

ADDENDUM NO. ONE (1)
CITY OF HOSCHTON
2024 LMIG ROADWAY IMPROVEMENTS
RFP #2024-05
EMI PROJECT NUMBER 21-009
ISSUED MAY 22, 2024

The following items of the RFP are modified as part of this Addendum:

➤ Section IV. Specifications

Relevant sections of the Georgia Department of Transportation Standard and Supplemental Specifications are now included for convenience in Appendix A.

➤ Section VIII. Material, Cost, Hours, and Price – Bid Schedule

The Bid Schedule has been revised as follows:

1. Reduced quantity of thermoplastic center double yellow and edge white striping/Added quantities for white and yellow wet striping with glass beads – Wet striping with glass beads is required along the south end of West Broad Street where seal coating will be applied. Pressurized and gravity applied systems are allowed.
2. Updated 24-inch stop bar quantity – Added stop bars along West Broad Street at the intersection with Mulberry Street.

The revised Bid Schedule and updated Plan Sheet C1 are attached.

Clarifications

The project completion timeframe on the Advertisement to Bid was incorrect. Time of completion for all work associated with this project shall be **forty-five (45)** consecutive calendar days from Notice to Proceed.

The following are clarifications based on questions received.

1. **Regarding the stop bar removal on Mulberry Street on the northbound side, will the stop bar be re-applied or just removed and then coated underneath where the old stop bar striping was located?**

Response: The existing stop bar extends across both lanes. The stop bar on the southbound side of the street will remain in place. The portion of the stop bar on the northbound side will be removed and the area previously under the stop bar will be seal coated.

2. **With the 24hr time frame to stay off the sealcoat what did the City have in mind for the residents that will have to be able to access their home?**

Response: The contractor will need to seal coat one lane at a time in stages, as necessary, to provide temporary on street parking for residents. Traffic control and property owner coordination will be required. Additives can be submitted for review along with the seal coat submittal.

END OF ADDENDUM NO.1

Receipt of Addendum 1 is hereby acknowledged by: _____

Company Name: _____

VIII. MATERIAL COST, HOURS, AND PRICE

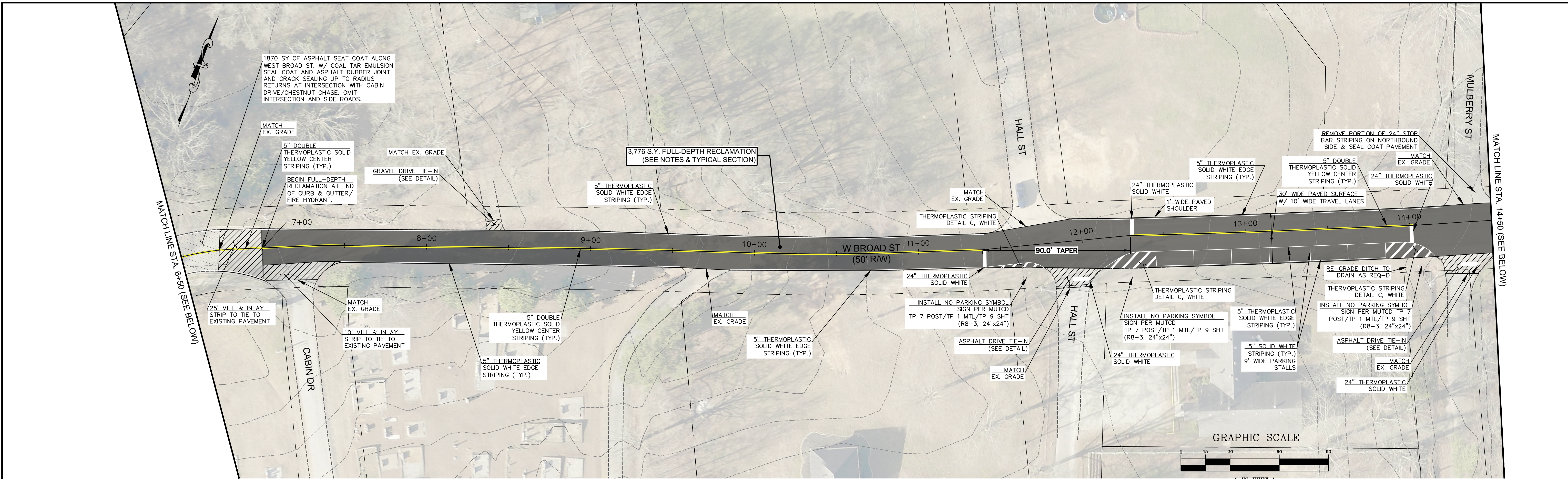
BID SCHEDULE						
LINE NO.	GDOT ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT AMOUNT	AMOUNT
0010	150-1000	Traffic Control	1	LS		
0015	210-0100	Grading Complete	1	LS		
0020	301-2160	Soil-Cem Stab Base Crs, 8 in	3776	SY		
0025	301-5000	Portland Cement	104	TN		
0030	402-3103	Recycled Asphaltic Concrete 9.5 mm Superpave, Type II, GP 2 Only, Incl Bitum Matl & H Lime	326	TN		
0035	402-3190	Recycled Asphaltic Concrete 19 mm Superpave, GP 1 or 2, Incl Bitum Matl & H Lime	415	TN		
0040	407-0000	Coal Tar Emulsion Seal Coat	1870	SY		
0045	407-0020	Asphalt-Rubber Joint and Crack Seal, Type "S"	150	LF		
0050	413-0750	Tack Coat	618	GAL		
0055	432-0206	Mill Asphaltic Concrete Pavement, 1-1/2 in Depth	170	SY		
0060	441-0600	Concrete Headwall, 30-inch	1	EA		
0065	550-5240	Storm Drain Pipe, 24-inch, Class III	48	LF		
0070	603-2180	Stone Dumped Rip Rap, Type 3, 12-inch	46	SY		
0075	603-7000	Plastic Filter Fabric	46	SY		
0080	611-5551	Reset Street Signs	10	EA		
0085	636-0000	No Parking Street Signs	4	EA		
0090	652-5451	Solid Traffic Stripe, 5-inch White	835	LF		
0095	652-5451	Solid Traffic Stripe, 5-inch White, Incl Beads	1190	LF		
0100	652-5452	Solid Traffic Stripe, 5-inch Yellow, Incl Beads	1190	LF		
0105	652-5701	Solid Traffic Stripe, 24-inch White, Incl Beads	32	LF		
0110	653-1501	Thermoplastic Solid Traffic Stripe, 5-inch White	2150	LF		
0115	653-1502	Thermoplastic Solid Traffic Stripe, 5 in, Yellow	2290	LF		
0120	653-1704	Thermoplastic Solid Traffic Stripe, 24 in, White	53	LF		
0125	653-6004	Thermoplastic Traffic Striping, White	116	SY		
0130	668-2100	Drop Inlet, GP 1	1	EA		
0135	716-0000	Miscellaneous Erosion Control (Silt Fencing, Grassing, Mulching, Slope Stability Matting, Etc.)	1	LS		
BASE BID TOTAL:						

TOTAL PRICE OF PROJECT NOT TO EXCEED: \$ _____

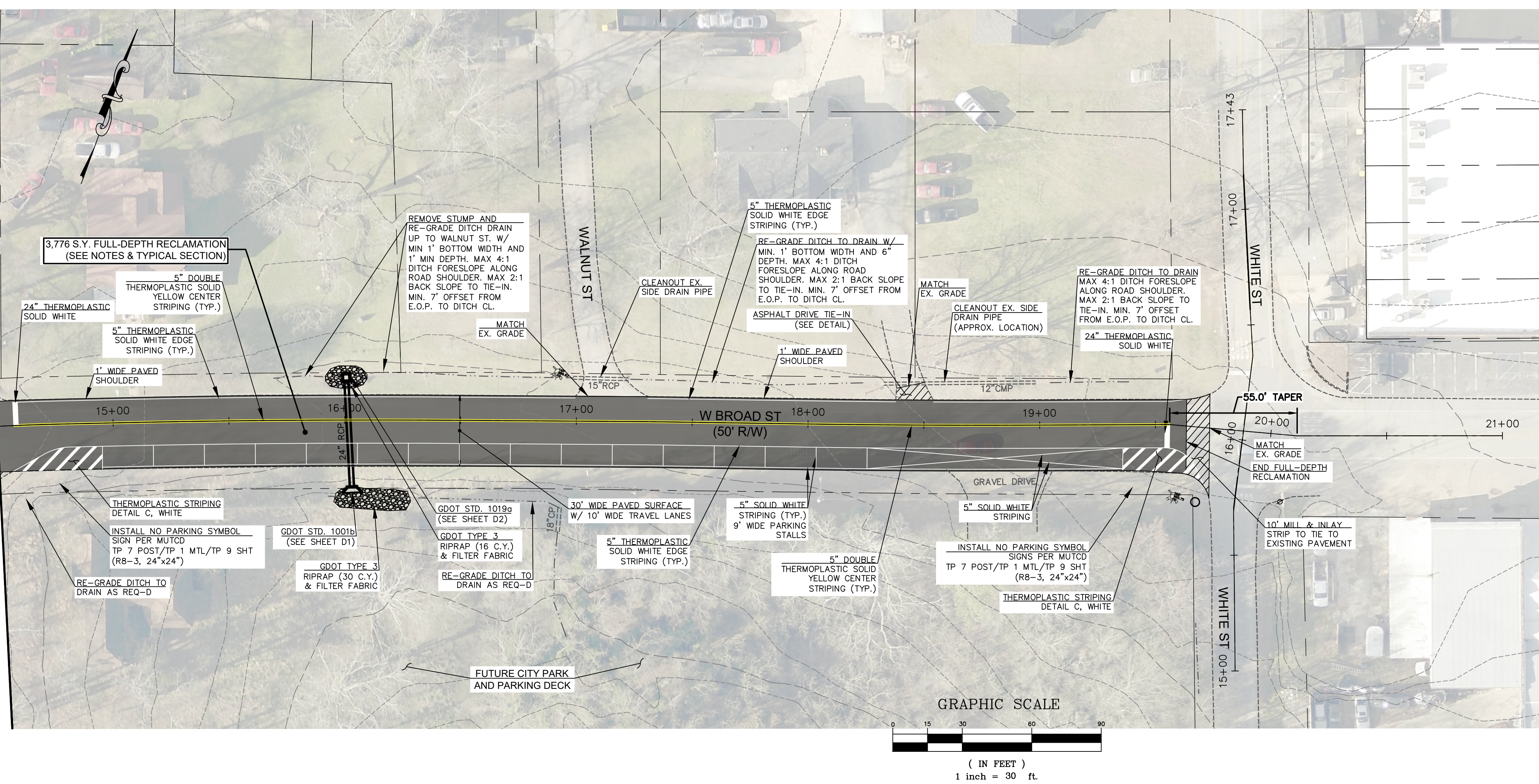
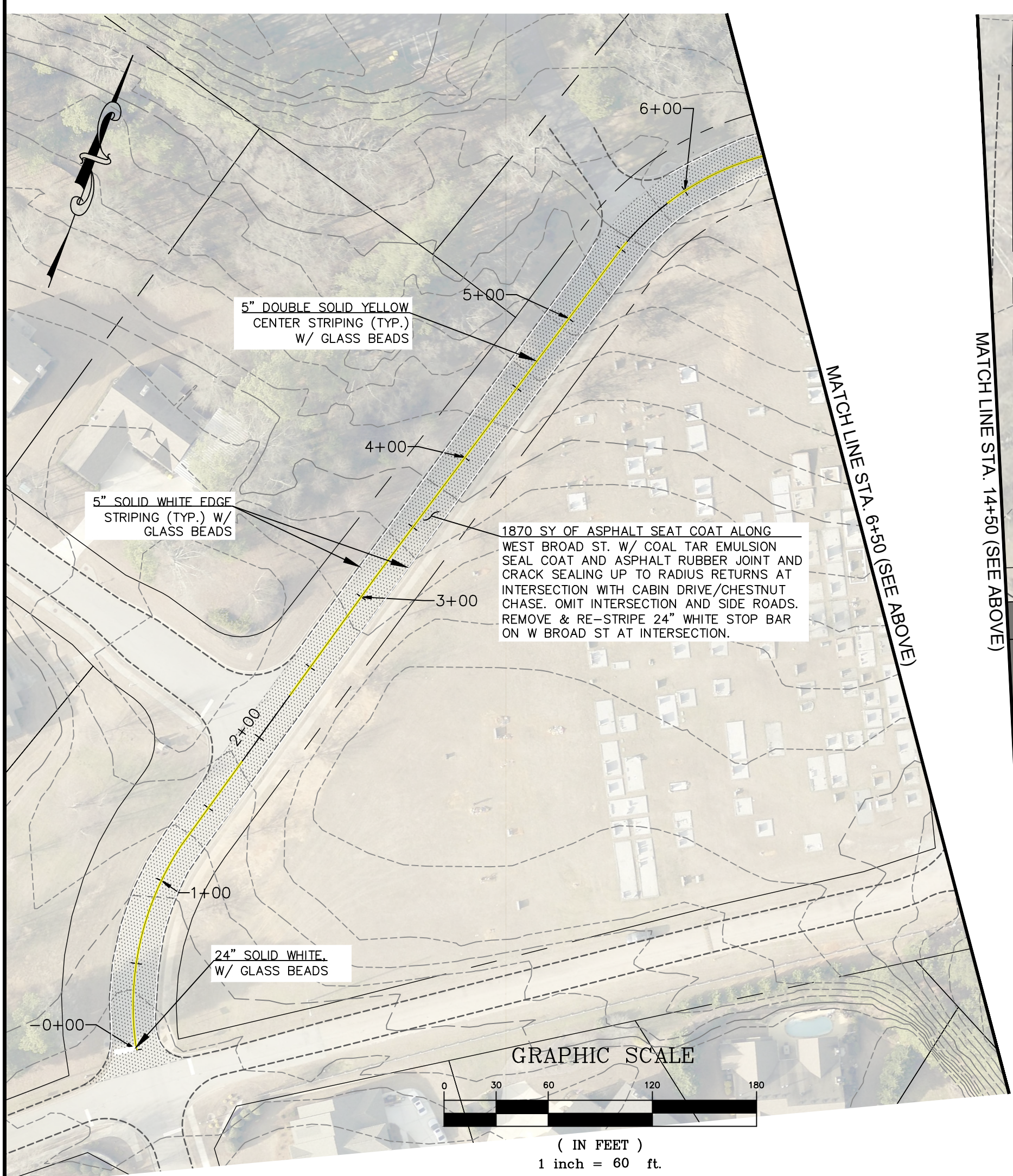
Respectfully Submitted: Signature of Principal: _____

