENTS.

731.03.1 Weather Limitations: Do not apply markers when there is moisture on the surface.

731.03.1.1 Epoxy Adhesive: When using a standard set adhesive, do not apply markers at ambient air temperatures less than 50°F. When using a rapid set adhesive, application of markers will be permitted at ambient air temperatures between 35°F and 50°F, provided the adhesive is adequately heated to obtain proper viscosity for mixing and application, and is also identified as a rapid set type on container labels and Certificates of Delivery.

731.03.1.2 Bituminous Adhesive: Apply markers when the ambient air temperature reaches 35°F or greater, or in accordance with the manufacturer's recommendations.

731.03.2 Removal of Markers: Remove markers by methods that will not damage the pavement surface. Repair damage to pavement surface at no cost to the Department. After removing the markers, the debris and

residue shall become the property of the contractor and be disposed of properly.

731.03.3 Cleaning of Surfaces:

Surfaces, including ramps and gore areas, on which markers are to be applied must be cleaned of all materials that may reduce the bond of adhesive. Clean surfaces by blast cleaning or other approved methods which do not damage the surface. Blast cleaning equipment must have positive cutoff controls. Maintain surfaces in a clean dry condition until placement of markers.

731.03.4 Application of Markers: Place markers with bituminous adhesive on asphalt surfaces.

Place markers with Type I or II epoxy resin adhesive, or Type II or III bituminous adhesive on portland cement concrete surfaces.

Surfaces on which markers are to be placed shall be blown dry immediately prior to marker placement. Apply markers to surfaces with adhesive in accordance with the manufacturer's recommendations.

Do not place pavement markers on joints.

731.03.4.1 Epoxy Adhesive: Mixed adhesive shall have a uniformly grey color with no streaks of either black or white on the surface or within mixed adhesive. Voids in a cured undisturbed sample approximately 1/16 inch thick from the extrusion nozzle shall not exceed 4 percent by volume. Machine mixer and applicator shall be capable of accurately and uniformly proportioning the two components in a 1:1 ratio within 5 percent by volume of each component (*i.e.*, within 47.5 to 52.5 percent for each component). Perform periodic checks of proportioning equipment to determine the actual ratio of components. Do this by placing containers in front of the mixing chamber and measuring the actual volume of each component. Arrange equipment so it is possible to bypass the mixer to perform these periodic checks. Maintain temperature of adhesive between 70°F and 110°F before mixing. Apply adhesive in sufficient quantity to cause excess adhesive to be forced out around the perimeter of the marker. Maintain the temperature to prevent excessive flow of epoxy from the marker when installed. Fill voids in markers with an open grid pattern on bottom with adhesive immediately prior to placement.

731.03.4.2 Bituminous Adhesive: Heat and melt the adhesive in either thermostatically controlled double boiler type units utilizing heat transfer oil or thermostatically controlled electric heating pots. The melter/applicator unit shall be suited for both melting and pumping application through heated applicator hoses. Heat the adhesive as per manufacturer's recommendations and apply directly to the pavement surface

from the melter/applicator by either pumping or pouring. The area of the bituminous adhesive bed shall be a minimum of 6 inches in diameter. Apply markers to the adhesive within 10 seconds. Place the marker in the adhesive bed by applying downward pressure until the marker is firmly seated. Immediately remove adhesive on exposed surfaces of markers with soft rags moistened with mineral spirits or kerosene. Protect markers against impact until the adhesive hardens. Reheat and reuse the adhesive; however, do not exceed the pot life at application temperatures.

731.04 MEASUREMENT. Raised pavement marker installation will be measured per each marker furnished, placed, and accepted.

 Raised pavement marker removal will be measured per linear mile.

731.05 PAYMENT. Payment for field layout and alignment of raised pavement markers will be in accordance with Section 740. Payment for installation of raised pavement markers will be made at the contract unit prices per each. Payment for removal of raised pavement markers will be made at the contract unit price per linear mile. Payment will include all labor, materials, equipment, and incidentals necessary to complete the work.

Item No.	Pay Item	Pay Unit
731-01	Non-reflectorized Raised Pavement Markers	Each
731-02	Reflectorized Raised Pavement Markers	Each
731-03	Removal of Raised Pavement Markers	Linear Mile

Section 732

Plastic Pavement Markings

732.01 DESCRIPTION. Furnish and place reflective pavement markings of hot applied thermoplastic or preformed (cold or hot applied) plastic at the locations shown on the plans. Plastic pavement markings include stripes, gore markings, lines, legends, and symbols.

732.02 MATERIALS.

732.02.1 Thermoplastic Markings and Glass Beads: Thermoplastic marking material shall be a plastic compound reflectorized by internal and external application of glass beads. Comply with 1015.10 and 1015.13. Width, thickness, and color of markings shall be as specified. Black thermoplastic pavement markings shall require skid-resistant filler in lieu of glass beads.

732.02.2 Preformed Plastic Marking Tape: Comply with 1015.11.

732.02.3 Surface Primer: Provide a single component surface primer or two component primer sealer for the appropriate application in accordance with 732.03.5. The primer shall form a continuous film that dries rapidly and adheres to the pavement. The primer material shall not discolor or cause any noticeable change in the appearance of the pavement outside of the finished pavement marking. Apply primer in accordance with the manufacturer's recommendation. Do not allow traffic over primed areas before applying thermoplastic.

732.02.4 Glass Beads: Glass beads for standard (flat) thermoplastic markings shall be in accordance with 1015.13.

732.03 CONSTRUCTION REQUIREMENTS.

732.03.1 Equipment for Standard (Flat) Thermoplastic Marking Material: Finished markings shall be continuous and uniform in shape, with clear and sharp dimensions. Applicators shall be capable of producing various widths of traffic markings. Applicators shall produce sharply defined lines and provide means for cleanly cutting off stripe ends and applying broken lines.

For new 90 mil application, equipment shall consist of an extrusion die or a ribbon gun that simultaneously deposits and shapes lines at a thickness of 90 mils or greater on the pavement surface.

When restriping 90 mils thickness onto existing thermoplastic markings, only a ribbon gun shall be used.

For 40 mils, only a spray application will be allowed.

732.03.2 Weather Limitations: Do not apply markings within 12 hours after rain, if moisture is present, or when the surface temperature or ambient temperature is below 50°F.

732.03.3 Cleaning of Surfaces: Clean surfaces, including ramps and gore areas, on which markings are to be applied of materials that may reduce adhesion of the thermoplastic marking materials to the pavement. Clean by blast cleaning or other approved methods, which do not damage the surface. Blast cleaning equipment must have positive cutoff controls. Keep surfaces clean and dry until placement of markings.

732.03.4 Removal of Existing Markings:

732.03.4.1 40 Mil Thickness: Remove existing thermoplastic markings that are flaking or peeling prior to placement of thermoplastic. Remove flaking or peeling material by mechanical sweeper or wire brush to the satisfaction of the engineer prior to thermoplastic application. After markings are removed, properly dispose of striping debris and residue.

732.03.4.2 90 Mil Thickness: Before placement of 90 mil or greater thermoplastic on portland cement concrete, remove existing thermoplastic markings regardless of condition. Apply a two part sealer before placement of any temporary paint or permanent thermoplastic. Asphalt sections do not require removal of thermoplastic unless otherwise noted on the plans. After markings are removed, properly dispose of striping debris and residue.

732.03.4.3 Intersection Markings, Legends and Symbols: Remove existing markings from the pavement surface. Apply 125 mils of new thermoplastic markings.

732.03.4.4 Preformed Plastic Markings (Tape): Remove existing markings to the pavement surface before applying the preformed plastic markings (tape).

Remove markings by methods that will not damage the pavement or bridge deck. After removing the markings, pick up and dispose of the debris and residue within 24 hours. Removal shall be to such extent that 75 percent of the pavement surface or bridge deck under the markings is exposed. At the end of each day's operations, the engineer may direct that temporary pavement markings complying with Section 713 be used in areas where existing markings have been removed and new markings not placed.

Satisfactorily remove temporary pavement markings prior to resuming thermoplastic marking operations.

Remove all markings made in error or not conforming to the traffic operation in use to the satisfaction of the engineer. Do not obliterate markings by painting with asphalt binder or other material.

732.03.5 Application of Surface Primer: When applying 90 mil thermoplastic, use a two component primer sealer prior to placement of thermoplastic materials on portland cement concrete surfaces and oxidized asphalt unless otherwise directed by the engineer.

When applying 40 mil thermoplastic, use a single component surface primer on portland cement concrete surfaces unless otherwise directed by the engineer.

When applying preformed thermoplastic, use primer as recommended by the manufacturer. Do not allow traffic over primed areas before applying thermoplastic.

732.03.6 Application of Markings: Install material in specified widths from 4 inches to 24 inches. Finished lines shall have well defined edges and be free of waviness. Measurements will be taken as an average through any 36-inch section of line. Offset longitudinal lines approximately 2 inches from longitudinal joints. A tolerance of + 1/2 inch and -1/8 inch from the specified width will be allowed, provided the variation is gradual. Lines should be squared off at each end without excessive mist or drip. Transverse variations from the control device up to 1 inch will be allowed provided the variation does not increase or decrease at the rate of more than 1/2 inch in 25 feet. Remove lines not meeting these tolerances and replace at no cost to the Department.

732.03.6.1 Thermoplastic Markings: For extruded or ribbon gun applied markings, the thickness of material, not including drop-on beads, shall not be less than 90 mils for lane lines, edge lines, black contrast, gore markings, and no less than 125 mils for crosswalks, stop lines, words, and symbol markings.

For spray applications the thickness of material, not including drop-on beads, shall not be less than 40 mils.

Apply glass beads to the molten surface of completed stripes by either a single drop or a double drop application depending on the thickness of the thermoplastic striping. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night. For a 40 mil single drop application, the contractor has discretion on which beads to use in order to meet the retroreflectivity requirements. For the first drop of a 90 mil double drop application, use Type 4 beads at a minimum rate of 211 pounds per mile

based on a 4-inch solid line. The type of bead for the second drop is at the contractor's discretion; however, a smaller bead is typical. Black thermoplastic pavement markings require skid-resistant filler in lieu of glass beads.

732.03.6.2 Preformed Plastic Markings: Apply preformed plastic markings in accordance with the manufacturer's recommendation.

732.03.7 Field Testing of Roadway Markings: The contractor and the Department will field test the pavement markings in accordance with 1015.10, 1015.11, and Table 732-1. Failure to meet these requirements will require the contractor to replace the portion of the material shown to be out of specification as directed by the engineer.

Take initial readings within 30 days of application. Initial readings taken after 30 days must meet the same requirements as initial readings. Any late readings submitted after the 30 days will be considered initial readings. Take the initial retroreflectivity readings with a DOTD inspector present. Upon completion of testing, the DOTD inspector will immediately take possession of a copy of the retroreflectivity readings in either a hard copy (8½ inches x 11 inches) or electronic format on a USB drive, as noted below. Additionally, provide documentation to the Department that the instrument has been calibrated in accordance with the manufacturer's requirements, including the required annual factory calibration.

The Department reserves the right to inspect the striping and take additional readings six months to one year after the date of installation for the one year warranty.

For each material type, take a different set of readings in accordance with Table 732-1. Provide the data to the Department electronically in Microsoft Excel® (xls) format downloaded from the reflectometer data. Each spreadsheet shall have a header that states all of the following:

1. Project number;
2. Date material installed;
3. Type of material installed;
4. Interstate: Specify the route and direction and show the beginning mile-point to ending mile-point, of material installed; and,
5. State Route: Specify the route and direction. Also specify X number mile from intersection to X number mile from intersection, of material installed. (*Ex.* Route US 61 South; 0.10 Mile South of Old Hammond Highway to 0.2 Mile South of I-12).

The format for the excel spreadsheet shall be (description, date, and reading). In the description cell, the format shall be Route (*i.e.*, LA, US, or I), Direction (*i.e.*, N, S, E, or W), Mile Point, and Color (W or Y).

Examples: LA 115; W; 23; Y
I-10; S; 4; W

The project engineer will input data into the striping input form.

**Table 732-1
Field Testing of Plastic Pavement Markings**

Length of Roadway (Segment)	Minimum Required Readings
Less than 1 mi	10 evenly spaced readings per line ^{a, c}
1 mi to 6 mi	10 evenly spaced readings per line for each 1-mi segment ^{a, c}
Greater than 6 mi	5 evenly spaced readings per line for each 1-mi segment ^{b, c}
Stop Bars, Cross Walks, Chevrons, Hash Marks, and Legends and Symbols	Visual nighttime inspection only
8-inch Lines (Parallel to Roadway)	5 readings per line ^{b, c, d}
^a Report average of 10 readings per line segment. ^b Report average of 5 readings per line segment. ^c Additional readings shall be taken if a defect is noticed by the engineer. ^d Only initial readings are required.	

General Notes:

1. Take readings on each line and color separately except as indicated below.
2. Adjacent lines applied at the same time are considered one line. Alternate readings between each line.
3. Take readings on dry, clean roadways.
4. Collect data in the direction lines were applied except for yellow centerlines on two lane roadways. For yellow centerlines on two lane roadways, collect data against the direction lines were applied.
5. On broken lines (skip striping), no more than two readings shall be taken per stripe, with readings 20 inches from ends of marking. This does not apply if using a vehicle mounted mobile unit.
6. Acceptance will be based on the average of each set of readings for each line segment.
7. Failure of the average reading for any segment to meet the specified minimum values will require replacement, corrective action or be subject to payment adjustments specified in Table 732-2.
8. Limits of replacement will be determined by the engineer.
9. Aggregate Surface Course projects will not be tested for retroreflectivity, but will be visually inspected at night for acceptance by the engineer.
10. No reflectance readings are required for black, red, or blue thermoplastic pavement markings.
11. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night.

732.03.8 Guarantee: All work performed in accordance with this section shall be guaranteed in accordance with 104.05.

732.04 MEASUREMENT.

732.04.1 Plastic Pavement Striping: Plastic striping will be measured by the linear foot or mile, as specified. When not including a bid item for wider markings, the Department will measure the quantity by converting the actual length and width of lines installed to an equivalent length of the normal width line on that section of roadway.

732.04.1.1 Linear Foot: Measurement will be made by the linear foot of striping, exclusive of gaps.

732.04.1.2 Mile: Measurement will be made by the mile of single stripe. No deduction will be made for standard broken-line gaps; however, deductions will be made for the length of other gaps or omitted sections.

732.04.2 Plastic Pavement Legends and Symbols: Plastic legends and symbols will be measured per each legend or symbol. Each symbol includes all letters, lines, bars, or markings necessary to convey the message at each location.

732.04.3 Removal of Existing Markings: For two-lane highways, markings will be measured by the linear mile of full roadway width including shoulders. For multilane highways and ramps, the markings will be measured by the linear mile of the full roadway width including shoulders for each direction of travel.

Removal of pavement markings will include removal of lane lines, edge lines, gore markings, legends, symbols, raised pavement markers, and disposal of debris.

732.05 PAYMENT. Payment for the completed and accepted quantities of plastic pavement markings and removal of existing markings will be made at the contract unit prices, which include all labor, materials, equipment, and incidentals necessary to complete the work.

**Table 732-2
Thermoplastic Payment Adjustment for Minimum Initial
Retroreflectivity**

Contract Unit Price ¹ , %	White (mcd\lux\sq m)		Yellow (mcd\lux\sq m)	
	40 mil	90 mil	40 mil	90 mil
100	250	375	175	250
90	230	360	165	230
80	220	340	155	220
50	200	325	150	200
Restripe	<200	<325	<150	<200

¹The payment requirements are based on the project total average of all test segments (on a route) for initial reading for white and yellow separately in accordance with Table 732-1. Payment adjustments will be based on each identifiable route within the contract.

Payment will be made under:

Item No.	Pay Item	Pay Unit
732-01	Plastic Pavement Striping (___inch Width)	Linear Foot
732-02	Plastic Pavement Striping (Solid Line) (___inch Width)	Linear Mile
732-03	Plastic Pavement Striping (Broken Line) (___inch Width)	Linear Mile
732-04	Plastic Pavement Legends and Symbols (Type)	Each
732-05	Removal of Existing Markings	Linear Mile

**Section 733
Vacant**

Section 734

Rubblizing Portland Cement Concrete Pavement

734.01 DESCRIPTION. Rubblize existing reinforced or non-reinforced portland cement concrete pavement using a pavement-fracturing machine capable of delivering sufficient energy to rubblize the pavement full-depth in a manner that fractures the concrete slab into smaller pieces that eliminates slab action without damaging the subgrade. Thoroughly compact and seat the rubblized pavement with appropriate equipment as outlined in this specification. Either the resonant frequency breaker (Method 1) or the multihead breaker (Method 2) process may be utilized to rubblize and seat the pavement. Use only one of the methods (Method 1 or Method 2) on the project.

When using Method 2 on concrete pavements with thickness greater than 11 inches, the contractor may use a guillotine-breaking device with the engineer's approval, if pre-fracturing of the pavement is necessary to achieve rubblization size requirements without damage to the subgrade.

Perform the work in accordance with the lines, grades, and typical sections shown on the plans and as outlined in this specification.

734.02 EQUIPMENT.

734.02.1 Method 1 (Resonant Frequency Breaker Process):

734.02.1.1 Resonant Frequency Breaker Machine: Use a self-contained, self-propelled, resonant frequency breaker for rubblizing existing pavement that is capable of producing 2000 pound force blows at a rate of not less than 44 cycles per second with an amplitude of less than 1 inch.

734.02.1.2 Resonant Frequency Breaker Seating Equipment:

734.02.1.2.1 Steel-Wheel Vibratory Roller: Use a steel-wheel vibratory roller having a gross weight of not less than 10 tons, operated in the vibrating mode, to compact the rubblized pavement.

734.02.1.2.2 Pneumatic-Tired Roller: Use a pneumatic-tired roller as specified in 503.16.3 to compact the rubblized pavement.

734.02.2 Method 2 (Multihead Breaker Process):

734.02.2.1 Multihead Breaker Machine: Use a multihead breaker that is a rubber-tired, self-propelled unit, which uses 12 to 16 hammers with weights ranging from 1,200 to 2,000 pounds mounted

laterally in pairs with half the hammers in a forward row and the remainder diagonally offset in a rear row so that there is continuous breakage from side to side. Each hammer shall have one continuous strike bar whose width varies from 1 to 2 inches. Each pair of hammers is attached to a hydraulic lift cylinder, which operates as an independent unit, and cycles at a rate of 30 to 35 impacts per minute. It shall be capable of rubblizing up to 13 feet in width of pavement in one pass.

734.02.2.2 Multihead Breaker Seating Equipment:

734.02.2.2.1 Z-Grid Roller:

Use a modified vibratory steel-wheel roller with a "Z" grid pattern on the drum face. The roller shall have a gross weight of at least 10 tons, and operate in the vibratory mode, to settle and seat the rubblized pavement.

734.02.2.2.2 Steel-Wheel Vibratory Roller: Use a steel-wheel vibratory roller having a gross weight of not less than 10 tons, operated in the vibrating mode, to compact the rubblized pavement.

734.02.2.2.3 Pneumatic-Tired Roller: Use a pneumatic-tired roller as specified in 503.16.3 to compact the rubblized pavement.

734.03 CONSTRUCTION REQUIREMENTS.

734.03.1 Preparation Prior to Rubblization:

734.03.1.1 Drainage System Installation: Prior to rubblization operations, install drainage systems as shown on the plans. Ensure that drainage systems are properly functioning for a minimum of two weeks prior to rubblization.

734.03.1.2 Removal of Existing Asphalt Surfaces: Remove existing asphalt concrete overlays and patches from the PCC pavement surfaces prior to rubblization. Existing full-depth asphalt patches shall remain in place, unless directed for removal and replacement by the engineer.

734.03.1.3 Saw-Cut Joints: Make new full-depth saw-cuts along existing joints on all pavement edges where rubblized PCC is adjacent to pavement that will remain in place. Sever all load transfer devices between the planned rubblization and PCC pavement remaining in place.

734.03.1.4 Shouldering: Complete shoulder adjustments and/or any pavement widening up to the elevation of the existing pavement grade prior to beginning the rubblization operations. These areas can be used to support the rubblization machines while the existing PCC pavement is being rubblized.

734.03.2 Test Strip and Test Pit to Establish Procedure:

734.03.2.1 Test Strip: Before the rubblization process begins, the engineer will designate a test section of at least 150 feet by 12 feet. Rubblize the test section using varying degrees of energy and/or various striking heights until a procedure is established that will rubblize the pavement as outlined herein.