Title: _____

Corporate Seal:



- NOTES:**
1. RELOCATE STREET SIGNS AS REQ'D PER MUTCD GUIDELINES.
 2. CONTRACTOR TO BUILD UP SHOULDER TO A MIN OF 4' WIDE ALONG SOUTH SIDE OF W BROAD STREET BETWEEN HALL ST AND WHITE ST. RE-GRADE TO 8% MIN./10% MAX CROSS SLOPE TO DRAIN, STABILIZE AND GRASS.
 3. REFER TO PAVEMENT SECTION DETAIL FOR ASPHALT AND BASE COURSE INFORMATION.
 4. PROVIDE A 1' WIDE PAVED SHOULDER ALONG THE NORTH SIDE OF WEST BROAD STREET.
 5. PROVIDE A 9' WIDE PAVED SHOULDER ALONG THE SOUTH SIDE OF WEST BROAD STREET FOR ON-STREET PARKING STALLS. STALLS LENGTHS SHALL BE A MINIMUM OF 22' AND MAXIMUM OF 26'. PROVIDE A MINIMUM OF 30' OFFSET FROM NEAREST EDGE OF PAVEMENT OF INTERSECTING SIDE STREET TO BEGINNING OF PARKING STALL.



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DATE	NO.	DESCRIPTION
04/30/2024	A	RELEASED FOR BID
05/22/2024	1	ADDENDUM #1 - STRIPING REVISIONS

EMI ENGINEERING MANAGEMENT
 Experience • Trust • Solutions
 303 Swanson Drive, Lawrenceville, GA 30043
 phone 770-962-1387 fax # 770-962-8010
 www.emimc.biz

2024 LMIG GRANT-W BROAD STREET BETWEEN CABIN DRIVE AND WHITE STREET ROADWAY IMPROVEMENTS FOR THE CITY OF HOSCHTON, GEORGIA

ROADWAY IMPROVEMENTS	SHEET TITLE	CHECKED BY
DESIGN BY	DRAWN BY	DESIGNED BY
CMB	DCS	CMB

GEORGIA REGISTERED PROFESSIONAL ENGINEER
 NO. 130787
 EXPIRES 12/31/2024
CORY M. BERKOWITZ
ENGINEER

STAMP

DATE: 5/9/2024
 JOB NUMBER: 21009
 FILE LOCATION: z:\projects

C1

SHEET

REVISION

PATH & FILE: z:\PROJECTS\2024\1009_Hoschton LMIG\Sheet Inventory\2024 LMIG\Sheet Inventory\2024 LMIG

APPENDIX A:

**RELEVANT SECTIONS OF THE
GEORGIA DEPARTMENT OF TRANSPORTATION
STANDARD & SUPPLEMENTAL SPECIFICATIONS**

Section 150—Traffic Control

150.1 General Description

Specifications for this work will be included elsewhere in the Contract.

Section 163—Miscellaneous Erosion Control Items

Replace Section 163 with the following:

163.1 General Description

This work includes constructing and removing:

- Silt control gates
- Temporary erosion control slope drains shown on the Plans or as directed
- Temporary sediment basins
- Sediment barriers and check dams
- Rock filter dams
- Stone filter berms
- Stone filter rings
- Temporary sediment traps
- Other temporary erosion control structures shown on the Plans or directed by the Engineer

This work also includes applying mulch (e.g., straw, hay, erosion control compost), and temporary grass.

163.1.01 Related References

A. Standard Specifications

Section 109—Measurement and Payment

Section 161—Control of Soil Erosion and Sedimentation

Section 171—Silt Fence

Section 500—Concrete Structures

Section 576—Slope Drain Pipe

Section 603—Rip Rap

Section 700—Grassing

Section 711—Turf Reinforcement Matting

Section 716—Erosion Control Mats (Slopes)

Section 720—Triangular Silt Barrier

Section 800—Coarse Aggregate

Section 801—Fine Aggregate

Section 822—Emulsified Asphalt

Section 845—Smooth Lined Corrugated Polyethylene (PE) Culvert Pipe

Section 860—Lumber and Timber

Section 863—Preservative Treatment of Timber Products

Section 881—Fabrics

Section 163 — Miscellaneous Erosion Control Items

Section 890—Seed and Sod

Section 893—Miscellaneous Planting Materials

B. Referenced Documents

AASHTO M252

AASHTO M294

163.1.02 Submittals

Provide written documentation to the Engineer as to the average weight of the bales of mulch.

163.2 Materials

Provide materials shown on the Plans, such as pipe, spillways, wood baffles, and other accessories including an anti-seep collar, when necessary. The materials shall remain the Contractor's property after removal, unless otherwise shown on the plans.

Materials may be new or used; however, the Engineer shall approve previously used materials before use.

Materials shall meet the requirements of the following specifications:

Material	Section
Mulch	893.2.02
Temporary Silt Fence	171
Concrete Aprons and Footings shall be Class A	500
Rip Rap	603
Temporary Grass	700
Triangular Silt Barrier	720
Coarse Aggregate	800
Lumber and Timber	860.2.01
Preservative Treatment of Timber Products	863.1
Corrugated Polyethylene Temporary Slope Drain Pipe	845

163.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

163.3 Construction Requirements

163.3.01 Personnel

General Provisions 101 through 150.

163.3.02 Equipment

General Provisions 101 through 150.

Section 163 — Miscellaneous Erosion Control Items

163.3.03 Preparation

General Provisions 101 through 150.

163.3.04 Fabrication

General Provisions 101 through 150.

163.3.05 Construction

Equivalent devices, as accepted by GDOT, shall be installed as accepted by GSWCC and shown in the Equivalent BMP List on the GSWCC Document List page.

A. Silt Control Gates

If silt control gates are required or are directed by the Engineer, follow these guidelines to construct them:

1. Clear and grade only that portion of the roadway within the affected drainage area where the drainage structure will be constructed.
2. Construct or install the drainage structure and backfill as required for stability.
3. Install the silt control gate at the inlet of the structure. Use the type indicated on the plans.
4. Vary the height of the gate as required or as shown on the plans.
5. Finish grading the roadway in the affected drainage area. Grass and mulch slopes and ditches that will not be paved. Construct the ditch paving required in the affected area.
6. Keep the gate in place until the work in the affected drainage area is complete and the erodible area is stabilized.
7. Remove the Type 1 silt gate assembly by sawing off the wood posts flush with the concrete apron. Leave the concrete apron between the gate and the structure inlet in place. The gate shall remain the property of the Contractor.

B. Temporary Slope Drains

If temporary slope drains are required, conduct the roadway grading operation according to Section 161 and follow these guidelines:

1. Place temporary pipe slope drains with inlets and velocity dissipaters (straw bales, silt fence, or aprons) according to the plans.
2. Securely anchor the inlet into the slope to provide a watertight connection to the earth berm. Ensure that all connections in the pipe are leak proof.
3. Place temporary slope drains at a spacing of 350 ft. (105 m) maximum on a 0% to 2% grade and at a spacing of 200 ft. (60 m) maximum on steeper grades, or more frequently as directed by the Engineer. Keep the slope drains in place until the permanent grass has grown enough to control erosion.
4. Remove the slope drains and grass the disturbed area with permanent grass. However, the temporary slope drains may remain in place to help establish permanent grass if approved by the Engineer.

C. Temporary Sediment Basins

Construct temporary sediment basins according to the Plans at the required locations, or as modified by the Engineer.

1. Construct the unit complete as shown, including:
 - Grading
 - Drainage
 - Riprap
 - Spillways
 - Anti-seep collar
 - Temporary mulching and grassing on internal and external slopes

Section 163 — Miscellaneous Erosion Control Items

- Accessories to complete the basin
- 2. When the sediment basin is no longer needed, remove and dispose of the remaining sediment.
- 3. Remove the sediment basin. Grade to drain and restore the area to blend with the adjacent landscape.
- 4. Mulch and permanently grass the disturbed areas according to Section 700.

D. Sediment Barriers

Construct sediment barriers according to the Plan details.

The following items may be used for sediment barriers

1. Type A Silt Fence.
2. Type C Silt Fence.
3. Rectangular, mechanically produced and standard-sized baled wheat straw.
4. Triangular Silt Barrier.
5. Synthetic Fiber: Use synthetic fiber bales of circular cross section at least 18 in. (450 mm) in diameter. Use synthetic bales of 3 ft. or 6 ft. (0.9 m or 1.8 m) in length that are capable of being linked together to form a continuous roll of the desired total length. Use bales that are enclosed in a geotextile fabric and that contain a pre-made stake hole for anchoring.
6. Coir: Use coir fiber bales of circular cross section at least 16" (400mm) in diameter. Use coir bales of 10 ft., 15 ft., or 20 ft. (3 m, 4.5 m, or 6 m) in length. Use coir baled with coir twine netting with 2 in. X 2 in. (50 mm X 50 mm) openings. Use coir bales with a dry density of at least 7 lb/ft.³ (112 kg/m³). Anchor in place with 2 in. X 4 in. (50 mm X 100 mm) wooden wedges with a 6 in. (150 mm) nail at the top. Place wedges no more than 36 in. (900 mm) apart.
7. Excelsior: Use curled aspen excelsior fiber with barbed edges in circular bales of at least 18 in. (450 mm) in diameter and nominally 10 ft. (3 m) in length. Use excelsior baled with polyester netting with 1 in. X 1 in. (25 mm by 25 mm) triangular openings. Use excelsior bales with a dry density of at least 1.4 lb/ft.³ (22 kg/m³). Anchor in place with 1 in. (25 mm) diameter wooden stakes driven through the netting at intervals of no more than 2 ft. (600 mm).
8. Compost Filter Sock: Use general use compost (see Subsection 893.2.02.A.5.b) in circular bales at least 18 in. (450 mm) diameter. Use compost baled with photo-degradable plastic mesh 5 mils thick with a maximum 0.38 in X 0.38 in (10 mm X 10 mm) openings. Anchor in place with 1 in. (25 mm) diameter wooden stakes driven through the netting at intervals of no more than 2 ft. (600 mm) in concentrated flow applications and no more than 5 ft. (1500 mm) in sheet flow applications. The sock shall be dispersed on site when no longer required, as determined by the Engineer. Do not use Compost Filter Socks in areas where the use of fertilizer is restricted.
9. Compost Filter Berm: Use erosion control compost (see Subsection 893.2.02) to construct a non-compacted 1.5 ft. to 2 ft. (450 mm to 600 mm) high trapezoidal berm which is approximately 2 ft. to 3 ft. (600 mm to 1 m) wide at the top and minimum 4 ft. (1.2 m) wide at the base. Do not use Compost Filter Berms in areas where the use of fertilizer is restricted.

The construction of the compost filter berm includes the following:

- a. Keeping the berm in a functional condition.
- b. Installing additional berm material when necessary.
- c. Removing the berm when no longer required, as determined by the Engineer. At the Engineer's discretion, berm material may be left to decompose naturally, or distributed over the adjacent area.

E. Other Temporary Structures

When special conditions occur during the design stage, the plans may show other temporary structures for erosion control with required materials and construction methods.

Section 163 — Miscellaneous Erosion Control Items

F. Temporary Grass

Use a quick-growing species of temporary grass such as rye grass, millet, or a cereal grass suitable to the area and season.

Use temporary grass in the following situations:

- When required by the Specifications or directed by the Engineer to control erosion where permanent grassing cannot be planted.
- To protect an area for longer than mulch is expected to last (60 calendar days), plant temporary grass as follows:
 1. Use seeds that conform to Subsection 890.2.01, *Seed*. Perform seeding according to Section 700; except use the minimum ground preparation necessary to provide a seed bed if further grading is required.
 2. Prepare areas that require no further grading according to Subsection 700.3.05.A, *Ground Preparation*. Omit the lime unless the area will be planted with permanent grass without further grading. In this case, apply the lime according to Section 700.
 3. Apply mixed grade fertilizer at 400 lbs./acre (450 kg/ha). Omit the nitrogen. Mulch (with straw or hay) temporary grass according to Section 700. (Erosion control compost Mulch will not be allowed with grassing.)
 4. Before planting permanent grass, thoroughly plow and prepare areas where temporary grass has been planted according to Subsection 700.3.05.A, *Ground Preparation*.
 5. Apply Polyacrylamide (PAM) to all areas that receive temporary grassing.
 6. Apply PAM (powder) before grassing or PAM (emulsion) to the hydroseeding operation.
 7. Apply PAM according to manufacturer specifications.
 8. Use only anionic PAM.