On projects that have a transition to a bridge or to an overpass, make the test pit in the transition where the material will be totally removed.

734.03.2.2 Test Pit: In the middle of the test strip, excavate a 4-foot square test pit at a location selected by the engineer, to determine that the breaker is producing rubblized pieces of the specified sizes as outlined in these specifications. Check the rubblized particle sizes throughout the entire depth of the pavement. Remove the test pit material from the project and fill the hole using coarse aggregate material as specified in 1003.03. Place and properly compact the replacement material to the satisfaction of the engineer.

The engineer and the contractor shall mutually agree upon the rubblization procedure based on the performance criteria contained herein. Use the established procedure to rubblize the remainder of the pavement. Continuously monitor the rubblization operation, and make minor adjustments in the striking pattern, striking energy, number of passes, and other factors necessary to continually achieve acceptable rubblization throughout the project. Inform the engineer of any major adjustments that may be required in the process to provide rubblized pavement that conforms to the specification requirements. Additional test pits may be required by the engineer to confirm that the PCC pavement is adequately rubblized.

734.03.3 Rubblization Criteria:

734.03.3.1 Method 1 (Resonant Frequency Breaker):

Compact the complete width of the rubblized pavement surface with the vibratory steel-wheel roller and pneumatic-tired roller in the following sequence as a minimum. The engineer will determine if more passes are necessary.

1. One pass with the vibratory steel-wheel roller in vibratory mode.
2. One pass with the pneumatic-tired roller.
3. Two passes with the vibratory steel-wheel roller in vibratory mode.

A pass shall be defined as forward and backward in the same path. Operate the roller at a speed not to exceed 4.5 feet per second.

Break the existing concrete pavement into pieces ranging from sand size to 6 inches, with no more than approximately 10 percent of the material larger than 6 inches and no individual pieces larger than 8 inches in any

dimension. The majority of rubblized concrete material shall be pieces ranging from 1 to 3 inches in size in any dimension.

734.03.3.2 Method 2 (Multihead Breaker): Compact the complete width of the rubblized pavement surface with the vibratory Z-grid roller, vibratory steel-wheel roller, and pneumatic-tired roller in the following sequence as a minimum. The engineer will determine if more passes are necessary.

1. Four passes with the Z-grid roller in vibratory mode (minimum).
2. Four passes with the vibratory steel-wheel roller in vibratory mode.
3. Two passes with the pneumatic-tired roller.
4. Two passes with the vibratory steel-wheel roller in vibratory mode immediately prior to asphaltic concrete overlay,

A pass shall be defined as forward and backward in the same path. Operate the roller at a two speed not to exceed 4.5 feet per second.

Break the existing concrete pavement into particles with at least 75 percent (as determined by visual observation) of the particles being less than 3 inches and no pieces larger than 6 inches in any dimension within the upper half of the slab thickness. The bottom half of the slab shall have rubblized pavement with no pieces larger than 9 inches in any dimension.

734.03.4 Reinforced Portland Cement Concrete Pavement: Debond the reinforcing steel from the concrete and leave in place. If any steel is protruding from the surface, cut the steel below the surface and remove.

734.03.5 General Rubblization Procedures: Rubblize in partial widths when necessary to maintain traffic as shown in the contract documents. When the rubblization process is adjacent to in-service pavement, take measures to prevent debris from entering the in-service pavement. In areas where the pavement is to be overlaid prior to completion of the rubblization, extend the initial rubblization a minimum of 6 inches beyond the width of the pavement to be overlaid. For the resonant frequency breaker process, begin rubblizing at a free edge or previously broken edge and progress toward the opposite shoulder or longitudinal centerline of the pavement. Continuous coverage of the entire pavement surface, overlapped if necessary to achieve adequate rubblization with the breaking shoe, will be required.

Additional passes of either rubblization device may be required to meet the particle sizes outlined in this specification as directed by the engineer.

734.03.6 Dust Control: Minimize the dispersion of dust from the rubblization operation until the rubblized surface is overlaid with asphalt concrete. Provide a water truck, operator, and all water necessary for dust-

control purposes. Do not apply excessive water to the rubblized surface. Dust control is incidental to the rubblization process and will not be paid for separately. Dust-mitigation measures must be acceptable to the engineer.

734.03.7 Damage to Base, Underlying Structures, and Other Facilities: Operate the rubblization machine and rollers in a manner that will avoid damaging the base, underlying structures, utilities, drainage facilities, bridge approach slabs, bridge decks, and other facilities on the project. If any damage occurs, immediately cease operations, notify the engineer, and repair the damage as directed. Make repairs in a timely manner at the contractor's expense.

734.03.8 Unstable Area Patching: If unstable areas occur because of expansion of the existing concrete pavement, remove the unstable areas to a maximum length of 4 feet by 12 feet in width and replace with full-depth asphalt concrete patching in accordance with Section 510 as directed. Patching procedures shall conform to the standard specifications, and shall be completed prior to placing the asphalt concrete overlay.

Patch areas of poor subgrade support that are identified during the rubblization and seating process as directed. Remove the rubblized pavement, base course, and subgrade material from unstable areas. Replace the material with full depth asphalt concrete patches in accordance with Section 510 as directed.

734.03.9 Progress of the Work: Unless otherwise specified, no more than 48 hours shall elapse between rubblizing the pavement and the placement of the asphalt concrete overlay. A minimum of 4 inches of asphalt concrete is required before traffic is allowed on the on the rubblized pavement. If rain occurs between these operations, this time limitation may be waived to allow sufficient time for the rubblized pavement to dry to the satisfaction of the engineer.

Except at restricted crossover and ramp crossings, do not allow traffic on the rubblized pavement before the initial asphalt concrete base and leveling courses, if required, are in place. Immediately remove rubblized material dislodged by construction traffic from the roadway in front of the paver.

734.04 MEASUREMENT. Rubblizing portland cement concrete pavement will be measured by the square yard. The width will be the nominal width of the existing pavement, and the length will be measured along the centerline of each roadway or ramp.

734.05 PAYMENT. Payment for rubblizing portland cement concrete pavement will be made at the contract unit price per square yard, which includes furnishing all materials, labor, equipment, and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
734-01	Rubblizing Portland Cement Concrete Pavement (Resonant Frequency Breaker)	Square Yard
734-02	Rubblizing Portland Cement Concrete Pavement (Multihead Breaker)	Square Yard

Section 735

Mailboxes and Mailbox Supports

735.01 DESCRIPTION. Remove and replace mailboxes, newspaper delivery tubes, and mailbox supports in accordance with these specifications, the plans, and as directed.

Mailboxes are privately owned, although placed on public right-of-way. Coordinate with the mailbox owner and the United States Postal Service (USPS) to ensure that the owner receives mail deliveries.

Using a form furnished by the Department a minimum of 10 calendar days before renewal, notify the property owners that the mailbox and supports will be removed for construction and will be replaced using approved materials in accordance with these specifications. Also notify the property owners that salvageable material will be placed on the owner's property for the owner's disposal if the owner so desires. Provide the engineer with documentation assuring that all property owners have been notified in accordance with these specifications.

735.02 MATERIALS. Fabricate mailboxes with light sheet metal or plastic complying with the requirements of the USPS. Provide the same size replacement mailbox as the existing mailbox. Newspaper tubes shall be furnished by the property owner. Names and numbers on mailboxes will be the responsibility of the property owner.

Provide galvanized metal posts for mailbox supports with a strength no greater than a 2-inch diameter standard-strength steel pipe or 2 pound per foot flanged channels. Include an anti-twist device for the mailbox supports.

735.03 CONSTRUCTION REQUIREMENTS. Install mailbox supports a maximum of 24 inches in the ground. Do not set supports in concrete.

Provide support-to-box attachments sufficient to prevent the box from separating from the support if the support is struck by an automobile or light truck. Mount newspaper tubes below the mailbox on the side of the mailbox support.

Dispose of materials in accordance with 202.02 at no direct pay.

Sampling and testing of materials will not be required.

735.04 MEASUREMENT. Mailboxes will be measured per each and will include furnishing new mailboxes. Mailbox supports will be measured per each and will include all materials, bolts, nuts, washers, and other components, equipment, and labor necessary to remove and replace mailbox supports, install mailboxes, and install newspaper delivery tubes.

735.05 PAYMENT.

Payment will be made at the contract unit price per each.

Payment will be made under:

Item No.	Pay Item	Pay Unit
735-01	Mailboxes	Each
735-02	Mailbox Supports (Single)	Each
735-03	Mailbox Supports (Double)	Each
735-04	Mailbox Supports (Multiple)	Each

Section 736 Traffic Signals

736.01 DESCRIPTION. Furnish and install necessary materials and equipment to complete new traffic signal systems or modify existing systems in accordance with plan details, Traffic Signal Standard Details, and these specifications.

Unless otherwise specified, furnish only new materials. When existing systems are to be modified, incorporate the existing material into the revised system, salvage the material, or abandon it, as specified.

Furnish and install incidental parts, which are necessary to complete the traffic signal or other electrical systems or required for modifying existing systems, even though not shown on the plans, specified herein, or in the project specifications. All systems shall be complete and in operation to the satisfaction of the engineer at the time of final acceptance.

736.02 MATERIALS. Materials shall comply with the following sections and subsections:

Usable Soil	203.06.1
Electrical Service	822.10
Portland Cement Concrete, Class S	901
Reinforcing Steel	1009.01
Ground Rods	1010.08
Manhole Frames and Covers	1013.05
Treated Timber Poles	1014
Precast Reinforced Concrete Junction Boxes and Manholes	1016.06
Rigid Metal Electrical Conduit	1018.11
Electrical Conductors	1018.11
Traffic Signal Heads	1020.01
Traffic Detectors and Associated Equipment	1020.02
Traffic Signal Hardware and Equipment	1020.03
Pedestal Anchor Bolts	1020.03.3
Support Cable	1020.03.4
Guy Components	1020.03.5
Traffic Signal Conductors	1020.03.6
Electrical Junction Boxes	1020.03.7
Poles for Traffic Signal Systems	1020.04
Steel Standards and Mast Arms	1020.04.3

Traffic Operations Approved Product List:

http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Operations/Traffic_Services/Pages/Traffic_Operations_Approved_Products_List.aspx

(Materials referenced to the Traffic Operations Approved Product List under Sections 736 and 1020 will require the materials to be included on the list before use.)

Controllers shall comply with the supplemental specifications titled *Traffic Signal Control System, Traffic Control Standards*.

Traffic detectors and associated equipment shall be included in the *Traffic Signal Control System, Traffic Control Standards*, unless otherwise noted on the plans.

736.03 REGULATIONS AND CODE. Electrical equipment shall comply with the latest standards of the NEMA or the RMA, whichever applies. In addition to the requirements of these specifications, the plans, and the project specifications, material and work shall comply with the latest requirements of NFPA No. 70 National Electrical Code and ANSI C2 National Electrical Safety Code, the Standards of ASTM, ANSI, MUTCD, ITE, and IMSA. When there is a discrepancy, IMSA will override the NEC. The term code as referred to in this section shall be the NFPA No. 70, National Electrical Code, and ANSI C2, National Electrical Safety Code. Discrepancies between codes or standards and these specifications shall be resolved in accordance with 105.04.

Contractors shall have a IMSA Traffic Signal Level 1 certified technician at all times at each work location and a IMSA Traffic Signal Level 2 certified technician to work in the cabinet for all signal work.

736.04 GENERAL REQUIREMENTS. All traffic signal projects shall follow the Traffic Signal Special Details.

Verify the location of existing utilities prior to construction. Verify the practicality of the location, elevation, and orientation of foundations for poles and pedestals prior to ordering materials.

Protect traffic control equipment to be salvaged during removal and delivery to the specified location. Equipment not to be salvaged shall become the property of the contractor. Dispose of unsalvageable equipment in accordance with 202.02.

Use the existing equipment or provide traffic signal equipment during the period of construction for continuous operation of the signal system at no

direct pay. Traffic control operations and construction shall be in accordance with the plans or these specifications. Submit operational differences in writing and obtain approval in advance by the Traffic Engineer.

Provide minimum clearances for traffic signal poles and apparatus in accordance with the MUTCD. Locate poles a minimum of 24 inches outside the barrier curb or a minimum of 10 feet outside the edge of the travel lane. Any deviation must be approved by the engineer.

736.05 DRAWINGS AND EQUIPMENT SUBMITTALS. Provide drawings and equipment submittals to the State Traffic Signal Engineer at Traffic Services, 7686 Tom Drive, Baton Rouge, LA 70806, before beginning work.

736.05.1 Required Documents: Electronically submit a PDF formatted letter on company letterhead for equipment submittals and shop drawings. Show the state project number or permit number, project location, project limits, pay item description, pay item number, manufacturer's name, and model numbers of the proposed equipment on each sheet. Ensure that the proposed equipment meets all contract requirements.

Submit shop drawings for mast arm poles and assemblies, including combination mast arm.

Equipment submittal shall include material catalog cuts. If multiple items are shown on material cut sheet, highlight the items submitted with the corresponding pay item number.

Submittals for equipment and materials shall be complete. Partial or incomplete submittals will be returned without review.

Where certifications and/or warranties are specified, the information submitted for acceptance shall include certifications and warranties. Certifications involving inspections and/or tests of material shall be complete with all test data, dates, and times.

After the engineer reviews the submittals for conformance with the design concept of the project, the engineer will stamp the drawings indicating their status as 'Accepted,' 'Accepted-As-Noted,' 'Rejected,' or 'Information Only.' Since the engineer reviews for conformance with the design concept only, it is the contractor's responsibility to coordinate the various items into a working system as specified. The contractor shall not be relieved from responsibility for errors or omissions in the shop, working, layout drawings, or other documents by the Department's acceptance thereof. The contractor must still be in full compliance with contract and specification requirements.

All submitted items reviewed and marked 'Rejected' are to be resubmitted in their entirety, unless otherwise indicated within the submittal comments, with a disposition of previous comments to verify contract compliance at no cost to the Department.

736.05.2 Exceptions, Deviations, and Substitutions: In general, exceptions to and deviations from the requirements of the contract documents will not be allowed. It is the contractor's responsibility to note any deviations from contract requirements at the time of submittal and to make any requests for deviations in writing to the engineer. In general, substitutions will not be acceptable. Requests for substitutions must demonstrate that the proposed substitution is superior to the material or equipment required by the contract documents and will be at no additional cost to the Department. No exceptions, deviations, or substitutions will be permitted without the approval of the engineer.

736.06 MAINTENANCE AND RESPONSIBILITY. Adhere to 107.19. Provide to the engineer a punch list of any equipment not working before beginning work. Once work begins on any portion of the signals on the project, those signals shall be the full responsibility of the contractor until final acceptance. Final repairs or replacement of damaged equipment must meet the approval of the engineer prior to or at the time of final inspection; otherwise, the traffic signal installation will not be accepted.

Provide the engineer a 24-hour emergency contact name and telephone number.

The existing and/or temporary traffic signals shall remain in operation during all construction stages, except for the most essential down time as determined by the project engineer. Provide police supervision of traffic at any time the traffic signal system is not in operation at no cost to the Department.

Any inquiry, complaint, or request by the Department shall be investigated and repairs begun within two hours of notification. Failure to respond satisfactorily will result in the Department making the necessary repairs. The contractor shall be responsible for all costs plus 15 percent.

The damages will be deducted from the cost of the contract.

Any proposed activity in the vicinity of a highway-rail grade crossing must adhere to the guidelines set forth in the current edition of the *Manual on Uniform Traffic Control Devices (MUTCD)* and the Railway-Highway Provisions in 107.08. Work in temporary traffic control zones in the vicinity of highway-rail grade crossings which states that lane restrictions, flagging, or other operations shall not create conditions where vehicles can be queued

across the railroad tracks. If the queuing of vehicles across the tracks cannot be avoided, a uniformed law enforcement officer or flagger shall be provided at the crossing to prevent vehicles from stopping on the tracks, even if automatic warning devices are in place.

736.07 SIGNAL INSPECTION. Call DOTD Traffic Operations Section at (225) 935-0100 at least 7 days before beginning construction activities, signal turn on, and final inspection to schedule an inspector to be present.

The signal inspector will inspect projects throughout the construction period, keep a diary of interim punch lists, and provide copies to the Project Engineer and District Traffic Operations Engineer (DTOE).

It is the intent to have all electrical work completed and equipment field tested prior to signal “turn-on.” If the Signal Inspector determines work is not complete and the remediation will require more than two hours to complete, the turn-on may be canceled and the contractor will be required to reschedule at another date.

Provide all of the following to the Traffic Signal Inspector at traffic signal turn-on:

1. One set of signal plans of record with field revisions marked in red ink;
2. One copy of the operation and service manuals for the signal controller and associated control equipment;
3. Five copies 11 inches x 17 inches of the cabinet wiring diagrams including field terminal connection diagrams; and,

736.07.1 Operations and Maintenance (O & M) Manual: The O&M Manual shall include, but not be limited to, the following data (where applicable):

1. Cover sheet with the project name, project number, route, parish, contractor name;
2. Table of contents;
3. Operational plan;
4. Contractor warranty letter, guarantees, and any other special warranties/guarantees as applicable;
5. Copy of executed Certificate of Substantial Completion (if applicable);
6. DOTD Final Acceptance letter;
7. Approved Shop Drawings/Submittals;
8. Fabrication Drawings;
9. Specific System and Equipment O&M Data;
10. Maintenance Requirements and Schedules;

11. Test Recordings;
12. Certifications;
13. Additional Wiring Schematics; and,
14. Certified As-Built Drawings.

Produce and submit two 90 percent draft manuals to the State Traffic Signal Engineer, 30 days before signal turn-on. The format and draft manual must be approved prior to final submission of the remaining manuals. The State Traffic Signal Engineer will return one marked-up review copy of the draft manual to the contractor for corrections. The contractor shall make the corrections and return one corrected copy to the State Traffic Signal Engineer. After receiving approval of the draft manuals from the State Traffic Signal Engineer, the contractor shall prepare the final PDF.

Submit final approved manuals upon Final Acceptance of the project. Final submission shall be a PDF formatted manual on a USB memory stick.

The cover shall include a title identifying each volume with project name, project number, and identity of subject matter enclosed. Include a table of contents and dividers for each section and bind-in drawings. Scan drawings to 11 inches x 17 inches.

736.07.2 Burn In: A 60-day “burn-in” period is required after the signal turn on prior to final acceptance. A signal acceptance document will be issued and provided to the project engineer by the State Traffic Signal Engineer at the completion of the “burn-in” period, barring any problems with signal function.

736.08 ELECTRICAL SERVICE. Verify the location of the power source and arrange for electrical service in accordance with 822.10. Use existing power service unless a new power source is indicated on the plans. Include the traffic signal control equipment in the same quadrant as the power source. If the power source is not in the same quadrant, submit a detailed drawing of proposed changes for approval.

At each power source, attach a 1-inch diameter conduit with conductors to the service pole and terminate with a threaded service entrance fitting (weather head) at a height designated by the power company. Extend the wires a minimum of 24 inches beyond the weather head.

736.09 FOUNDATIONS. Concrete shall be Class S in accordance with Section 901. Install in accordance with the Traffic Signal Standard Details. Drill holes for mast arm and strain pole foundations with an auger. Excavation for pedestal poles and controller foundations may be made with approved equipment or by hand. If a cave-in occurs during excavation,

install a casing or sleeving before continuing. Repair cave-ins before placing the foundation. When encountering subsurface obstructions, remove the obstructions or replace the excavated material and relocate the foundation as directed, at no cost to the Department. Thoroughly moisten forms and ground which will be in contact with concrete before placing concrete.

Cast foundations monolithically. Form the exposed portions to present a neat appearance. Rest the bottom and sides of concrete foundations on firm undisturbed ground. Place pole foundations with the bored hole as the form. Do not backfill around a cast-in-place foundation.

Finish tops of foundations for signal poles, except special foundations, at grade of curb top or sidewalk or as directed. Place conduit ends and anchor bolts in correct position and hold in place by a template.

Finish exposed surfaces of concrete with a Class 1, Ordinary Surface Finish in accordance with 805.08.1. Finish the sidewalk section in accordance with Section 706 except when the edge of a concrete foundation is within 18 inches of a sidewalk.

Level the tops of mast arm foundations so the pole base will be in full contact and the pole will be vertical. Shims may be allowed at the discretion of the engineer. Extend anchor bolts a minimum of 1/4 inch above the nut.