For projects that consist of shoulder reconstruction and/or shoulder widening, refer to Section 161.3.05H for Wood Fiber Blanket requirements.

G. Mulch

When staged construction or other conditions prevent completing a roadway section continuously, apply mulch (straw or hay or erosion control compost) to control erosion. Mulch may be used without temporary grassing for 60 calendar days or less. Areas stabilized with only mulch (straw/hay) shall be planted with temporary grass after 60 calendar days.

Apply mulch as follows:

9. Mulch (Hay or Straw) - Without Grass Seed
 - a. Uniformly spread the mulch over the designated areas from 2 in. to 4 in. (50 mm to 100 mm) thick.
 - b. After spreading the mulch, walk in the mulch by using a tracked vehicle (preferred method), empty sheep foot roller, light disking, or other means that preserves the finished cross section of the prepared areas. The Engineer will approve of the method.
 - c. Place temporary mulch on slopes as steep as 2:1 by using a tracked vehicle to imbed the mulch into the slope.
 - d. When grassing operations begin, leave the mulch in place and plow the mulch into the soil during seed bed preparation. The mulch will become beneficial plant food for the newly planted grass.
10. Erosion control compost - Without Grass Seed
 - a. Uniformly spread the mulch (erosion control compost) over the designated areas 2 in. (50 mm) thick.
 - b. When rolling is necessary, or directed by the Engineer, use a light corrugated drum roller.
 - c. When grassing operations begin, leave the mulch in place and plow the mulch into the soil during seed bed preparation. The mulch will become beneficial plant food for the newly planted grass.
 - d. Plant temporary grass on area stabilized with mulch (erosion control compost) after 60 calendar days.
 - e. Do not use Erosion Control Compost in areas where the use of fertilizer is restricted.

Section 163 — Miscellaneous Erosion Control Items

H. Miscellaneous Erosion Control Items Not Shown on the Plans

When conditions develop during construction that were unforeseen in the design stage, the Engineer may direct the Contractor to construct temporary devices such as but not limited to:

- Bulkheads
- Sump holes
- Half round pipe for use as ditch liners
- U-V resistant plastic sheets to cover critical cut slopes

The Engineer and the Contractor will determine the placement to ensure erosion control in the affected area.

I. Diversion Channels

When constructing a culvert or other drainage structure in a live stream that requires diverting a stream, construct a diversion channel.

J. Check Dams

Check dams are constructed of the following materials;

- Stone plain riprap according to Section 603 (Place woven plastic filter fabric on ditch section before placing riprap.)
- Sand bags as in Section 603 without Portland cement
- Baled wheat straw
- Compost filter socks
- Fabric (Type C silt fence)

Check dams shall be constructed according to plan details and shall remain in place until the permanent ditch protection is in place or being installed and the removal is approved by the Engineer.

K. Construction Exits

Locate construction exits at any point where vehicles will be leaving the project onto a public roadway. Install construction exits and tire wash area at the locations shown in the plans and in accordance with plan details.

Construction exit tire cleaning station shall be installed when conditions dictate additional tire cleaning measures are necessary to assist in protecting public roadways. Tire cleaning station shall consist of two pressure washers, water source and necessary labor and materials to clean tires of exiting vehicles. When conditions warrant the use of the tire cleaning station or as directed by the Engineer, the Department will pay \$750 dollars per day for the use. The Contractor may submit other construction exit tire wash assembly and sediment storage methods for review and approval by the Engineer.

L. Retrofits

Add the retrofit device to the permanent outlet structure as shown on the plan details.

When all land disturbing activities that would contribute sediment-laden runoff to the basin are complete, clean the basin of sediment and stabilize the basin area with vegetation.

When the basin is stabilized, remove the retrofit device from the permanent outlet structure of the detention pond.

M. Inlet Sediment Traps

Inlet sediment traps consist of a temporary device placed around a storm drain inlet to trap sediment. An excavated area adjacent to the sediment trap will provide additional sediment storage.

Inlet sediment traps may be constructed of Type C silt fence, plastic frame and filter, hay bales, baffle box, or other filtering materials approved by the Engineer. Construct inlet sediment traps according to the appropriate specification for the material selected for the trap. Place inlet sediment traps as shown on the plans or as directed by the Engineer.

Section 163 — Miscellaneous Erosion Control Items

N. Rock Filter Dams

Construct rock filter dams of the material selected as shown in the approved erosion and sediment control plan. Construct and place this item in accordance with the approved erosion control construction detail(s) and Standard Specification Section 603.

Rock filter dams shall remain in place until the permanent ditch protection is in place or is being installed and their removal is approved by the Engineer.

O. Stone Filter Berms

Construct stone filter berms of the material selected as shown in the approved erosion and sediment control plan. Construct and place this item in accordance with the approved erosion control construction detail(s) and Standard Specification Section 603.

Stone filter berms shall remain in place until the permanent slope protection is in place or is being installed and their removal is approved by the Engineer.

P. Stone Filter Rings

Construct stone filter rings of the material selected as shown in the approved erosion and sediment control plan. Construct and place this item in accordance with the approved erosion control construction detail(s) and Standard Specification Section 603.

A stone filter ring shall remain in place until final stabilization of the area which drains toward it is achieved and its removal is approved by the Engineer.

Q. Temporary Sediment Traps

Construct temporary sediment traps of the material selected as shown in the approved erosion and sediment control plan. Construct and place this item in accordance with the approved erosion control construction detail(s) and Standard Specification Section 603.

A temporary sediment trap shall remain in place until final stabilization of the area which drains toward it is achieved and its removal is approved by the Engineer.

163.3.06 Quality Acceptance

General Provisions 101 through 150.

163.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

163.4 Measurement

Equivalent devices shall be measured in the same manner as the device to which they are equivalent.

A. Silt Control Gates

Silt control gates are measured for payment by the entire structure constructed at each location complete in place and accepted. Silt control gates constructed at the inlet of multiple lines of drainage structures are measured for payment as a single unit.

B. Temporary Slope Drains

Temporary slope drains are measured for payment by the linear foot (meter) of pipe placed. When required, the inlet spillway and outlet apron and/or other dissipation devices are incidental and not measured separately.

C. Temporary Sediment Basins

Temporary sediment basins are measured for payment by the entire structure complete, including construction, maintenance, and removal. Temporary grassing for sediment basins is measured separately for payment. Measurement also includes:

Section 163 — Miscellaneous Erosion Control Items

- Earthwork
- Drainage
- Spillways
- Baffles
- Riprap
- Final cleaning to remove the basin

D. Sediment Barriers

Sediment barriers are measured by the linear foot (meter).

E. Other Temporary Structures

Other temporary structures are not measured for payment. Costs for the entire structure complete, including materials, construction (including earthwork), and removal is included in the price bid for the drainage structure or for other Contract items.

F. Temporary Grass

Temporary grass is measured for payment by the acre (hectare). Lime, when required, is measured by the ton (megagram). Mulch and fertilizer are measured separately for payment.

G. Mulch

Mulch (straw or hay, or erosion control compost) is measured for payment by the ton (megagram).

H. Miscellaneous Erosion Control Items Not Shown on the Plans

These items are not measured for payment. The cost for construction, materials, and removal is included in the price bid for other contract items.

I. Diversion Channels

Diversion channels are not measured for payment. The cost for the entire structure complete, including materials, construction (including earthwork), and removal is included in the price bid for the drainage structure or for other contract items.

J. Check Dams

Stone, sand bags, baled wheat straw, and compost filter sock check dams are measured per each, which includes all work necessary to construct the check dam including woven plastic filter fabric placed beneath stone check dams. Fabric check dams are measured per linear foot.

K. Construction Exits

Construction exits are measured per each which will include all work necessary to construct the exit including the required geotextile fabric placed beneath the aggregate.

Construction exit tire cleaning station are measured per day when added to an existing construction exit. Measurement includes all work necessary to construct the construction exit tire cleaning station including equipment, material, water source, and removal.

L. Retrofits

Retrofit will be measured for payment per each. The construction of the detention pond and permanent outlet structure will be measured separately under the appropriate items.

M. Inlet Sediment Traps

Inlet sediment traps, regardless of the material selected, are measured per each which includes all work necessary to construct the trap including any incidentals and providing the excavated area for sediment storage.

Section 163 — Miscellaneous Erosion Control Items

N. Rock Filter Dams

Rock filter dams are measured for payment per each required. This includes the entire structure at each location and all the work necessary for construction.

O. Stone Filter Berms

Stone filter berms are measured for payment per linear foot (meter) required. This includes the entire structure at each location and all the work necessary for construction.

P. Stone Filter Rings

Stone filter rings are measured for payment per each required. This includes the entire structure at each location and all the work necessary for construction.

Q. Temporary Sediment Traps

Temporary sediment traps are measured for payment per each required. This includes the entire structure at each location and all the work necessary for construction.

163.4.01 Limits

General Provisions 101 through 150.

163.5 Payment

Equivalent devices shall be paid for in the same manner as the device to which they are equivalent.

A. Silt Control Gates

The specified silt control gates are paid for at the Contract Unit Price per each. Payment is full compensation for:

- Furnishing the material and labor
- Constructing the concrete apron as shown on the Plans
- Excavating and backfilling to place the apron
- Removing the gate

B. Temporary Slope Drains

Temporary slope drains are paid for by the linear foot (meter). Payment is full compensation for materials, construction, removal (if required), inlet spillways, velocity dissipaters, and outlet aprons.

When temporary drain inlets and pipe slope drains are removed, they remain the Contractor's property and may be reused or removed from the Project as the Contractor desires. Reused pipe or inlets are paid for the same as new pipe or inlets.

C. Temporary Sediment Basins

Temporary sediment basins, measured according to Subsection 163.4,C *Measurement*, are paid for by the unit, per each, for the type specified on the plans. Price and payment are full compensation for work and supervision to construct, and remove the sediment basin, including final clean-up.

D. Sediment Barriers

Sediment barriers are paid by the linear foot (meter). Price and payment are full compensation for work and supervision to construct, and remove the sediment barrier, including final clean-up.

Section 163 — Miscellaneous Erosion Control Items

E. Other Temporary Structures

Other temporary structures are not measured for payment. Costs for the entire structure complete, including materials, construction (including earthwork), and removal is included in the price bid for the drainage structure or for other Contract items.

F. Temporary Grass

Temporary grass is paid for by the acre (hectare). Payment is full compensation for all equipment, labor, ground preparation, materials, wood fiber mulch, polyacrylamide, and other incidentals. Lime (when required) is paid for by the ton (megagram). Mulch and fertilizer are paid for separately.

G. Mulch

Mulch is paid for by the ton. Payment is full compensation for all materials, labor, maintenance, equipment and other incidentals.

The weight for payment of straw or hay mulch will be the product of the number of bales used and the average weight per bale as determined on certified scales provided by the Contractor or state certified scales. Provide written documentation to the Engineer stating the average weight of the bales.

The weight of erosion control compost mulch will be determined by weighing each loaded vehicle on the required motor truck scale as the material is hauled to the roadway, or by using recorded weights if a digital recording device is used. The Contractor may propose other methods of providing the weight of the mulch to Engineer for approval.

H. Miscellaneous Erosion Control Items Not Shown on the Plans

These items are not paid for separately. They are included in the price bid for other contract items.

I. Diversion Channel

Diversion channels are not paid for separately. They are included in the price bid for other contract items.

J. Check Dams

Payment is full compensation for all materials, construction, and removal. Stone plain riprap, sand bag, baled wheat straw, or compost filter socks check dams are paid for per each. The required woven filter fabric required under each stone check dams is included in the bid price. Fabric check dams are paid for per linear foot.

K. Construction Exits

Construction exits are paid for per each. Payment is full compensation for all labor and materials including the required geotextile, construction, and removal.

Construction exit tire cleaning stations are paid for per day when added to an existing construction exit. Payment is full compensation for all labor, equipment, materials, water source, and removal.

L. Retrofits

This item is paid for at the Contract Unit Price per each. Payment is full compensation for all work, supervision, materials (including the stone filter), labor and equipment necessary to construct and remove the retrofit device from an existing or proposed detention pond outlet structure.

M. Inlet Sediment Traps

Inlet sediment traps are paid for per each. Payment is full compensation for all materials, construction, and removal.

N. Rock Filter Dams

Rock filter dams are paid for per each. Payment is full compensation for all materials, construction, and removal for each. Clean reused stone Type 3 riprap and #57 stone are paid for on the same basis as new items. Plastic woven filter fabric is required under rock filter dams and is included in the price bid for each.

Section 163 — Miscellaneous Erosion Control Items

O. Stone Filter Berms

Stone filter berms are paid for per linear foot (meter). Payment is full compensation for all materials, construction, and removal for each. Clean reused stone Type 3 riprap and #57 stone are paid for on the same basis as new items. Plastic woven filter fabric is required under rock filter berms and is included in the price bid for linear foot (meter).

P. Stone Filter Rings

Stone filter rings are paid for per each. Payment is full compensation for all materials, construction, and removal for each. Clean reused stone Type 3 riprap and #57 stone are paid for on the same basis as new items. Plastic woven filter fabric is required under stone filter rings and is included in the price bid for each.

Q. Temporary Sediment Traps

Temporary sediment traps are paid for payment per each required. This includes the entire structure at each location and all the work necessary for construction.