Extend conduits which terminate in anchor base type poles and pedestals approximately 3 inches above the foundation and align toward the hand-hole opening.

Install an additional 3 inch diameter spare conduit from the foundation to the nearest junction box for future use.

736.10 PEDESTAL POLES. Install the pedestal poles plumb within 1 inch at the top. Remove pedestal poles not constructed within the 1 inch tolerance and reconstruct the foundation at no cost to the Department. Shims will be allowed at the discretion of the engineer. When an existing pedestal pole cannot be shimmed within tolerance through no fault of the contractor, replace the existing foundation in accordance with 109.04.

736.11 MAST ARMS. After installation and loading, plumb the mast arm shaft within 1 inch at the top. The end of the mast arm shall be a minimum of 5 feet above the top of the shaft. The end of the mast arm shall be a minimum of 21 feet above the bottom of the transformer base. Install the mast arms with compression grommet bushing (CGB) connectors in bosses utilized for cabling.

736.12 STRAIN POLES. Furnish anchor base type strain poles for the attachment of support cables. Attach the support cable in accordance with 736.15. Poles shall be plumb within 6 inches at the top after support cable tensioning in accordance with the plans.

736.13 TIMBER POLES. Set poles in holes drilled by an auger to a minimum depth of 6 feet. Auger diameter shall be approximately 4 inches greater than the pole butt diameter. Embed the poles in the ground a minimum of 20 percent of the pole length. Ensure the poles are plumb within 6 inches at the top after support cable tensioning in accordance with the plans. Provide and compact backfill material as directed.

Fit holes for the attachment of support cables with 5/8-inch diameter thimble-eye through-bolts and 2¹/₂-inch square curved washers.

Provide each pole with a continuous length of No. 6 AWG copper wire along the length of the pole. Coil a minimum of 6 feet of the copper wire and attach to the bottom of the pole forming a coil ground. Extend the copper wire a minimum of 6 inches above the top of the pole. Staple the wire with galvanized 1¹/₂-inch staples at approximately 6-inch intervals beginning at the butt, then at approximately 12-inch intervals beginning at 12 feet from the butt and continuing to the top of the pole.

Install anchors on new poles in accordance with the plans.

736.14 GUY-WIRE ASSEMBLIES. Attach guy wire to the pole with a 5/8-inch diameter angle thimble-eye bolt of appropriate length through a lift plate fastened to the pole by two 3/8-inch diameter lag screws. The opposite side of the pole shall have a 2¹/₂-inch square curved washer, a square nut, and a thimble-eye nut for termination of support cable. Use an additional square nut as a locking nut against the thimble-eye nut.

Tighten hardware against the pole. Saw excess bolt length to within 1/4 inch of the nut and repair the galvanized coating in accordance with 811.08.

Provide the guy assembly with strain insulator, thimble eye anchor rod, service sleeves, and screw-type anchors as shown on the plans. Develop holding strength and properly align the installed anchors to provide permanent stability to the installation.

Install guy assemblies and tension before erection of signals so that they will resist the major portion of the horizontal loading.

736.15 SUPPORT CABLE. Install support cable with accessories between two or more poles to provide support and attachment for traffic

control equipment. Ground all support cables. Accessories used with support cables shall include three-bolt clamps and service sleeves. Use long strain insulators as needed for safety clearance, which must be approved by the engineer when not shown on the plans. Attach the support cable with standard thimble-type hardware.

736.16 VEHICLE AND PEDESTRIAN SIGNAL HEADS. Install signals vertically unless otherwise specified. Fit cable suspended heads with a universal hanger. Use drop pipes only when necessary to provide proper roadway clearance. Provide disconnect hangers for cable suspended heads.

Install mast arm mounted signals using an approved adjustable rigid bracket.

All signal heads on mast arms shall have a backplate conforming to 1020.01.6.

Each LED traffic signal lamp module in the signal head shall be connected to an individual wire from the controller.

Orient each signal head to its lane or crosswalk and secure in-place by a serrated or other locking device incorporated in signal housing and support hardware. Use supporting brackets on the top and bottom of the section assembly to rigidly support all faces. Close openings not used for mounting purposes with approved threaded weatherproof plugs.

Provide a minimum of 8 feet between signal heads, measured between imaginary lines centered on each signal head parallel to the approach. Aim the signal head within 3 degrees of parallel to the approach lane to which it applies, or as directed.

Cover vehicular signal heads with a sturdy opaque material until placed in service.

Provide a 12-inch light emitting diode (LED) traffic signal lamp unit as part of a new traffic signal head or as a retrofitted replacement into a new or existing signal housing.

If proper orientation of the LED traffic signal lamp unit is required for optimum performance, prominently and permanently display clear directional marking(s), such as an "UP arrow," for correct indexing and orientation on the unit.

Provide each LED traffic signal lamp unit with a complete and accurate installation wiring guide and the name, address, and telephone number for the representative, manufacturer, or distributor for warranty replacement.

736.17 VEHICLE LOOP DETECTOR INSTALLATION.

Saw slots in the pavement for installation of vehicle detector loop wire in the configuration, dimensions, and combinations shown on the plans. Cut an extension from the loop to the pavement edge to permit wire routing to an adjacent pullbox through a 1/2-inch conduit.

Clean slots of loose material. The engineer will examine and approve the depth of each loop slot for conformance with the plans before the contractor places the loop wires in the slot. Carefully place wires in the slot. The number of turns of wire installed for each loop shall be as required on the plans. Carefully push the wire into the slots with a blunt tool to avoid damaging the insulation. No splices will be permitted in the loop installation except in the pull-box, conduit fittings, or pole. Install wires from the pavement to the controller box inside a conduit as shown on the plans. Uniformly twist wire installed from the pavement edge to the splice at 2 to 5 turns per foot. Splice the loop ends to a lead-in cable. Connect the lead-in cable inside the controller cabinet. Splice the wires inside the junction box using an approved connector, then encapsulate with an approved electrical insulating waterproof epoxy as shown on the plans.

Completely fill the slots to within 1/8 inch of the pavement surface with an approved sealant in accordance with Table 1020-1.

736.18 VIDEO DETECTORS. Follow the manufacturer's installation instructions. Place the video detectors and video detection zones as shown on the plans. At the contractor's expense, the equipment manufacturer shall provide factory direct technical support to supervise and provide onsite assistance for the installation and testing of the video detectors for signal turn-ons. The contractor shall provide compatible computer equipment to set-up detection zones, if required, and shall repair any malfunction within 24 hours of notification by DOTD.

Placement of detection zones shall be by means of a graphical interface using the video image of the roadway. The monitor shall show images of the detection zones superimposed on the video image of traffic while the VDS processor is running.

Use the mouse or handheld programming device to draw detection zones on the monitor. The detection zones shall be capable of being sized, shaped and overlapped to provide optimal road coverage and detection. Save the detector configurations on disk to download detector configurations to the VDS processor unit and to retrieve the detector configuration that is currently running in the VDS processor unit.

Use the mouse or handheld programming device to edit previously defined detector configurations so as to fine-tune the detection zone placement size and shape. Once a detection configuration has been created, the system shall provide a graphic display of the new configuration on its monitor. While this fine-tuning is being done, continue operating the detection from the current detector configuration.

When a vehicle occupies a detection zone, the detection zone on the live video shall indicate the presence of the vehicle, thereby verifying proper operation of the detection system. With the absence of a video monitor, the card shall have an LED that will indicate proper operation of the detection zones.

Provide detection zones that are sensitive to the direction of vehicle travel. The direction to be detected by each detection zone shall be user programmable. Each detection zone shall be labeled with the corresponding movement and phasing information.

Program video cameras with IP addresses assigned by the Department.

736.19 LED PEDESTRIAN SIGNAL HEAD AND PUSHBUTTON.

Mount LED pedestrian signal and LED pedestrian countdown modules with the bottom of the signal housing, including brackets, no less than 7 feet or more than 10 feet above sidewalk level. Position and adjust each LED pedestrian countdown module to provide maximum visibility at the beginning of the controlled crosswalk.

Place pedestrian push buttons either on signal pedestals, or on side of mast arms, strain poles, and wood poles, or around whichever is applicable, at a minimum height of 42 inches from the top of sidewalk. The pedestrian push button shall be located adjacent to a level, all-weather surface to provide access from a wheelchair according to the requirements of the Americans with Disabilities Act (ADA).

Service push-buttons mounted on steel poles by wiring inside the poles. Install wires through a hole in the pole and through the back of housing through a rubber grommet. Plug unused conduit attachment holes. Attach the housing to the pole using stainless steel bolts or screws.

Install pedestrian pushbutton signs above the pushbutton.

736.20 ELECTRICAL. Neatly lace wires in cabinets into cables with nylon lacing or plastic straps.

Install conductors in conduit except where the run is inside poles or suspended from support cable.

After completion of field wiring, seal the conduit entering cabinets with a removable sealing material compatible with the cable jacket, insulation, and conduit material.

Mechanically and electrically secure and ground cabinet, support cable, metallic cable sheaths, transformer cases, metal poles, and pedestals. Bonding and grounding jumpers shall be No. 6 AWG solid copper wire. Ground all equipment on wood poles.

Cable from the circuit breaker at the service to the controller shall consist of a minimum of three No. 6 AWG THWN stranded copper wires.

Install 6 feet of spare signal, loop lead-in, and communication cable in each base-mounted cabinet. Connect field wiring to terminals by one piece, screw-tightened lugs.

Provide aerial signal cable with a drip loop extending at least 6 inches below the entrance. Do not allow the aerial signal cable and drip loop to chafe on the equipment.

Install signal cable between signal heads and controller cabinets. When specified, install interconnect and/or communication cable between controller cabinets of different intersections. Lash signal, interconnect, and/or communication cable to support cable or install in underground conduit as shown on the plans. Use stainless steel lashing material for interconnect and aluminum lashing material for signal cable.

736.21 CONDUIT INSTALLATION. Enclose underground wiring in flexible conduit.

Enclose all above ground wiring in rigid conduit. Cut threads clean, straight, and true, and of sufficient length to permit full-depth coupling. Excessive threads will not be permitted. Thread, ream, and cap ends of conduit installed for future connections. Tighten couplings until the conduit ends are together. Repair damaged coatings in exposed threads in accordance with 811.08.1. Terminate exposed threaded ends of conduit with an insulated-throat, ground-type bushing.

Backfill with select soils conforming to 701.08.1, place, and compact to at least the density of the surrounding ground at no cost to the Department. After installation, test conduits for clearance with a 2 inches long mandrel having a diameter 1/4-inch smaller than the inside diameter of the conduit if directed by the engineer. Conduits not allowing passage of the mandrel will be rejected.

The contractor may install a larger size conduit at no cost to the Department. No reducing couplings will be permitted in a conduit run.

Bury underground conduits a minimum of 24 inches below the surface. Install conduits for loop detectors parallel to existing or proposed curbs and a maximum of 24 inches behind the back of curb, or as directed. Jack or bore conduit under existing pavements and within the drip line of trees in accordance with Section 728.

736.22 CONTROL EQUIPMENT. Neatly arrange field wiring in controller cabinets and bases, lash into cables, route to the appropriate terminal blocks and permanently identify near the terminal.

Label all signal, pedestrian, loop, and video detectors with a waterproof labeling tape showing approach, direction, and phase assignment.

Provide controller equipment programming. When the information supplied by the Department is insufficient for functional operation of the installed equipment, notify the engineer in writing of the problem identifying discrepancies and proposing specific remedies or corrections. After programming, test the controller equipment operations with the signals off, using the signal shutdown switch.

736.23 JUNCTION BOXES. The maximum distance for traffic junction boxes is 500 feet and 1000 feet for communication junction boxes. Backfill trench with selected soils conforming to 701.08.1, place, and compact to the density of the surrounding ground at no cost to the Department.

Install electrical conductors clear of the top of the junction box.

736.24 LED BLANK OUT SIGN. Follow the manufacturer's installation instructions and the plans for placement location.

736.25 CABINET/CONTROLLER TESTING. When design tests are specified herein, additional tests will not be required if documentation is provided indicating that such tests have been previously completed. Equipment shall be subject to factory demonstration tests and design approval tests at a location agreed upon by the contractor and the Department. The Department reserves the right to have its representative witness all factory demonstration tests and design approval tests.

Performance tests may be required on equipment not previously tested or approved. The Department will not be responsible for time lost or delays caused by sampling and testing prior to final approval of any item.

Conduct special tests when equipment or systems are suspected of improper operation, or when additional data is necessary to determine proper operation or conformance with specifications.

Perform a test on the completely assembled equipment, cabinet, and control equipment by the manufacturer prior to shipment. Correct malfunctions or defects and retest the equipment. The complete log, beginning with the first test and showing the results of the test, shall be delivered with the equipment. The test shall require the operation of the equipment with each signal circuit connected to an incandescent load of a minimum of 600 watts. The equipment shall operate sequentially and continuously for a minimum of 48 hours as stated above in an environment having a minimum temperature of 140°F.

736.26 TEMPORARY TRAFFIC SIGNAL INSTALLATION. Furnish, install, maintain, and remove a temporary traffic signal installation as shown on the plans, including but not limited to controllers, temporary signal heads, interconnect, vehicle detectors, and signing. Temporary signal equipment may be used equipment in good working condition.

736.26.1 Controllers: Only controllers meeting the Department's latest controller specification will be approved for use at temporary signal locations.

All control equipment for the temporary traffic signal(s) shall be furnished by the contractor unless otherwise stated on the plans.

A prefabricated cabinet foundation may be allowed with prior approval.

736.26.2 Traffic Signal Heads: All traffic signal sections shall contain 12 inches LED lamp modules. Place the temporary traffic signal heads as indicated on the temporary traffic signal plan or as directed by the engineer. Furnish enough extra cable length to relocate heads to any position on the span wire or at locations illustrated on the plans for construction staging. The temporary traffic signal shall remain in operation during all signal head relocations.

736.26.3 Interconnect: Provide temporary traffic signal interconnect if specified on the plans. The contractor may request, in writing, to substitute a wired interconnect indicated in the contract documents with a secured wireless interconnect at no cost to the Department. Provide a radio device that will operate properly at all times and during all construction staging. If approved for use by the engineer, submit marked-up traffic signal plans indicating locations of radios and antennas and installation details. If using a wireless interconnect that proves unviable in the opinion of the engineer, or if the interconnect fails during testing or operations, the contractor shall be responsible for installing all necessary poles, wired interconnect, and

other infrastructure for providing temporary interconnect at no cost to the Department.

The existing system interconnects and phone lines are to be maintained as part of the Temporary Traffic Signal Installation specified for on the plans. Install interconnects into the temporary controller cabinet according to the notes or details on the plans. All labor and equipment required to install and maintain the existing interconnect as part of the Temporary Traffic Signal Installation shall be included in the item Temporary Traffic Signal Installation. When shown in the plans, temporary traffic signal interconnect equipment shall be furnished and installed. The temporary traffic signal interconnect shall maintain interconnect communications throughout the entire signal system for the duration of the project.

736.26.4 Vehicle Detection: All temporary traffic signal installations shall have vehicular detection installed as shown on the plans or as directed by the engineer.

736.26.5 Signs: Remove all existing street name and intersection regulatory signs from existing poles and relocate to the temporary signal span wire. If new mast arm assembly, poles, and posts are specified for the permanent signals, relocate the signs to the new equipment at no cost to the Department.

736.26.6 Energy Charges: The electrical utility energy charges for the operation of the temporary traffic signal installation shall be paid by the contractor.

736.27 MEASUREMENT.

736.27.1 Trenching and Backfilling: Trenching and backfilling will be measured by the linear foot of excavated trench backfilled and accepted. The conduit will be paid under a separate pay item. Repair trenching through asphalt pavement in accordance with Section 510 and through portland cement concrete pavement as directed at no cost to the Department.

736.27.2 Jacking or Boring: A jack or bore will be measured by the linear foot. Measurement will include the jacking or boring of conduit. The conduit will be paid under a separate pay item.

736.27.3 Signal Pole (Mast Arm, Strain, and Pedestal): Signal poles will be measured per each installed and accepted. Measurement will include the pole, mast arm, base assembly, and anchor bolts.

736.27.4 Pole Foundation: Pole foundation will be measured per each and will include concrete foundation, reinforcing steel, conduits in foundation, ground rod, ground wires, ground clamp, hardware, drilled

excavation, backfill, grout, electrical oxide-inhibiting compound, and disposal of excess excavated material.

736.27.5 Signal Heads: Signal heads will be measured per each head installed and/or retrofitted, and accepted. Measurement will include disconnect hangers, backplates, visors, mounting hardware, LED traffic signal lamp units, head programming, mounting connections, and hardware.

736.27.6 Signal Service:

Signal service will be measured per each installed and accepted. Measurement will include disconnect, ground rod, wire, and conduit on service pole, conduit and conductors on utility company pole, and connections and hardware required.

736.27.7 Temporary Traffic Signal Installation: Temporary traffic signal will be measured per each intersection. The contractor shall retain ownership of this equipment after removal. This item will include modifications required for traffic staging, changes in signal phasing as required in the plans, all items for a complete temporary signalized intersection including but not limited to controller, poles, temporary signal heads, microwave vehicle sensors, video vehicle detection system, any maintenance, or adjustment to the microwave vehicle sensors/video vehicle detection system, interconnect equipment, signing, and any miscellaneous equipment for a fully functioning temporary traffic signal intersection. Installation and removal will also be included.

736.27.8 Signal Controller:

736.27.8.1 Contractor Furnish and Install:

1. Signal Controller and Cabinet: Signal controllers will be measured per each controller installed and accepted. Measurement will include all electronic control equipment specified, prewired cabinet, foundation, conduits in foundation, ground rod assembly, anchor bolts and hardware, connections, documentation, programming, and testing.

2. Signal Controller Only: Signal controllers will be measured per each controller furnished and installed by the contractor. Measurement will include all electronic control equipment specified, hardware, connections, documentation, programming, and testing.

736.27.8.2 Department Furnish and Contractor Install: Upon request from the contractor, the Project Engineer will request DOTD Traffic Operations Section to order equipment. DOTD will require approximately 90 calendar days to receive items ordered. The contractor shall be responsible for any inspection and testing of DOTD provided equipment before acceptance. The contractor shall schedule with DOTD Traffic Operations Section, 7686 Tom Drive, Baton Rouge, LA at 225-935-0111 a

minimum of five working days in advance to inspect and test equipment before acceptance. Written acceptance of equipment by the contractor is considered verification that the equipment is in complete working order and the contractor has taken full responsibility for the equipment.

1. Signal Controller and Cabinet: DOTD furnished signal controllers and cabinet will be measured per each controller and cabinet installed, and accepted. Measurement will include pickup of the DOTD Signal Controller and Cabinet from the DOTD Traffic Operations Section, all testing of equipment prior to acceptance, and installation of the provided controller and prewired cabinet with anchor bolts. The contractor shall also furnish and install any required foundation, conduits in foundation, ground rod assembly, hardware, connections, documentation, programming, and testing.

2. Signal Controller: DOTD furnished signal controllers will be measured per each controller installed and accepted. Measurement will include pickup of the DOTD provided controller from the DOTD Traffic Operations Section, all testing of equipment prior to acceptance and installation of the provided controller. The contractor shall furnish and install any required hardware, connections, documentation, and programming.

736.27.9 Loop Detector: Detectors will be measured by the linear foot of sawn slot. Measurement will include sawing, installed wire wraps, wire to junction box and sealing. Measurement will be made from the edge of the pavement and once around each loop perimeter.

736.27.10 Video Detection: Video Detection Cabinet Components, will be measured per each and includes Bus Interface Unit (BIU), VDS processor(s) (housed in camera or cabinet), all required materials, tools, equipment, labor, and incidentals as described above, cables, cabinet and communication interface devices, programming, communications software, and other associated equipment such as power supply, a mouse, and a 5 inch to 9 inch video monitor with compatible hardware and cables required for proper operation of the system.

Video Detection Cameras will be measured per each and includes all required materials, tools, equipment, labor and incidentals required to install each video camera. VDS processor will be housed in camera or cabinet, and be fully functioning, per each as indicated on the plans.

Video Camera Cable will be measured per linear foot of cable installed and accepted.

736.27.11 LED Pedestrian Signal Head and Push Button: LED Pedestrian Signal Head and LED Pedestrian Countdown Signal Head will be

measured per each and include the following components: single section housing, hinged door, z-crate visor, LED module, and required mounting hardware to form a complete assembly.