The items in this section (except temporary grass and mulch) are made as partial payments as follows:

- When the item is installed and put into operation the Contractor will be paid 75 percent of the Contract price.
- When the Engineer instructs the Contractor that the item is no longer required and is to remain in place or is removed, whichever applies, the remaining 25 percent will be paid.

Temporary devices may be left in place at the Engineer's discretion at no change in cost. Payment for temporary grass will be made based on the number of acres (hectares) grassed. Mulch will be based on the number of tons (megagrams) used.

Payment is made under:

Item No. 163	Construct and remove silt control gates	Per each
Item No. 163	Construct and remove temporary pipe slope drains	Per linear foot (meter)
Item No. 163	Construct and remove temporary sediment barriers	Per linear foot (meter)
Item No. 163	Construct and remove sediment basins	Per each
Item No. 163	Construct and remove check dams except fabric dams	Per each
Item No. 163	Construct and remove fabric check dams	Per linear foot (meter)
Item No. 163	Construct and remove construction exits	Per each
Item No. 163	Construction exit tire cleaning station	Per day
Item No. 163	Construct and remove retrofits	Per each
Item No. 163	Construct and remove rock filter dams	Per each
Item No. 163	Construct and remove stone filter berms	Per linear foot (meter)
Item No. 163	Construct and remove stone filter rings	Per each
Item No. 163	Construct and remove inlet sediment traps	Per each
Item No. 163	Construct and remove temporary sediment traps	Per each
Item No. 163	Temporary grass	Per acre (hectare)
Item No. 163	Mulch	Per ton (megagram)

163.5.01 Adjustments

General Provisions 101 through 150.

Section 165—Maintenance of Temporary Erosion and Sedimentation Control Devices

Replace Section 165 with the following:

165.1 General Description

This work consists of providing maintenance on temporary erosion and sediment control devices, including but not limited to the following:

- Silt control gates
- Temporary erosion control slope drains shown on the Plans or as directed
- Temporary sediment basins
- Silt control gates
- Check dams
- Sediment barriers
- Rock filter dams
- Stone filter berms
- Stone filter rings
- Temporary sediment traps

It also consists of removing sediment that has accumulated at the temporary erosion and sedimentation control devices.

165.1.01 Definitions

General Provisions 101 through 150.

165.1.02 Related References

A. Standard Specifications

General Provisions 101 through 150.

B. Referenced Documents

General Provisions 101 through 150.

165.1.03 Submittals

General Provisions 101 through 150

165.2 Materials

General Provisions 101 through 150.

165.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

165.3 Construction Requirements

165.3.01 Personnel

General Provisions 101 through 150.

165.3.02 Equipment

General Provisions 101 through 150.

165.3.03 Preparation

General Provisions 101 through 150.

165.3.04 Fabrication

General Provisions 101 through 150.

165.3.05 Construction

As a minimum, clean sediment from all temporary erosion control devices (except as noted in the standard construction details) installed on the project when one-half the capacity by volume, as measured by depth, has been reached. All other devices as noted in the standard construction details shall be cleaned when one-third the capacity of the storage volume has been reached.

Handle excavated sediment from any erosion or sediment control device in one of the following ways:

- Remove sediment from the immediate area and immediately stabilize it to prevent the material from refilling any erosion or sediment control device.
- Place and mix it in the roadway embankment or waste it in an area approved by the Engineer.

Repair or replace at no cost to the Department any erosion or sediment control device that is not functioning properly or is damaged due to negligence or abuse.

A. Temporary Silt Fence

Maintenance of temporary silt fence consists of furnishing all labor, tools, materials, equipment and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0 % filled). Also included is the removal of sediment accumulations (“filtercake”) on the fabric by tapping the fabric on the downstream side. Maintenance of silt fence also includes the removal and replacement of any deteriorated filter fabric reducing the effectiveness of the silt fence on any properly installed silt fence.

B. Silt Control Gates

Maintenance of temporary silt control gates consists of all labor, tools, materials, equipment and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled). When applicable, this item will include the removal of sediment accumulations on the fabric by tapping the fabric on the downstream side.

C. Check Dams (all types)

Maintenance of temporary erosion control check dams shall consist of all labor, tools, materials, equipment and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled). This item also includes the removal of any material deposited in sump holes. When applicable, this item will include the removal of sediment accumulations on the fabric by tapping the fabric on the downstream side, or from the baled straw by similar means.

D. Silt Retention Barriers

Maintenance of temporary silt retention barriers consists of all labor, tools, materials, equipment and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled).

Section 165 — Maintenance of Temporary Erosion and Sedimentation Control Devices

E. Temporary Sediment Basins

Maintenance of temporary sediment basins consists of all labor, tools, materials, equipment and necessary incidentals to remove and dispose of accumulated sediment down to the original bottom of the basin. This also includes removing accumulated sediment from the rock filter and restoring the rock filter to its original specified condition and any work necessary to restore all other components to the pre-maintenance conditions.

F. Sediment Barriers

Maintenance of sediment barriers consists of furnishing all labor, tools, materials, equipment and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0 % filled). Also included is the removal of sediment accumulations on the barriers by tapping.

G. Triangular Silt Barriers

Maintenance of triangular silt barriers consists of all labor, tools, materials, equipment and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled).

H. Retrofits

Maintenance of the retrofits device consists of all labor, tools, materials, equipment and necessary incidentals to remove and properly dispose of accumulated sediment in the permanent detention pond being utilized as a temporary sediment basin. This item also includes any maintenance that is required to ensure the retrofit device is maintained per Plan details and any maintenance of the stone filter to maintain its filtering ability, including cleaning and replacement.

I. Construction Exits

Maintenance of the construction exits consists of all labor, tools, materials, equipment and incidentals, including additional stone and geotextile fabric as required to prevent the tracking or flow of soil onto public roadways. This includes scarifying existing stone, cleaning existing stone, or placement of additional stone.

Maintenance of the construction exit tire wash area consists of all labor, tools, materials, and equipment and incidentals. It also includes the removal and disposal of accumulated sediment in the required approved sediment storage device down to the original ground line (0% filled).

Cleaning of the construction exit by scraping and/or brooming only will not be measured for payment.

J. Inlet Sediment Traps

Maintenance of inlet sediment traps consists of all labor, tools, materials, equipment, and necessary incidentals to remove and properly dispose of accumulated sediment in the trap and/or the excavated area adjacent to the trap. It also includes any maintenance that is required to remove sediment accumulations ("filtercake") from the material selected to construct the inlet sediment trap.

K. Rock Filter Dams

Maintenance of rock filter dams consists of all labor, tools, materials, equipment, and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled). This item also includes the removal of any material deposited in sump holes.

L. Stone Filter Berms

Maintenance of stone filter berms consists of all labor, tools, materials, equipment, and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled). This item also includes the removal of any material deposited in sump holes.

M. Stone Filter Rings

Maintenance of stone filter rings consists of all labor, tools, materials, equipment, and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled). This item also includes the removal of any material deposited in sump holes.

N. Temporary Sediment Traps

Section 165 — Maintenance of Temporary Erosion and Sedimentation Control Devices

Maintenance of temporary sediment traps consists of all labor, tools, materials, equipment, and necessary incidentals to remove and dispose of accumulated sediment down to the original ground line (0% filled). This item also includes the removal of any material deposited in sump holes.

165.3.06 Quality Acceptance

General Provisions 101 through 150.

165.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

165.4 Measurement

A. Temporary Silt Fence

Maintenance of temporary silt fence, Type A or C, is the actual linear feet (meter) of silt fence measured in place where sediment is removed or where the silt fence has become undermined due to no fault or negligence of the Contractor. Any deteriorated filter fabric reducing the effectiveness of the silt fence that needs to be removed and replaced will be measured as maintenance of temporary silt fence.

B. Silt Control Gates

Maintenance of temporary silt control gates, Type 1, 2, or 3, as specified on the plans is measured as a single unit.

C. Check Dams (All Types)

Maintenance of temporary erosion control check dams as specified on the plans is the actual linear feet (meter) of baled straw, or rip rap, measured in place, where sediment is removed.

D. Silt Retention Barriers

Maintenance of temporary silt retention barrier as specified on the plans is measured by the linear foot (meter) where sediment is removed.

E. Temporary Sediment Basins

Maintenance of temporary sediment basins as specified on the plans is measured as a single unit.

F. Sediment Barriers

Maintenance of sediment barriers is the actual linear feet (meter) measured in place where sediment is removed.

G. Triangular Silt Barriers

Maintenance of triangular silt barrier as specified on the plans is measured by the linear foot (meter) where sediment is removed.

H. Retrofits

Maintenance of retrofit devices at the location specified on the plans is measured per each.

I. Construction Exits

Maintenance of construction exits at the location specified on the plans, or as directed by the Engineer is measured per each.

Maintenance of construction exit tire wash area, including the required approved sediment storage device, at the location specified on the plans, or as directed by the Engineer are measured per each when added to an existing construction exit.

Each location will be measured as either maintenance of construction exit, or maintenance of construction exit tire wash assembly.

Section 165 — Maintenance of Temporary Erosion and Sedimentation Control Devices

J. Inlet Sediment Traps

Maintenance of inlet sediment traps at the location specified on the plans, or as added by the Engineer is measured per each.

K. Rock Filter Dams

Maintenance of rock filter dams as specified on the plans is measured as a single unit.

L. Stone Filter Berms

Maintenance of stone filter berms as specified on the plans is measured per linear foot (meter).

M. Stone Filter Rings

Maintenance of stone filter rings as specified on the plans is measured as a single unit.

N. Temporary Sediment Traps

Maintenance of temporary sediment traps as specified on the plans is measured as a single unit.

165.4.01 Limits

General Provisions 101 through 150.

165.5 Payment

A. Temporary Silt Fence

Maintenance of temporary silt fence, Type A or C, is paid for at the contract unit price bid per linear foot (meter).

B. Silt Control Gates

Maintenance of temporary silt control gates, Type 1, 2, or 3, as specified on the plans is paid for at the contract unit price bid per each.

C. Check Dams

Maintenance of check dams as specified on the plans is paid for at the contract unit price bid per linear foot (meter).

D. Silt Retention Barriers

Maintenance of temporary silt retention barriers as specified on the plans is paid for at the contract unit price bid per linear foot (meter).

E. Temporary Sediment Basins

Maintenance of temporary sediment basins as specified on the plans is paid for at the contract unit price bid per each.

F. Sediment Barriers

Maintenance of sediment barriers as specified on the plans is paid for at the contract unit price bid per linear foot (meter).

G. Triangular Silt Barriers

Maintenance of triangular silt barriers as specified on the plans is paid for at the contract unit price bid per linear foot (meter).

H. Retrofits

Maintenance of the retrofit devices at the location specified on the plans is paid for at the contract unit price bid per each.

Section 165 — Maintenance of Temporary Erosion and Sedimentation Control Devices

I. Construction Exits

Maintenance of the construction exits at the location specified on the plans or as added by the Engineer is paid for at the contract unit price per each.

Maintenance of construction exit tire wash assembly at the location specified on the plans or as added by the Engineer is paid for at the contract unit price per each when added to an existing construction exit.

J. Inlet Sediment Traps

Maintenance of the inlet sediment traps at the location specified on the plans or at the location specified by the Engineer is paid for at the contract unit price per each.

K. Rock Filter Dams

Maintenance of rock filter dams as specified on the Plans is paid for at the contract unit price bid per each.

L. Stone Filter Berms

Maintenance of stone filter berms as specified on the Plans is paid for at the contract unit price bid per linear foot (meter).

M. Stone Filter Rings

Maintenance of stone filter rings as specified on the plans is paid for at the contract unit price bid per each.

N. Temporary Sediment Traps

Maintenance of temporary sediment traps as specified on the plans is paid for at the contract unit price bid per each.

Payment will be made under:

Item No. 165	Maintenance of temporary silt fence	per linear foot (meter)
Item No. 165	Maintenance of silt control gates	per each
Item No. 165	Maintenance of check dams	per linear foot (meter)
Item No. 165	Maintenance of silt retention barriers	per foot (meter)
Item No. 165	Maintenance of temporary sediment basins	per each
Item No. 165	Maintenance of sediment barriers	per linear foot (meter)
Item No. 165	Maintenance of triangular silt barriers	per linear foot (meter)
Item No. 165	Maintenance of retrofits	per each
Item No. 165	Maintenance of construction exits	per each
Item No. 165	Maintenance of construction exit tire wash area	per each
Item No. 165	Maintenance of inlet sediment traps	per each
Item No. 165	Maintenance of rock filter dams	per each
Item No. 165	Maintenance of stone filter berms	per linear foot (meter)
Item No. 165	Maintenance of rock filter dams	per each
Item No. 165	Maintenance of temporary sediment traps	per each

165.5.01 Adjustments

General Provisions 101 through 150.

Section 171—Silt Fence

Replace Section 171 with the following:

171.1 General Description

This work includes furnishing, installing, and removing a water permeable filter fabric fence to remove suspended particles from drainage water.

171.1.01 Definitions

General Provisions 101 through 150.

171.1.02 Related References

A. Standard Specifications

Section 163—Miscellaneous Erosion Control Items

Section 700—Grassing

Section 862—Wood Posts and Bracing

Section 881—Fabrics

Section 894—Fencing

B. Referenced Documents

ASTM D 3786

ASTM D 4355

ASTM D 4632

ASTM D 4751

GDT 87

QPL 36

171.1.03 Submittals

General Provisions 101 through 150.

171.2 Materials

Materials shall meet the requirements of the following Specifications:

Material	Section
Fabrics	<u>881</u>
Fencing	<u>894</u>
Wood Posts and Bracing	<u>862</u>

Conditions during Project construction will affect the quantity of the silt fence to be installed.

The Engineer may increase, decrease, or eliminate the quantity at his or her direction. Variations in quantity are not changes in details of construction or in the character of the work.

Section 171 — Silt Fence

For Type A, B, and C fences, use fabric as specified in Subsection 881.2.07, *Silt Fence Filter Fabric*.

171.2.01 Delivery, Storage, and Handling

During shipment and storage, wrap the fabric in a heavy-duty covering protecting the cloth from sunlight, mud, dust, dirt, and debris. Do not expose the fabric to temperatures greater than 140 °F (60 °C).

When installed, the Engineer will reject the fabric if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

171.3 Construction Requirements

171.3.01 Personnel

General Provisions 101 through 150.

171.3.02 Equipment

General Provisions 101 through 150.

171.3.03 Preparation

General Provisions 101 through 150.

171.3.04 Fabrication

General Provisions 101 through 150.

171.3.05 Construction

Install the silt fence according to this Specification, as shown on the plans, or as directed by the Engineer

A. Install Silt Fence

1. Install silt fence by either of the following methods:
 - a. Excavated Trench Method
Excavate a trench 4 to 6 in. (100 to 150 mm) deep using equipment such as a trenching machine or motor grader. If equipment cannot be operated on the site, excavate the trench by hand.
 - b. Soil Slicing Method
Create a mechanical slice in the soil 8 to 12 in. (200 to 300 mm) deep to receive the silt fence. Ensure the width of the slice is not more than 3 in. (75 mm). Mechanically insert the silt fence fabric into the slice in a simultaneous operation with the slicing ensuring consistent depth and placement.
2. Install the first post at the center of the low point (if applicable). Space the remaining posts a maximum of 6 ft. (1.8 m) apart for Types A and B fence and 4 ft. (1.2 m) apart for Type C fence.
3. Bury the posts at least 18 in. (450 mm) into the ground. If this depth cannot be attained, secure the posts enough to prevent the fence from overturning from sediment loading.
4. Attach the filter fabric to the post using wire, cord, staples, nails, pockets, or other acceptable means.
 - a. Staples and Nails (Wood Posts): Evenly space staples or nails with at least five per post for Type A fence and four per post for Type B fence.
 - b. Pockets: If using pockets and they are not closed at the top, attach the fabric to a wood post using at least one additional staple or nail, or to a steel post using wire. Ensure the additional attachment is within the top 6 in. (150 mm) of the fabric.
 - c. Install the filter fabric so 6 to 8 in. (150 to 200 mm) of fabric is left at the bottom to be buried. Provide a minimum overlap of 18 in. (450 mm) at all splice joints.

Section 171 — Silt Fence

- d. For Type C fence:
- 1) Woven Wire Supported
 - Steel Post: Use wire to attach the fabric to the top of the woven wire support fence at the midpoint between posts. Also, use wire to attach the fabric to the post.
 - 2) Polypropylene Mesh Supported
 - Wood Post: Use at least six staples per post. Use two staples in a crisscross or parallel pattern to secure the top portion of the fence. Evenly space the remaining staples down the post.
 - Steel Post: Use wire to attach the fabric and polypropylene mesh to the post.
 - 3) High Tensile Polypropylene Integrated Support Woven Fabric
 - Wood Post: Use at least six staples per post. Use two staples in a crisscross or parallel pattern to secure the top portion of the fence. Evenly space the remaining staples down the post.
 - Steel Post: Shall not be used with this type of C-system
5. Install the fabric in the trench so 4 to 6 in. (100 to 150 mm) of fabric is against the side of the trench with 2 to 4 in. (50 to 100 mm) of fabric across the bottom in the upstream direction.
 6. Backfill and compact the trench to ensure flow cannot pass under the barrier. When the slice method is used, compact the soil disturbed by the slice on the upstream side of the silt fence first, and then compact the downstream side.
 7. When installing a silt fence across a waterway producing significant runoff, place a settling basin in front of the fence to handle the sediment load, if required. Construct a suitable sump hole or storage area according to Section 163.

B. Remove the Silt Fence

1. Keep all silt fence in place unless or until the Engineer directs it to be removed. A removed silt fence may be used at other locations if the Engineer approves of its condition.
2. After removing the silt fence, dress-the area to natural ground, grass-and mulch the area according to Section 700.
3. The silt fence shall remain until the Project is accepted or until the fence is removed. Also, remove and dispose of the silt accumulations at the silt fence.
4. Remove and replace any deteriorated filter fabric reducing the effectiveness of the silt fence.

171.3.06 Quality Acceptance

Approved silt fence is listed in QPL 36. Approved fabrics must consistently exceed the minimum requirements of this Specification as verified by the Office of Materials and Research. The Office of Materials and Research will remove fabric failing to meet the minimum requirements of this specification from the QPL until the products' acceptability has been reestablished to the Department's satisfaction.

At the time of installation, the Engineer will reject the fabric if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

Section 171 — Silt Fence

171.4 Measurement

The quantity of silt fence to be paid for is the actual number of linear feet (meters) of silt fence, measured in place from end post to end post of each separate installation. The silt fence must be complete and accepted.

171.4.01 Limits

General Provisions 101 through 150.

171.5 Payment

Silt fence Type A, B, or C measured as defined in Subsection 171.4, *Measurement*, is paid for at the Contract Unit Price bid per linear foot (meter).

Payment is full compensation for the following:

- Furnishing materials
- Erecting the fence
- Dressing and grassing, when required
- Removing the fence, when required

Payment for this Item is made as follows:

- Seventy-five percent of the Contract Price bid per linear foot (meter) is paid when each fence is complete in place.
- Twenty-five percent is paid at removal or acceptance.

If the silt fence must be repaired or removed, as the result of neglect or damage, perform the work at no additional cost to the Department.

Payment will be made under:

Item No. 171	Silt fence, type__	Per linear foot (meter)
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171.5.01 Adjustments

General Provisions 101 through 150.

Section 210—Grading Complete

Replace Section 210 with the following:

210.1 General Description

This work includes:

- Excavating of all materials including ditches, undesirable material (including removal and replacement), and borrow (if required)
- Hauling
- Forming embankments
- Constructing shoulders and subgrades
- Finishing, dressing, and disposing of undesirable or surplus material
- Clearing and grubbing according to Section 201 and Section 202 unless these items are established as Pay Items in the Contract
- Removing and disposing of miscellaneous roadway items, including but not limited to curbs, drainage structures, and pavements (unless established as separate contract items)

Ensure that the completed grading work conforms to the horizontal and vertical alignment and typical cross-sections shown on the Plans or as directed by the Engineer.

210.1.01 Definitions

General Provisions 101 through 150.

210.1.02 Related References

A. Standard Specifications

- Section 109—Measurement and Payment
- Section 201—Clearing and Grubbing Right-of-Way
- Section 202—Random Clearing and Grubbing
- Section 204—Channel Excavation
- Section 205—Roadway Excavation
- Section 206—Borrow Excavation
- Section 207—Excavation and Backfill for Minor Structures
- Section 208—Embankments
- Section 209—Subgrade Construction

B. Referenced Documents

General Provisions 101 through 150.

210.1.03 Submittals

General Provisions 101 through 150.

Section 210 — Grading Complete

210.2 Materials

Use materials required for grading construction that conform to the requirements of Section 204, Section 205, Section 206, Section 207, Section 208, and Section 209.

210.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

210.3 Construction Requirements

210.3.01 Personnel

General Provisions 101 through 150.

210.3.02 Equipment

Use equipment approved by the Engineer that will not damage base, pavement, or other appurtenances to be retained.

210.3.03 Preparation

Before placing base material, finish the subgrade according to Subsection 209.3.05.E.

210.3.04 Fabrication

General Provisions 101 through 150.

210.3.05 Construction

Perform The Work according to the appropriate portions of Section 201, Section 202, Section 204, Section 205, Section 206, Section 207, Section 208, and Section 209 of the Specifications. Measurement and payment shall be according to the provisions of this Section. See Subsection 210.4 and Subsection 210.5, below.

210.3.06 Quality Acceptance

When the Engineer determines that the existing material in areas where fills are to be placed is undesirable, the Engineer may require the Contractor to remove the undesirable material and replace it with suitable material.

- Compact the replacement materials according to the applicable portions of Section 208.
- In cut areas, where the material below the template line is undesirable for subgrade or shoulders, undercut it to a depth established by the Engineer and replace it with suitable material.
- Compact the replacement materials as specified herein.

210.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

210.4 Measurement

A. Grading Complete

The Work under this Item is not measured separately for payment.

B. Grading Per Mile (Kilometer)

This Item is measured in linear miles (kilometers) along the centerline of the road or the median, including ramps where shown on the Plans.

Section 210 — Grading Complete

C. Undercut Excavation

The amount of undercut excavation (when directed by the Engineer and not addressed in the Plans) measured for payment is the product of the length, width, and depth of excavation. Replacement material for undercut excavation is not measured for payment. There will be no separate payment for undercut excavation required by the Plans or rock excavation required under Subsection 205.3.

210.4.01 Limits

General Provisions 101 through 150.

210.5 Payment

A. Grading Complete

This Item completed and accepted will be paid for at the Lump Sum Price bid. Payment is full compensation for all work and material specified in this section.

The Contractor may initiate a partial payment process for the lump sum grading complete by submitting a written request to the Engineer. Unless the Engineer approves this request, this item, completed and accepted, will be paid for at the Lump Sum Price Bid according to the following schedule:

Clearing and Grubbing	Section 201 & 202	25%
Embankment/Heavy Grading/Rough Grading/Mass Grading	Section 204, 205, 206, 207, & 208	60%
Subgrade/Shoulder/Fine Grading	Section 209	10%
Dressing/Finish Grading	Section 208.3.05.E & 209.3.05.E	5%

B. Grading Per Mile (Kilometer)

This Item will be paid for at the Contract Unit Price per linear mile (kilometer) complete in place and accepted. This price is full compensation for furnishing the materials and performing the work specified in this Section.

C. Undercut Excavation

Undercutting areas not shown in the Plans when directed by the Engineer will be paid for at the rate of \$18.00 per cubic yard (\$21.50 per cubic meter) for quantities up to 750 yd³ (575 m³).

Quantities exceeding 750 yd³ (575 m³) will be considered Extra Work as defined in Subsection 109.05, and will be paid for accordingly. Payment is full compensation for excavating and disposing of undesirable material and supplying, placing, and compacting replacement material.

Payment will be made under:

Item No. 210	Grading complete	Per lump sum
Item No. 210	Grading per mile (kilometer)	Per mile (kilometer)
Item No. 210	Undercut excavation	Per cubic yard (meter)

210.5.01 Adjustments

General Provisions 101 through 150.

Section 301—Soil-Cement Construction

Replace Section 301 with the following:

301.1 General Description

This work includes constructing a base, subbase, or shoulder course composed of soil, or a mixture of soils, and stabilizing with Portland cement. Construct according to these Specifications and conform to the lines, grades, and typical sections shown on the plans or established by the Engineer.

Requirements for the mix design, quality control and quality acceptance testing will be controlled by Standard Operating Procedures 29 (SOP 29).

The provisions in Section 300 apply to this Item.

301.1.01 Definitions

Mixed in Place Construction - This method of construction is used when the Plans and Proposal indicate that the Work will be paid by the square yard (meter). The plans will indicate the method of construction and depth of base unless otherwise directed by the Engineer.

1. For Mixed in Place Construction, the Contractor will be required to submit a mix design for approval prior to construction. Requirements for the submittal will be controlled by SOP 29.
2. The Contractor testing will determine if the materials in the roadbed are suitable for use. If the Engineer approves, use materials in the roadbed without additional payment, except for the payment per square yard (meter) provided in Subsection 301.5.A, *Soil-Cement Material*.
3. If it is found necessary to add other materials to those in the roadbed to meet the desired thickness or to modify the physical properties of the existing materials, these materials will be paid for as soil-cement material.

Central Plant Mixed Construction - This method of construction is used when the plans and proposal indicate that the Work will be paid by the ton (megagram). The plans will indicate the method of construction and depth of base unless otherwise directed by the Engineer.

1. For Central Plant Mixed Construction, the Contractor shall be responsible for locating the source of soil material. Borrow pits will be sampled under the authority of the District Materials Engineer.
2. For Central Plant Mixed Construction, the Contractor will be required to submit a mix design for approval prior to construction. Requirements for the submittal will be controlled by SOP 29.
3. The Department testing will determine if the materials in the pit are suitable for use. If the Engineer approves, use materials in the pit without additional payment, except for the payment per square yard (meter) provided in Subsection 301.5.A, *Soil-Cement Material*.