Pedestrian Push Buttons will be measured per each and includes the following components: housing, plunger, switch, electrical components, and mounting assemblies.

736.27.12 Underground Junction Box: Underground junction boxes will be measured per each box installed and accepted. Measurement will include the box, cover, excavation, backfill, and any concrete patching required.

736.27.13 LED Blank-Out Sign: The LED Blank-Out Sign will be measured per each, and shall include the enclosure, LED module, visor, span wire or mast arm mounting assembly, and all materials, tools, equipment, labor, and incidentals required for completion of the work.

736.27.14 Flashing Switch Assembly for Beacons: The Flashing Switch for Beacons, including cabinet, mounting, labor, and all incidental items for a fully functioning flashing switch, will be measured per each for payment by the actual number of units installed, tested, and accepted.

736.27.15 Conduit: Conduit will be measured by the linear foot point to point of conduit installed and accepted. Measurement will include conduit (including conduit within junction boxes), clamps, fittings, above ground junction boxes, and all miscellaneous hardware required for a complete conduit installation.

736.27.16 Conductors: Conductors will be measured by the linear foot of conductor installed and accepted. Measurement will include conductor, clamps, connectors, and all miscellaneous hardware required for a complete conductor installation.

736.27.17 Support Cable (Span): Cable will be measured by the linear foot installed and accepted. Measurement will include cable, clamps, connectors, long insulators, wrapping conductors, and all miscellaneous hardware required for a complete cable installation.

736.27.18 Guy Cable: Guy Cable will be measured by the linear foot of cable installed and accepted. Measurement will include cable, clamps, connectors, anchors, insulators, and all miscellaneous hardware required for a complete cable installation.

736.28 PAYMENT. Payment for traffic signal work will be made at the contract unit prices, which includes all materials, tools, equipment, labor, and incidentals necessary to complete the work.

The concrete in foundations for signal poles, signal controllers, and other signal equipment will be identified by lots and shall be subject to pay adjustments for Class S concrete in accordance with Table 901-4 and Note 1 therein. Size, sampling, and testing of each concrete lot shall be in accordance with the Materials Sampling Manual.

Payment will be made under:

Item No.	Pay Item	Pay Unit
736-01	Trenching and Backfilling	Linear Foot
736-02	Conduit with Conductors (Size & Type)	Linear Foot
736-03	Jacking or Boring for Conduit (Size & Type)	Linear Foot
736-04	Signal Pole (Size & Type)	Each
736-05	Signal Heads (Type)	Each
736-06	Signal Service	Each
736-07	Traffic Signal System	Lump Sum
736-08	Signal Controller	Each
736-09	Loop Detector	Linear Foot
736-10	Underground Junction Box	Each
736-11	Conduit (Size & Type)	Linear Foot
736-12	Conductor (Size & Type)	Linear Foot
736-13	Cable (Size & Type)	Linear Foot
736-14	Signal Support (Pedestal Foundation Only)	Each
736-15	Signal Support (Strain pole/Mast Arm)	Each
736-16	Temporary Traffic Signal Installation (Intersection)	Each
736-17	Video Detection Cabinet Components	Each
736-18	Video Detection Camera	Each
736-19	Video Camera Cable	Linear Foot
736-20	Video Detection Training	Lump Sum
736-21	LED Pedestrian Countdown Signal Head	Each
736-22	Pedestrian Push Button	Each
736-23	LED Blank Out Sign	Each
736-24	Flashing Switch Assembly For Beacons	Each
736-25	Support Cable (Span)	Linear Foot
736-26	Guy Cable	Linear Foot

Section 737

Painted Traffic Striping

737.01 DESCRIPTION. Furnish and apply reflective white or yellow paint for pavement striping in accordance with plan details, the MUTCD, and these specifications.

737.02 MATERIALS. Traffic paint shall be waterborne and comply with 1015.12. Glass beads for drop-on application shall comply with 1015.13.

737.03 EQUIPMENT. Selection of proper equipment to produce satisfactory results shall be the responsibility of the contractor.

737.04 CONSTRUCTION REQUIREMENTS. Pavement striping shall be 4 inches in width on all routes. Striping widths for gore markings and turning lanes shall be 8 inches unless noted otherwise on the plans. All lines shall have clean edges.

Paint for curbs and islands may be applied by machine or hand methods as accepted by the engineer. Apply all striping on pavement prior to opening to traffic, except when rain or other unavoidable occurrences prevent marking the pavement, in which case mark the pavement as soon as conditions permit. The requirements of 713.07 shall govern over the above mentioned application requirements.

737.04.1 Surface Preparation: Clean surfaces, including ramps and gore areas, to be striped of materials that may reduce adhesion of paint to pavement. Remove all flaking or peeling material to the satisfaction of the engineer by blast cleaning or other approved methods, which do not damage the surface. Blast cleaning equipment must have positive cutoff controls. Keep surfaces clean and dry at the time of paint application.

737.04.2 Weather Limitations: Do not paint striping when pavement surface is wet or damp, when air is foggy or misty, when air or surface temperature is below 50°F, or when wind or other conditions create a dust film on the clean pavement surface before striping can be applied or causes displacement of striping material.

737.04.3 Application: Use the longitudinal joint or existing centerline stripe to determine the location of the centerline of new striping. In the

absence of a longitudinal joint or existing stripe, locate the centerline of new striping with the acceptance of the engineer.

737.04.4 Application Rate: Apply paint at a thickness of 22 wet mils to produce a line of 15 dry mils. Apply temporary paint at a thickness of 15 wet mils. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night.

737.04.5 Tolerances: Construct broken lines with a stripe-to-gap ratio of a 10-foot paint stripe to a 30-foot gap. The length of the stripe shall be 10 feet minimum and 10¹/₂ feet maximum. The stripe-gap cycle shall be 40 feet minimum and 40 ¹/₂ feet maximum.

A tolerance of +1/2 inch and -1/8 inch from the specified painted line width will be allowed, provided the variation is gradual. Segments of broken line may vary ± 6 inches from the specified length provided it is not consistently short. Square off painted line segments at each end without mist or drip. Longitudinal painted lines shall not deviate from established alignment by more than 1 inch. The rate of deviation shall not increase or decrease more than 1/2 inch in 25 feet. Remove lines not meeting these tolerances by abrasive blasting or grinding and replace at no cost to the Department. The Project Engineer may waive the tolerance when deviations are caused by undulation in the pavement surface.

737.04.6 Protection of Markings: Do not allow traffic to cross over a wet stripe. Use flaggers or other methods to prevent traffic from crossing the wet stripe or adjust the operation. Repair stripes that have been marred or picked up by traffic before they have dried; clean the pavement outside the stripe at no cost to the Department. The contractor shall be responsible for resolving all issues related to paint on private vehicles at no cost to the Department.

737.04.7 Field Testing of Painted Traffic Striping: Field-test the pavement markings in accordance with 1015.12 and Table 737-1. Replace the portion of the material shown to be out of specifications as directed by the engineer.

Take initial readings within 30 days of application. Any late readings submitted after the 30 days will be considered initial readings. Take the initial retroreflectivity readings with a DOTD inspector present during testing. Upon completion of the testing, the DOTD inspector will immediately take possession of a copy of the retroreflectivity readings in either a hard copy, 8¹/₂ inch x 11 inch, or electronic format on a USB drive and as noted below. Additionally, provide documentation to the Department that the instrument has been calibrated in accordance with the

manufacturer's requirements, including the required annual factory calibration.

For each material type, take a different set of readings in accordance with Table 737-1. Provide the data to the Department electronically in Microsoft Excel® (xls) format downloaded from the reflectometer data. Each spreadsheet shall have a header that states all of the following:

1. Project number;
2. Date material installed;
3. Type of material installed;
4. Interstate: Specify the route and direction and show the beginning mile-point to ending mile-point of material installed.
5. State Route: Specify the route and direction. Also specify X number mile from intersection to X number mile from intersection, of material installed. (e.g. Route US 61 South; 0.10 Mile South of Old Hammond Highway to 0.2 Mile South of I-12.)

The format for the excel spreadsheet shall be (description, date, and reading). In the description cell the format shall be Route (*i.e.*, LA, US, or I), Direction (*i.e.*, N, S, E, or W), Mile Point and Color (W or Y).

Examples:

LA 115; W; 23; Y.

I-10; S; 4; W.

**Table 737-1
Field Testing of Painted Pavement Markings**

Length of Roadway (Segment)	Minimum Required Readings
Less than 1 mi	10 evenly spaced readings per line ^{a, c}
1 to 6 mi	10 evenly spaced readings per line for each 1 mi segment ^{a, c}
>6 mi	5 evenly spaced readings per line for each 1 mi segment ^{b, c}
Stop Bars, Cross Walks, Chevrons, Hash Marks, Legends and Symbols	Visual nighttime inspection only
8 inch Lines (Parallel to Roadway)	5 readings per line ^{b, c, d}
^a Report average of 10 readings per line segment. ^b Report average of 5 readings per line segment. ^c Additional readings shall be taken if deemed necessary by the engineer. ^d Only initial readings are required.	

General Notes:

1. Take readings on each line and color separately except as indicated below.
2. Adjacent lines applied at the same time are considered one line. Alternate readings between each line.
3. Take readings on dry, clean roadways.
4. Collect data in the direction lines were applied except for yellow centerlines on two lane roadways. For yellow centerlines on two lane roadways, collect data against the direction lines were applied.
5. On broken lines (skip striping), no more than two readings shall be taken per stripe, with readings 20 inches from ends of marking. If using a vehicle mounted mobile unit this does not apply.
6. Acceptance will be based on the average of each set of readings for each line segment.
7. Failure of the average reading for any segment to meet the specified minimum values will require replacement, corrective action or be subject to payment adjustments specified in Table 737-2.
8. Limits of replacement will be determined by the engineer.
9. Aggregate Surface Course projects will not be tested for retroreflectivity, but will be visually inspected at night for acceptance by the engineer.
10. Glass beads shall be uniformly distributed to ensure that the full width of the line is visible at night.

737.05 GUARANTEE. All work performed in accordance with this section shall be guaranteed in accordance with 104.05.

737.06 MEASUREMENT.

737.06.1 Painted Traffic Striping: Painted traffic striping will be measured by the linear foot or mile, as specified. When a bid item is not included for wider markings, the Department will measure the quantity by

converting the actual length and width of lines installed to an equivalent length of the normal width line on that section of roadway.