Accreditations

1. AASHTO resource – The American Association of State Highway and Transportation Officials
2. CMEC – Construction Materials Engineering Council

SOP – Georgia Department of Transportation Standard Operating Procedures

301.1.02 Related References

A. Standard Specifications

Section 109—Measurement and Payment

Section 301 — Soil-Cement Construction

Section 205—Roadway Excavation

Section 300—General Specifications for Base and Subbase Courses

Section 412—Bituminous Prime

Section 814—Soil Base Materials

Section 821—Cutback Asphalt

Section 822---Emulsified Asphalt

Section 824—Cationic Asphalt Emulsion

Section 830—Portland Cement

Section 880—Water

B. Referenced Documents

GDT 19

GDT 20

GDT 21

GDT 59

GDT 65

GDT 67

GDT 86

GSP 16

SOP 29

AASHTO T 134

AASHTO R18

301.1.03 Submittals

A. Construction Work Plan

Prior to construction, submit a written Construction Work Plan to the Engineer for approval which shall include the following:

1. Proposed starting date
2. Location of plant (Central Plant Mixed Construction)
3. Plant and or roadway equipment (type and size)

B. Mix Design Package

For both Mixed in Place and Central Plant Mixed Construction, the Contractor shall submit a mix design package to the Office of Materials and Testing for approval at least three weeks prior to construction. The Mix Design process shall be completed in accordance with GDOT Test Method 65/GDT 65 by an accredited materials laboratory. The sampling, testing, proportioning and documentation shall be completed by an accredited materials laboratory. The Contractor will be responsible for ensuring that appropriate traffic control measures are in place during the sampling operations. The Portland cement used in the design process must be from an approved source listed on GDOT's Qualified Products List/QPL3 and representative of the same material to be used in construction.

(Mixed in Place Construction). In-place samples of the road structure shall be taken at a minimum frequency of 1000 feet (300m) per two lanes; alternating the sample locations to achieve a sample every 500 lane-feet (152m). Additional

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samples may be needed to represent material changes and/or problem areas. Each sample shall contain at least 20 lbs. (14kg) of proportionally blended material from the roadway.

(Central Plant Mixed Construction) The Contractor shall be responsible for locating the source of soil material. The borrow pit is to be sampled in accordance with Georgia Sampling Procedure 16/GSP 16. Borrow pits will be under the authority of the District Materials Engineer.

The mix design package shall include the following:

1. Approximately 22 lbs. (10,000 grams) of proportionally blended material from all in-place samples taken from the roadway
2. Approximately 2 lbs. (900 grams) of cement that is same type and source that will be used in construction.
3. The water used in construction must be from a potable source

Note: Since the Mix Design is based on source specific materials, any changes to materials, sources, or types will render the design invalid.

301.2 Materials

Ensure that materials meet the requirements of the following specifications:

Material	Specification
Soil-Cement Material	Subsection 814.2.02
Portland cement (Type I or Type II)	Subsection 830.2.01
Water	Subsection 880.2.01
Cutback asphalt, RC-30, RC-70, RC-250 or MC-30, MC-70, MC-250	Subsection 821.2.01
Emulsified Asphalt, EAP, AEP	Subsection 822.2.01
Cationic Asphalt, CSS-1h, CRS-2	Subsection 824.2.01
Blotter Material (Sand)	Subsection 412.3.05.G.3

301.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

301.3 Construction Requirements

A. General

1. Weather Limitations

Mix and place cement-treated base or subbase only when the weather permits the course to be finished without interruption in the time specified.

Mix and place materials only when the moisture content of the soil to be used in the mixture meets the limits specified in this Subsection 301.3.05.B.7.c, *Moisture Control*.

Begin mixing only when the air temperature is above 40 °F (4 °C) in the shade and rising.

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Ensure that the temperature of the soil to be used in the mixture and the subbase or subgrade is above 50 °F (10 °C).

2. Interruption of Work

If the work is interrupted for more than two hours after cement has been added, or if rain increases the cement's moisture content outside the limits specified in Subsection 301.3.05.B.7.c, *Moisture Control*, remove and replace the affected portion at no additional cost to the Department.

301.3.01 Personnel

General Provision 101 – 150

301.3.02 Equipment

Use equipment that meets the requirements of Subsection 300.3.02 and this subsection. The Engineer will approve equipment type and condition before construction begins.

Provide sufficient equipment in good working condition to do the following:

1. Allow continuous prosecution of the work.
2. In-Place Mixing
 - a. Use a cyclone-type spreader or its equivalent to spread the cement uniformly across the coverage area and capable of metering the spread rate being placed.
 - b. Use a rotary type mixer with sufficient tines which produces a uniform and homogenous blend of materials. The use of disk harrows will not be allowed for the mixed-in-place soil-cement base construction method. Mixer shall be inspected by the Engineer daily and tines with more than 25% wear must be replaced.
3. Central Plant Mixing
 - a. Provide a plant capable of producing a uniform and homogenous blend of material. The mixing chamber should be inspected daily and tines with more than 25 percent wear must be replaced.
4. The type and size of equipment must be sufficient enough to mix, place, and compact within the time limits.
5. Use any applicable equipment specified in Subsection 412.3.02, *Equipment* for bituminous prime.

301.3.03 Preparation

A. Subgrade or Subbase Preparation

1. Prepare the subgrade or subbase as specified in Subsection 300.3.03.C, *Preparing the Subgrade* or Subsection 300.3.03.D, *Preparing the Subbase* if the base, subbase, or shoulders will be composed entirely of new materials, whether mixed-in-place or central plant mixed. In addition to the above requirements, ensure that the subgrade materials used underneath the soil-cement base meets the sulfates and PH requirements of Subsection 814.2.02.A. Place materials only on dry, thawed subgrade or subbase.
2. For Projects that require Central Plant mixed soil-cement base, the Subgrade or Subbase directly shall be graded with a fine grader as outlined in Subsection 300.3.02.H.

301.3.04 Fabrication

General Provisions 101 through 150.

301.3.05 Construction

A. In-Place Mixing

1. Soil

If additional soil is needed on the roadbed, place and spread the soil uniformly to the proper depth to obtain the specified thickness.
2. Pulverization

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Pulverize the roadbed materials as follows:

- a. Loosen and pulverize roadbed materials to the width and depth to be stabilized without disturbing or damaging the underlying subgrade.
- b. Continue pulverizing until 100 percent of roadbed material passes through a 1-1/2 in. (37.5 mm) sieve, and until at least 80 percent of the soil, excluding any stone or gravel, passes through a No. 4 (4.75 mm) sieve.
- c. Add water to assist pulverization if necessary.
- d. Remove all roots, sod, and rocks that exceed 3 in. (75 mm) in diameter.
- e. Remove all other harmful materials.

3. Moisture Adjustments

Immediately before spreading cement, adjust the moisture content of the in-place material so it will stabilize to within 100 to 120 percent of optimum moisture (amount of moisture in the mixture at maximum dry density).

4. Cement

Spread cement as follows:

- a. Uniformly spread the required amount of Portland cement with a cyclone-type mechanical spreader or its equivalent.
- b. Apply the Portland cement at a rate that ensures the pounds spread are within ± 10 percent of the amount specified. Furnish a square-yard cloth, scales and personnel for checking the spread rate of cement placed.
- c. Apply cement on soils with a moisture content less than 120 percent of optimum.
- d. Apply cement on days when wind will not interfere with spreading.
- e. If the cement content is below the 10 percent limit in the mixing area, add additional cement to bring the affected area within the tolerance specified and recalibrate the mechanical spreader's spread rate. If the cement content is more than the 10 percent limit in the mixing area, the excess quantity will be deducted from the Contractor's pay for cement.
- f. Regulate operations to limit the application of cement to sections small enough so that all of the compacting and finishing operations specified in Subsection 301.3.05.B.7, *Compacting and Finishing* can be completed within the required time limits.
- g. Pass only spreading and mixing equipment over the spread cement. Operate this equipment so that it does not displace cement.
- h. Replace damaged cement at no additional cost the Department when damage is caused by:
 - Hydration due to rain, before or during mixing operations
 - Spreading procedures contrary to the requirements mentioned above
 - Displacement by the Contractor's equipment or other traffic

5. Mixing

Mix the material as follows:

Begin mixing as soon as practical after the cement is spread and continue until a homogeneous and uniform mixture is produced. If the equipment does not produce a homogeneous and uniform mixture meeting these specifications, make any necessary changes to meet the Engineer's requirements.

6. Road Methods

i. Multiple Pass Mixing

Perform multiple pass mixing as follows:

- 1) After spreading the cement, mix it with the material to be treated.
- 2) Ensure that the material has been adjusted for moisture as stated in Subsection 301.3.05.B.7.c, *Moisture Control*.

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- 3) Continue mixing with successive passes until a uniform mixture of cement and soil, or soil-aggregate is obtained.
 - 4) Immediately after the preliminary mixing of cement and soil or soil-aggregate, add water as needed to maintain or bring the mixture to within the moisture requirements of Subsection 301.3.05.B.7.c, *Moisture Control*.
 - 5) Uniformly mix the additional water to incorporate it into the full depth of the mixture.
7. Compacting and Finishing
- Compact and finish according to Subsection 301.3.05.B.7, *Compacting and Finishing*.

B. Central Plant Mixing

1. Soil

Do the following:

- a. Before introducing any soil into the mixer, pulverize it until 100 percent passes a 1-1/2 in. (37.5 mm) sieve.
- b. Ensure that at least 80 percent of the soil, excluding any stone or gravel, passes through a No. 4 (4.75 mm) sieve.
- c. Have enough stockpile material meeting the requirements of Subsection 300.3.05.B, *Mining and Mixing in a Pit* for at least one day of base construction before operations begin.

2. Cement

Do the following:

- a. Measure cement by weight.
Uniformly add cement into the mixture. The cement incorporated, per ton (megagram) of soil, shall be within ± 5 percent of the amount prescribed by the Engineer.
- b. Perform cement checks that compare the actual percent cement in the mixture with the required percent cement specified in the approved Mix Design for the Project on each of the first two tankers supplying cement to the plant. If these checks are within the specified tolerance, one cement check per day will be required.
- c. Perform and make available to the Engineer a minimum of four daily comparison checks between the certified scales and the plant computer to ensure the proper percentage of cement is being incorporated into the mixture between cement checks.
- d. When a cement check is out of the specified tolerance, at least two, passing one-tanker checks, are required before returning to a one cement check per day basis. When three consecutive cement checks fail to meet the specified tolerance, discontinue soil-cement plant production. Correct the problem, and recalibrate the plant as specified in Subsection 300.3.06.A *Monitoring Quality Control* before resuming the work.
- e. When the cement content exceeds the specified tolerance, the Department will deduct the excess cement from the Contractor's pay for cement. When the cement content does not meet the specified tolerance, the Engineer will evaluate the strength of the affected area after 7 days.
- f. Correct any areas of base with deficient strength as specified in the Strength Correction Chart at no additional cost to the Department, regardless of the percent of compaction. This correction also applies to the test section described in Subsection 301.3.05.B.7.a, *Test Section*.
- g. Quantities of cement used in calibrating the plant will also be deducted from the Contractor's pay for cement.

3. Mixing

Do the following:

- a. Measure proportions of soil, cement, and water separately and accurately before mixing.
- b. Charge all materials into the mixer together. Begin mixing immediately.

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- c. Mix until a homogeneous and uniform mixture is produced. If the final blend of materials is not homogeneously mixed or does not meet the moisture range specified in Subsection 301.3.05.B.7.c, *Moisture Control*, cease plant operations until corrections are made in the plant or to the materials.

4. Hauling

Do the following:

- a. Deliver soil-cement material to the project.
- b. Spread soil-cement material so that compaction can begin within 45 minutes after the soil, cement, and water have been charged into the mixer.
- c. Protect the mixture in transit by using a securely fastened waterproof cover large enough to extend down over the sides and the end of the bed of each haul vehicle.

5. Spreading

Spread the soil-cement mixture as follows:

- a. Use an approved mixture spreader as specified in Subsection 300.3.02.D, *Mixture Spreader* to obtain the specified thickness. Spread the mixture the full width of the area to be covered.
- b. Ensure that trucks and other construction equipment, including motor graders, do not travel over the material until compaction equipment has made initial passes over the mixture.
- c. Ensure that less than 30 minutes elapse between the placement of cement-treated material in adjacent lanes at any location, unless longitudinal joints are specified.

6. Thickness of Course

Compact the soil-cement base to a maximum thickness of 10 in. (250 mm). Place the full thickness in one course only and compact as specified in Subsection 301.3.05.B.7, *Compacting and Finishing* below.

7. Compacting and Finishing

a. Test Section

Construct a test section as follows:

- 1) Use the first section of each constructed soil-cement base course as a test section.
- 2) Use a test section between 350 ft. (100 m) and 500 ft. (150 m) long for the designated width.
- 3) Before constructing a test section, submit a Construction Work Plan to the Engineer for approval. The Construction Work Plan must indicate proposed equipment and compaction procedures.
- 4) If the Construction Work Plan is approved, the Engineer will evaluate the Work Plan during test section construction. The Engineer will evaluate compaction, moisture, homogeneity of mixture, thickness of course, and laminations or compaction planes (scabbing).
- 5) If the Engineer determines that the Work Plan is not satisfactory, revise the compaction procedure and augment or replace equipment, as necessary, to complete work according to the specifications.

b. Time Limits

Observe the following time limits:

- 1) Begin compaction within 45 minutes of the time water is added to the soil-cement mixture.
- 2) Complete compaction within 2 hours.
- 3) Complete all operations in four hours, from adding cement to finishing the surface.

c. Moisture Control

Control moisture as follows:

- 1) During compaction, ensure a uniform moisture content of the mixture that is between 100 and 120 percent of the optimum moisture content.
- 2) If the moisture content exceeds the tolerance at any time, cease operations immediately and make the adjustments necessary to bring the moisture content within tolerance.
- 3) Do not use materials that “pump” under construction traffic, regardless of moisture content.

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d. Additional Compaction Requirements

Perform the following additional compaction requirements:

- 1) Compact the soil-cement base, subbase, or shoulder course to at least 98 percent of the maximum dry density as determined in this Subsection.
- 2) Do not perform vibratory compaction on materials more than 1-1/2 hours old, measured from the time the cement was added to the mixture.
- 3) Uniformly compact the mixture and then fine-grade the surface to the line, grade, and cross-section shown on the Plans.
- 4) Loosened material accumulated during this process is considered waste and is to be removed from the Project. Do not use additional layers of cement-treated materials in order to conform to cross-sectional or grade requirements.
- 5) Use a pneumatic-tired roller to roll the finished surface until the surface is smooth, closely knit, free from cracks, and in conformance with the proper line, grade, and cross-section.
If the Engineer requires, lightly apply water to the finished surface to aid in sealing the completed base and preparing the surface for priming.
- 6) At any place inaccessible to the roller, secure the required compaction with mechanical tampers approved by the Engineer. The same compaction requirements stated in the above subsection apply.

e. Additional Finishing Requirements

Perform the following additional finishing requirements:

- 1) Use the automatically controlled screed equipment when required by Subsection 300.3.03.H, *Fine Grading Machine* of the Specifications. Control fine-grading for this requirement with sensing wires or a taut string line. Furnish, install, and maintain this operation as a part of this Pay Item. When automatically controlled screed equipment is not required, fine-grading with motor graders is permitted.
- 2) Fine-grade the surface of the cement-stabilized subbase for Portland cement concrete pavement or the cement-stabilized base for asphaltic concrete pavement.
- 3) Fine-grade immediately after placement and compaction. Roll the subbase again according to this subsection.

8. Construction Joints

Form construction joints as follows:

- a. Form a straight transverse joint at the end of each day's construction or when the work is interrupted so that the material cannot be compacted within the time limit specified in this subsection.
- b. Create the straight transverse joint by cutting back into the completed work to form a true vertical face free of loose or shattered material.
- c. Form the joint at least 2 ft. (600 mm) from the point at which the strike-off plate of the spreader comes to rest at the end of the day's work, or at the point of interruption.
- d. Form a longitudinal joint as described above if the soil-cement mixture is placed over a large area where it is impractical to complete the full width during one day's work. Use the procedure for forming a straight transverse joint. Ensure that waste material is removed from the compacted base.

9. Prime

Apply bituminous prime to the finished surface of the base course at the end of each day or as soon as the Engineer determines it is practical. Apply prime only to an entirely moist surface.

If weather delays prime application, apply prime as soon as the surface moisture is adequate. Apply prime according to Section 412.

Apply a single #89 surface treatment layer over the primed base course.

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10. Opening to Traffic

No traffic or equipment is permitted to operate on the finished base, subbase, or shoulders until the prime has hardened enough so that it does not pick up under traffic. For the first seven days after priming, traffic is restricted to lightweight vehicles such as passenger cars and pickup trucks. Vehicles with an average axle load exceeding 20,000 pounds (9 Mg) will not be allowed on the finished base or subbase at any time.

Correct any failures caused by traffic at no additional cost to the Department.

11. Protection of Course

Maintain the base, subbase, or shoulder course constructed under these specifications until the Engineer determines that it has sufficiently cured and is ready to be covered with the next base or pavement course. Make repairs specified in Subsection 300.3.06.B, *Repairing Defects* whenever defects appear. This preservation action does not relieve the Contractor of his responsibility to maintain the work until final acceptance as specified in Section 105.

301.3.06 Quality Acceptance

A. Compaction Tests

Test compaction as follows:

1. Determine the maximum dry density for central plant mix construction from representative samples of the material to be compacted according to GDT 19.
2. Determine the maximum dry density for mixed-in-place construction according to GDT 19 or GDT 67 .
3. Determine the in-place density of the cement-stabilized base, subbase, or shoulders as soon as possible after compaction, but before the cement sets. Determine in-place density according to GDT 20, GDT 21, or GDT 59.

B. Finished Surface Tests

Test the finished surface as follows:

1. Check the finished surface of the cement stabilized base, subbase, or shoulder course transversely.
2. Place a 15 ft. (4.5 m) straightedge parallel to the centerline. Additionally, use one of the following tools:
 - A template, cut true to the required cross-section and set with a spirit level on non-super elevated sections
 - A system of ordinates, measured from a string line
 - A surveyor's level
3. Ensure that ordinates measured from the bottom of the template, string line, or straightedge to the surface do not exceed 1/4 in. (6 mm) at any point. Rod readings shall not deviate more than 0.02 ft. (6 mm) from the required readings.
4. Correct any variations from requirements immediately, as specified in Subsection 300.3.05.D.

C. Tolerances

1. Thickness Measurements

- a. Thickness requirements apply to shoulder construction where the Plans specify a uniform thickness, or where the shoulders will be surfaced. Do the following:
- b. Determine the thickness of the base, subbase, or shoulder course, by making as many checks as necessary to determine the average thickness.

2. Deficient Thickness

- a. If any measurement is deficient in thickness more than 1/2 in. (13 mm), make additional measurements to determine the deficient area.
- b. Correct any area deficient by more than 1/2 in. (13 mm) to the design thickness by using one of the following methods according to these Specifications:

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- Apply Asphaltic Concrete 9.5 mm Superpave.
- Remove material to the full depth of the course and reconstruct to the required thickness.

No payment will be made for any 9.5 mm Superpave asphaltic concrete applied to correct deficiencies nor will payment be made for removing and reconstructing the deficient work.

3. Average Thickness

Average thickness is measured as follows:

- The average thickness per linear mile (kilometer) is determined from all measurements within the mile (kilometer) increments.
- The average thickness shall not exceed the specified thickness by more than 1/2 in. (13 mm).
- If the unit of payment is by the ton (megagram) or cubic yard (meter), and the average thickness for any mile (kilometer) increment exceeds the allowable 1/2 in. (13 mm) tolerance, payment for the excess quantity in that increment will be deducted.
- The excess quantity is calculated by multiplying the average thickness that exceeds the allowable 1/2 in. (13 mm) tolerance by the surface area of the base, subbase, or shoulder, as applicable.

4. Strength

Do the following:

- Ensure that the strength of the soil-cement base, subbase, or shoulder course is at least 300 psi (2070 kPa), as determined from testing the unconfined compressive strength of cores from the completed course in accordance with GDT 86.
- If a strength test falls below 300 psi (2070 kPa), do the following:
 - 1) Isolate the affected area by securing additional cores 75 ft. (22 meters) in each direction until passing strengths are achieved.
 - 2) Average all compressive strengths in the affected area to determine the basis for corrective work according to the table below or the Engineer's directions.

5. Compaction

The compaction requirement for soil-cement base, subbase, or shoulder course shall be a minimum of 98 percent of the specified theoretical density.

If any compaction test falls below 98 percent, core and retest the represented area for compressive strength determination after 7 days. If the strength is 300 psi (2070 kPa) or greater, no correction will be required. If the strength is less than 300 psi (2070 kPa), isolate the affected area by obtaining additional cores.

Average all compressive strengths in the affected area to determine the basis for corrective work, according to the following table.

Compressive Strength	Corrective Work
300 psi (2070 kPa) or greater	None
200 psi (1379 kPa) to 299 psi (2062 kPa)	6 in., 8 in., & 10 in. (150 mm, 200 mm, & 250 mm) base - add 135 lbs./yd ² (75 kg/m ²) asphaltic concrete
Less than 200 psi (1379 kPa)	Reconstruct the affected area

Ensure that a corrected area requiring asphaltic concrete is at least 150 ft. (45 m) long.

Perform corrective work requiring asphaltic concrete or reconstruction at no additional cost to the Department.

301.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

301.4 Measurement

A. Soil-Cement Material

Soil-cement material is measured by the cubic yard (meter), loose volume, as specified in Section 109, during mixed-in-place construction if it is necessary to add materials to the roadbed or to build up the base, subbase, or shoulders with new material.

B. Soil-Cement Stabilized Base, Subbase, and Shoulder Course

Soil-cement stabilized base, subbase, and shoulder course are measured as follows:

1. The surface length is measured along the centerline when payment is specified by the square yard (meter). The width is specified on the plans.
 - a. Irregular areas, such as turnouts and intersections, are measured by the square yard (meter).
 - b. Material is measured in tons (megagrams), as mixed and accepted, when payment is specified by the ton (megagram).

The actual weight is determined by weighing each loaded vehicle on a required motor truck scale as the material is hauled to the roadway. The actual weight will be the pay weight; no deduction will be made for the weight of the cement.

C. Portland Cement

Portland cement is measured by the ton (megagram).

D. Prime

Bituminous prime is not measured for separate payment. Include the cost of furnishing and applying bituminous prime according to the provisions of Section 412 in the Unit Price Bid for each individual base item.

E. Unsuitable Material

Unsuitable materials that have been removed are measured and paid for according to the Earthwork Item in the Contract.

301.4.01 Limits

General Provisions 101 through 150.

301.5 Payment

A. Soil-Cement Material

Where in-place mixing is done, and when it is necessary to add other materials to those in the roadbed or to build up the base, subbase, and shoulders entirely with new materials, the added soil-cement material, in place and accepted, will be paid at the Contract Price per cubic yard (meter). Payment will be full compensation for soil-cement material; mixing in the pit; loading, hauling, and unloading; and spreading

B. Soil-Cement Stabilized Base, Subbase, and Shoulder Course

Where specified, soil-cement stabilized base, subbase, and shoulder course, in place and accepted, will be paid at the Contract Price per square yard (meter). Payment will be full compensation for roadbed preparation, mixing on the road, shaping, pulverizing, watering, compaction, defect repair, and maintenance.

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C. Pre-mixed Soil-Cement Stabilized Base, Subbase, and Shoulder Course

Where specified, pre-mixed soil-cement stabilized base, subbase, and shoulder course, in place and accepted, will be paid at the Contract Price per ton (megagram) or square yard (meter).

Payment will be full compensation for roadbed preparation; all materials except Portland cement; loading, hauling, and unloading; mixing; spreading; watering; rolling and shaping; and maintenance.

D. Portland Cement

Portland cement will be paid at the Contract Price per ton (megagram). Payment is full compensation for furnishing, hauling, and applying the material. Only Portland cement incorporated in the finished course will be paid; no payment will be made for cement used to correct defects due to the Contractor's negligence, faulty equipment, or plant calibration error.

Payment will be made under:

Item No. 301	Soil-cement material—including material and haul	per cubic yard (meter)
Item No. 301	Soil-cement stabilized base, subbase, and shoulder course ___in. (mm)	per square yard (meter)
Item No. 301	Pre-mixed soil-cement stabilized base, subbase, and shoulder course—including material and haul	per ton (megagram) or per square yard (meter)
Item No. 301	Pre-mixed soil-cement stabilized base and shoulder course—including material and haul	per ton (megagram) or per square yard (meter)
Item No. 301	Portland cement	per ton (megagram)

301.5.01 Adjustments

General Provisions 101 through 150.

Section 315—Cement Stabilized Reclaimed Base Construction (CSRB)

Replace Section 315 with the following:

315.1 General Description

This work includes constructing a cement stabilized base course by pulverizing the existing flexible pavement, underlying base and subgrade, and mixing with Portland cement. Construct according to these specifications and to the lines, grades, thickness, and typical cross-sections shown on the plans or established by the Engineer.

315.1.01 Related References

General Provisions 101 through 150

A. Standard Specifications

Section 109—Measurement and Payment

Section 301—Soil-Cement Construction

Section 412—Bituminous Prime

Section 424—Bituminous Surface Treatment

Section 814—Soil Base Materials

Section 821—Cutback Asphalt

Section 822—Emulsified Asphalt

Section 824—Cationic Asphalt Emulsion

Section 830—Portland Cement

Section 880—Water

B. Referenced Documents

GDT 19 – Determining Maximum Density of Soil-Cement mixtures

GDT 20 – Determining Field Density of soils with <45% retained on the No. 10 sieve and < 10% retained on the 1 in. sieve

GDT 21 - Determining Field Density of soils containing >45% retained on the No.10 sieve or >10% retained on the 1 in. sieve

GDT 59 - Testing Density of roadway materials with Nuclear Gauge

GDT 65 – Laboratory Design of Soil-Cement and Cement Stabilized Graded Aggregate

GDT 67 – Family of Curves Method for determining Maximum Density of soils

GDT 86 – Determining the compressive strength of Cement Stabilized Base cores taken from the roadway

Section 315 — Cement Stabilized Reclaimed Base Construction (CSRB)

315.1.02 Submittals

Prior to construction, submit a Construction Work Plan to the Engineer consisting of the proposed equipment, materials, and operation procedures. If the Engineer determines that the work plan is not satisfactory, revise the procedures and augment or replace equipment, as necessary, to complete the work.

315.1.03 Mix Design

The Contractor shall submit a mix design to the Office of Materials and Testing for approval at least three weeks prior to construction. The Mix Design process shall be completed in accordance with GDOT Test Method/GDT 65 by an accredited materials laboratory. The sampling, testing, proportioning, and documentation shall be completed by an accredited materials laboratory. The Contractor will be responsible for ensuring that appropriate traffic control measures are in place during the sampling operations. In-place samples of the road structure shall be taken at a minimum frequency of 1000 ft. (300m) per two lanes; alternating the sample locations to achieve a sample every 500 lane-feet (152m). Additional samples may be needed to represent material changes and/or problem areas. Each sample shall contain at least 30 lbs. (14kg) of proportionally blended materials to be reclaimed. The Portland cement used in the design process must be from an approved source listed on GDOT's Qualified Products List/QPL3 and representative of the same material to be used in construction.