1. Linear Foot: Measurement will be made by the linear foot of striping, exclusive of gaps.

2. Mile: Measurement will be made by the mile of single stripe. No deduction will be made for standard broken-line gaps; however, deductions will be made for the length of other gaps or omitted sections.

737.06.2 Pavement Legends and Symbols: Legends and symbols will be measured per each legend or symbol. Each symbol includes all letters, lines, bars, or markings necessary to convey the message at each location.

737.07 PAYMENT. Payment for painted traffic striping, legends, and symbols will be made at the contract unit prices.

**Table 737-2
Payment Adjustment for Initial Retroreflectivity**

Contract Unit Price ¹ , %	Retroreflectivity Number (Painted Markings)	
	White (mcd\lux\sq m)	Yellow (mcd\lux\sq m)
100	250	175
90	230	165
80	220	155
50 or Restripe	200	150

¹ The payment requirements are based on the project total average of all test segments for initial reading in accordance with Table 737-1.

Payment will be made under:

Item No.	Pay Item	Pay Unit
737-01	Painted Traffic Striping (Solid Line)	Mile
737-02	Painted Traffic Striping (Broken Line)	Mile
737-03	Painted Traffic Striping (Solid Line)	Linear Foot
737-04	Pavement Legends and Symbols	Each

Section 738 Mulch Sodding

738.01 DESCRIPTION. Furnish, haul, spread, roll, water, and maintain live grass roots with topsoil at locations shown on the plans or as directed. Fertilize and lime (if required).

738.02 MATERIALS. Mulch sod shall consist of a combination of grass roots and topsoil. Mulch sod shall be predominately bermuda grass or other approved grass roots reasonably free of weeds and debris.

Topsoil shall comply with 715.02.

Fertilizer and agricultural lime shall comply with Section 718.

Obtain water from any source except do not use brackish, chemically contaminated, or oily water.

738.03 EQUIPMENT. Use a single or double type soil roller or culti-packer weighing not less than 500 pounds and not more than 1500 pounds.

Water wagons, tanks, or sprinkling devices will be required.

738.04 CONSTRUCTION REQUIREMENTS.

738.04.1 Preparation: Mow and rake the source of mulch sod approved by the Roadside Development Coordinator when necessary. Do not stockpile mulch sod for more than 48 hours.

738.04.2 Digging and Hauling: Mulch sod shall be free of tree roots, branches, or other debris. Remove such foreign material prior to the sod being stockpiled or delivered. Depth of removal shall be as specified or as directed but not to exceed 12 inches.

Dig and load mulch sod with suitable equipment, and haul to the areas designated and spread to the depth shown on the plans or as directed.

738.04.3 Surface Preparation: Broadcast fertilizer over the entire area to be mulch sodded before mulch sod is placed and disked. When required, furnish and place agricultural lime in accordance with Section 718 to the area to be mulch sodded prior to scarifying. Scarify and pulverize areas to receive mulch sod to a depth of approximately 3 inches and dress to grade at no direct pay.

738.04.4 Spreading: Spread the mulch sod to a depth of approximately 6 inches with a minimum amount of root exposure. Do not

use spike tooth harrows or drags to spread mulch sod. Dress the mulch sod to grade.

738.04.5 Seeding: Apply seed over mulch sodded area as directed and in accordance with Section 717.

738.04.6 Rolling: Roll the mulch sod with a culti-packer or soil roller as directed. Hand-tamp locations inaccessible to rolling equipment.

738.04.7 Watering: Water mulch sod and keep moist until satisfactory growth is established at no direct pay.

738.05 MEASUREMENT. Mulch sod will be measured by the cubic yard in approved hauling vehicles at the point of delivery in accordance with 109.01.

Fertilizer will be measured and paid for in accordance with Section 718. Agricultural lime, when specified, will be measured and paid for in accordance with Section 718.

738.06 PAYMENT. Payment for mulch sodding will be made at the contract unit price per cubic yard, which includes all labor, materials, equipment and incidentals necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
738-01	Mulch Sodding (Vehicle Measurement)	Cubic Yard

Section 739 Hydro-Seeding

739.01 DESCRIPTION. Prepare seed beds and sow grass seed utilizing hydro-seeding equipment and methods in order to establish a turf grass cover to areas designated on the plans or as directed.

739.02 BED PREPARATION. Prepare seed beds in accordance with 717.04.

739.03 HYDRO-SEEDING GENERAL. Hydro-seeding consists of mixing and applying seed, commercial fertilizer, lime, polyacrylamide tackifier, and mycorrhizal inoculum with paper or wood fiber and water. Uniformly spread seed and commercial fertilizer over the area at the rates specified in Table 717-1 and Table 718-1. Mix and apply paper or wood fiber with the seed in accordance with the manufacturer's recommendations and as approved by the engineer. Fertilizer and lime may be included in the seeding slurry for application during hydro-seeding operations. All of these materials may be included in a single manufacturer's hydro-seeding system. Use Approved Materials List systems.

Determine the application rate for pellet-inoculated seed by using the seed mass exclusive of inoculant materials.

Mix the materials with water according to the manufacturer's specifications. Mix the materials in a tank with a built-in continuous agitation system with sufficient operating capacity to produce a homogeneous mixture, and with a discharge system that will apply the mixture at a continuous and uniform rate. Provide a tank with a minimum capacity of 962 gallons. The engineer may authorize use of equipment of smaller capacity if it is demonstrated that the equipment is capable of performing all operations satisfactorily.

A dispersing agent may be added to the mixture provided evidence is furnished showing that the additive will not affect germination. Do not use any material considered detrimental, as determined by the engineer.

Do not apply any mixture containing polyacrylamide tackifier during rainy weather, or when soil temperatures are below 41°F, or if the wind speed is above 20 miles per hour. Do not permit pedestrian traffic or equipment to enter areas where hydro-seeding has been applied.

Prior to planting, the engineer will contact the Department's Roadside Development Coordinator to select the varieties of seed to be used.

739.04 MEASUREMENT. Quantities for hydro-seeding will be measured by the acre.

739.05 PAYMENT. Payment for hydro-seeding will be made at the contract unit price per acre and shall include the seed, mulch, tackifier, lime, fertilizer, water and bed preparation as a system and all labor and equipment necessary to complete the work.

Payment will be made under:

Item No.	Pay Item	Pay Unit
739-01	Hydro-Seeding	Acre

Section 740

Construction Layout

740.01 DESCRIPTION. This section sets forth requirements for all construction layouts. Establish lines and grades, take all cross-sections, and stake out the construction work in accordance with these specifications, plan details, and as directed. Construction layout also includes, but is not limited to, the layout of pavement striping and raised pavement markers, setting of line and grade for construction of superelevated curves or other applicable work items, and assisting in the coordination of utility relocation activities to ensure that the placement of relocated facilities will not conflict with required construction.

740.02 CONSTRUCTION REQUIREMENTS. Establish all lines and grades and stake out all project work, including sufficient vertical and horizontal control points for utility relocations for use by the Department and others.

The project survey control and horizontal alignment are based on the Louisiana State Plane Coordinate System. The construction plans and/or right-of-way map depicts the coordinates and datum of sufficient survey control points to establish or re-establish horizontal control throughout the length of the project. Employ such methods as approved by the project engineer for the location of the project alignment and other necessary survey control points in accordance with currently acceptable surveying standards and practices. When required, the Department will also provide one bench mark on or near the project for vertical control. Verify the values of any intermediate bench marks shown on the plans, by checking against the bench mark established by the Department for vertical control.

Employ qualified engineering and surveying personnel experienced in layout and construction of highways and bridges to correctly establish and keep complete and comprehensive records (field books or approved electronic files) of all lines and grades necessary from initial layout to final acceptance. Provide sufficient qualified staff, of at least one employee, on site during utility relocation periods. Provide any necessary survey work to ensure there are no utility conflicts with required construction. Provide daily documentation of utility relocation activities for incorporation into the project diaries.

The contractor shall be liable for the accuracy of the initial layout and all subsequent alignment and elevations and shall, at no additional pay, rebuild,

repair or make good any portion of the work found to be incorrectly positioned either horizontally or vertically at any time before final acceptance. Notify the engineer immediately of any apparent errors in the plans. Compute and provide template grades to the engineer. In order to obtain pipe order lengths, provide the appropriate grades to the engineer two weeks in advance of the work.

Numbered notebooks for recording of all lines and grades will be provided by the Department and shall be properly indexed and cross referenced by the contractor before return to the engineer for submittal with the final estimate. Computer generated printouts will be allowed when approved.

Set stationing for overlay projects using an approved measuring device that is accurate to 0.1 percent. Place stakes every 100 linear feet and maintain throughout construction.

For pavement preservation type projects, the contractor will be responsible for recording the location of all existing pavement markings and laying out the required final markings subject to the approval of the Project Engineer.

Perform the layout of striping, raised pavement markers, and signs by methods approved by the engineer prior to placement.

740.03 MEASUREMENT.

Measurements for determination of pay quantities will be made by the Department. Construction layout and utility oversight and coordination will be measured per lump sum, which will include all labor, materials, tools, equipment, and incidentals required to complete the work.

No changes in the lump sum contract price will be made for minor additions or deletions to the scope of work.

740.04 PAYMENT.

Payment for construction layout, and utility oversight and coordination will be made at the contract lump sum price in accordance with Table 740-1 and Table 740-2, respectively.

**Table 740-1
Construction Layout Payment Schedule**

Percent of Total Contract Amount Earned	Allowable Percent of Lump Sum Price for Construction Layout
Staffed	25
25	50
50	80
75	95
100	100

**Table 740-2
Utility Oversight and Coordination Payment Schedule**

Percent of Utility Relocation Complete	Allowable Percent of Lump Sum Price for Construction Layout
Staffed	25
25	50
50	65
75	80
100	85
Project Completion	100

Payment will be made under:

Item No.	Pay Item	Pay Unit
740-01	Construction Layout	Lump Sum
740-02	Utility Oversight and Coordination	Lump Sum

Section 741
Water Distribution Systems
(Supplemental Specification)
(Under Separate Cover)

Section 742
Sanitary Sewer Systems
(Supplemental Specification)
(Under Separate Cover)

Section 743
Airport Pavement Markings
(Supplemental Specification)
(Under Separate Cover)

**Section 744
Traffic Control Devices**

**(Supplemental Specification)
(Under Separate Cover)**