The mix design submittal to the Office of Materials and Testing shall include the following:

1. Approximately 100 lbs. (45kg) of proportionally blended material from all in-place samples taken from the roadway.
2. A one-gallon sample (plastic container) of the stabilizer used in the mix design.
3. All test data (charts, graphs, spreadsheets, etc.) along with design parameters. Test data should include the target gradation of the blended material, optimum moisture content of mixing, and application rate of the stabilizer to meet the design requirements.

Note: Since the Mix Design is based on source specific materials, any changes to materials or sources will render the design invalid.

315.2 Materials

Ensure that materials meet the requirements of the following GDOT Standard Specifications:

Material	Section
Blotter material (sand)	412.3.05.G.3
Soil Base Material	814.2.02
Cutback asphalt, RC-30, RC-70, RC-250 or MC-30, MC-70, MC-250, CSS-1h, AE-P, CRS-2	821.2.01
Portland Cement (Type I or Type II)	830.2.01
Water	880.2.01
Emulsified Asphalt *AEP, EAP-1	822.2.01
Cationic Emulsified Asphalt *C-AEP,	824.2.01

315.3 Construction Requirements

315.3.01 Personnel

Ensure that only experienced and capable personnel operate equipment.

315.3.02 Equipment

Equipment used in CSRB construction must meet the following requirements and be approved by the Engineer prior to the beginning of construction. All equipment shall be in satisfactory condition and capable of its intended purpose. The Engineer may at any time reject any equipment that is deemed unsafe, erratic, or produces an inadequate performance.

Note: Equipment type, size, operation and condition are subject to the Engineer's approval and must be adjusted and/or replaced upon their request.

A. Reclaimer

CSRB will require a reclaimer unit that meets the following requirements:

1. Designed expressly for reclamation capable of pulverizing and mixing through asphaltic pavement, granular/soil base, Subbases, and subgrade down to depths of at least 12 in. (300mm).
2. Have a cutting drum with a minimum width of 8 ft. (2m).
3. Capable of continuously mixing materials to a homogenous blend and at a consistent depth.
4. Powered by an engine of at least 500 horsepower with steerable front and rear wheels.
5. Controlled by an electronic metering system capable of injecting water directly into the mixing chamber and has automatic sensors to monitor water application and mixing depth.

B. Spreader

For CSRB construction, use a cyclone-type mechanical spreader, or its equivalent, that will spread Portland cement in a relatively dust-free process. The spreader must have an electronic or mechanical metering system which monitors the application rate.

Note: The use of pneumatic tubes to transfer cement or lime directly onto the roadway will not be allowed.

C. Additional Equipment (Water Truck, Compaction and Grading equipment, and Prime Distributer)

Additional equipment necessary to complete the work must be in satisfactory condition and proper for its intended purpose. Compactive equipment includes a sheep's foot roller, vibratory steel wheel roller and a pneumatic rubber tire roller. Use the correct size/type rollers or combination thereof that is capable of achieving the required density. A pressure distributor that complies with GDOT Standard Specifications/Subsection 424.3.02.B will be required to apply the bituminous prime coat.

Note: Equipment type, size, operation and condition are subject to the Engineer's approval and must be adjusted and/or replaced upon their request.

315.3.03 Preparation

Prior to commencing reclaiming operations, blade grass and excess soil a minimum of 12 in. (300mm) from the edge of pavement. Locate, mark and preserve existing centerline, manholes, and utilities (gas, water, and electric lines). Relocate mailboxes and other appurtenances within such proximity to the roadway as to risk damage or interfere with the work. Remove sections of driveway aprons in the Right-of-Way where necessary to permit the reclaimer to operate without damaging the machinery or driveway pavement. If necessary, saw-cut a neat parallel line to the proposed edge of pavement and remove the concrete along the road. After all work is complete, replace appurtenances to their original location as nearly as possible.

315.3.04 Construction

A. Weather Limitations

1. Mix only when the weather permits the course to be finished without interruption and within the time specified.
2. Mix materials only when the moisture of the materials to be used in the mixture meets the specified limits.
3. Begin mixing only when the air temperature is above 40°F in the shade and rising.

B. Moisture Adjustment

Adjust the moisture content of the roadway materials to within 100 to 120 percent of the optimum moisture immediately before spreading the cement. The optimum moisture content is determined by the Job Mix Design and can be adjusted by the Engineer.

C. Cement Application

1. Apply cement on days when wind will not interfere with spreading.
2. Apply cement at the rate specified on the Job Mix Design (as established by GDT-65) and mix to the depth shown on the Plans. The Engineer may alter the spread rate during the progress of construction if necessary. Maintain the application rate within ± 10 percent of that specified by the Engineer.
3. Provide both equipment and personnel to measure the application rate of cement placed. Each tanker of cement shall be checked by using a square yard cloth/certified scales and by determining the overall coverage area of each tanker. Multiple checks may be necessary to ensure that the spread rate is maintained within the ± 10 percent limit.
4. If the cement content falls below the 10 percent limit in the mixing area, add additional cement to bring the affected area within the tolerance specified, make necessary adjustments to the spreader, and perform additional checks to ensure the problem is corrected. If the cement content is more than the 10 percent limit in the mixing area, the excess quantity will be deducted from the Contractor's pay for cement.
5. Regulate operations to limit the application of cement to sections small enough so that all of the mixing, compacting, and finishing operations can be completed within the required time limits.
6. Pass only spreading and mixing equipment over the spread cement and operate this equipment so that it does not displace cement.
7. Replace damaged cement at no cost to the Department when damage is caused by:
 - a. Hydration due to rain, before or during mixing operations.
 - b. Spreading procedures that are contrary to the requirements stated above.
 - c. Displacement by the Contractor's equipment or other traffic.

D. Mixing

1. Begin mixing as soon as possible after the cement is spread and continue until a homogeneous and uniform mixture is produced. The Engineer at any time may require adjustments or replacement of equipment if a homogeneous and uniform mixture conforming to these Specifications is not achieved.
2. Continue pulverizing until the base mixture is uniform in color and conforms to the following gradation requirements:
 - a. 100 percent passing the 3 in. sieve (76.1mm) or the natural size of the in-situ aggregate.
 - b. 55 percent of the roadway material, excluding gravel, passes the No. 4 sieve (4.75mm).
3. Add water as needed to maintain or bring the moisture content to within the moisture requirements immediately after the preliminary mixing of the cement and roadway material.
4. Mix the additional water homogeneously into the full depth of the mixture.

E. Compaction and Finishing

1. Test Section
 - a. A test section shall be constructed with the first tanker of cement delivered to the project. The length of the test section will be determined by the area in which the entire tanker of cement will cover.
 - b. The Engineer will evaluate compaction, moisture, homogeneity of mixture, thickness of stabilization, and finished base surface. If the Engineer deems necessary, revise the compaction procedure or replace equipment.
2. Time Limits
 - a. Begin compaction within 45 minutes of the time of the mixing of cement.
 - b. Complete compaction within 2 hours after the cement has been applied.
 - c. Do not perform vibratory compaction on materials more than 90 minutes old, measured from the time cement was added to the mixture.
 - d. Complete all operations within 4 hours from adding cement to finishing the surface.
3. Moisture Control
 - a. During compaction, ensure that the moisture is uniformly distributed throughout the mixture at a level of between 100 and 120 percent of the optimum moisture content.
4. Compaction Requirements
 - a. Use a sheep's foot roller, steel wheel roller or pneumatic-tired roller for initial compactive effort unless an alternate method is approved by the Engineer.
 - b. Compact the cement-stabilized base course to at least 98 percent of the maximum dry density established on the Job Mix Design.
 - c. Uniformly compact the mixture and then shape to the grade, line, and cross-section shown on the Plans.
 - d. Remove all loosened material accumulated during the shaping process. Do not use additional layers of cement-treated materials in order to conform to cross-sectional or grade requirements.
 - e. Use a pneumatic-tired roller to roll the finished surface until it is smooth, closely knit, and free from cracks or deformations, and conforming to the proper line, grade, and cross-section.
 - f. In places inaccessible to the roller, obtain the required compaction with mechanical tampers approved by the Engineer. Apply the same compaction requirements as stated in this subsection.
 - g. Perform grading operations immediately after the placement and compaction operations. Roll the stabilized base course again with a pneumatic-tired roller.

F. Construction Joints

1. Form a straight transverse joint at the end of each day's construction or whenever the work is interrupted.
2. Create the straight transverse joint by cutting back into the completed work to form a true vertical face free of loose or shattered material.
3. Form the joint at least 2 ft. (0.6m) from the point where the spreader strike-off plate comes to rest at the end of the day's work, or at the point of interruption.
4. Form a longitudinal joint, as described above, if cement-stabilized mixture is placed over a large area where it is impractical to complete the full width during one day's work. Use the procedure for forming a straight transverse joint. Remove all waste material from the compacted base.

Section 315 — Cement Stabilized Reclaimed Base Construction (CSRB)

G. Priming the Base

1. The surface of the completed base course must be moist cured until the bituminous prime is applied.
2. Apply prime only to an entirely moist surface. If weather delays prime application, apply prime as soon as the surface moisture is adequate.
3. Apply bituminous prime according to GDOT Standard Specifications/Section 412 as soon as possible and in no case later than 24 hours after completion of the finishing operations.
4. Protect finished portions of the cement-stabilized base course that are used by equipment in the construction of an adjoining section to prevent marring or damaging of the completed work. Protect the stabilized area from freezing during the curing period.
5. Apply cure coat depending on project ADT:
 - < 400 ADT: Prime and sand.
 - \geq 400 ADT: Apply single 89 surface treatment layer.

H. Opening to Traffic

1. Correct any failures caused by traffic at no additional cost to the Department. Make repairs specified in GDOT Standard Specifications/Subsection 300.3.06.B whenever defects appear. This preservation action does not relieve the Contractor of his responsibility to maintain the work until final acceptance, as specified in GDOT Standard Specifications/Section 105.

315.3.05 Quality Acceptance

A. Compaction Tests

1. Determine the maximum dry density from representative samples of compacted material, according to GDOT Test Method/GDT 19 or GDT 67.
2. Determine the in-place density of finished courses according to GDOT Test Method/GDT 20, GDT 21 or GDT 59 as soon as possible after compaction but before the cement sets.

B. Gradation Tests

1. Ensure that the gradation of the completely mixed cement-stabilized base course meets the requirements as stated above in Subsection 315.3.04.D.2.

C. Finished Surface Tests

1. Check the finished surface of the cement-stabilized base course transversely using one of the following tools:
 - a. A template cut true to the required cross-section and set with a spirit level on non-super elevated sections.
 - b. A system of ordinates measured from a string line.
 - c. A surveyor's level.
2. Ensure the ordinates measured from the bottom of the template, string line, or straightedge to the surface do not exceed $\frac{1}{2}$ in. (12.5mm) at any point.

D. Thickness Tolerances

1. Determine the thickness of the cement-stabilized base course by making as many checks as necessary to determine the average thickness, but not less than one check per 1000 ft. (300m) per 2 lanes. Checks shall be taken after the completion of the base course and prior to priming.
2. If any measurement is deficient in thickness by more than $\frac{1}{2}$ in. (12.5mm), make additional measurements to isolate the affected area. Correct any area deficient by more than $\frac{1}{2}$ in. (12.5mm) to the design thickness by using one of the following methods:

Section 315 — Cement Stabilized Reclaimed Base Construction (CSRB)

- a. Apply GDOT approved asphaltic concrete 9.5mm Superpave.
- b. Reconstruct to the required thickness.

No payment will be made for any Asphaltic Concrete 9.5mm Superpave used to correct deficiencies nor will payment be made for removing and reconstructing the deficient work.

- 3. If any measurement exceeds thickness by more than ½ in. (12.5mm), make additional measurements to isolate the affected area. If the basis of payment is per cubic yard and the average thickness for any mile increment exceeds the allowable ½ in. (12.5mm) tolerance, the excess quantity in that increment will be deducted from the Contractor's payments. The excess quantity is calculated by multiplying the average thickness that exceeds the allowable ½ in. (12.5mm) tolerance by the surface area of the base, as applicable.

315.4 Measurement

A. Cement-Stabilized Base Course

Measure the surface length along the centerline when payment is specified by the square yard. The width is specified on the plans. Measure irregular areas, such as turnouts and intersections, by the square yard.

B. Portland Cement

Measure Portland cement by the ton.

C. Bituminous Prime

Bituminous prime is not measured for separate payment. Include the cost of furnishing and applying bituminous prime according to the provisions of GDOT Standard Specifications/Section 412 in the Unit Price Bid for each individual base item.

315.5 Payment

A. Cement-Stabilized Base Course

Cement-stabilized base, in-place and accepted, will be paid for at the Contract Unit Price per square yard. Payment will be full compensation for roadbed preparation, mixing on the road, shaping, pulverizing, watering, compaction, defect repair, bituminous prime and maintenance.

B. Portland Cement

Portland cement will be paid for at the Contract Unit Price per ton. Payment is full compensation for furnishing, hauling, and applying the material. Only Type I or Type II Portland cement incorporated into the finished course will be paid for, and no payment will be made for cement used to correct defects due to the Contractor's negligence, faulty equipment, or error.

Payment will be made under:

Item No. 315	Cement Treated Base Course	Per square yard (meter)
Item No. 315	Portland Cement	Per ton (megagram)

Section 402—Hot Mix Recycled Asphaltic Concrete

Replace Section 402 with the following:

402.1 General Description

This work includes producing and placing hot mix recycled asphaltic concrete that incorporates reclaimed asphalt pavement (RAP), reclaimed asphalt shingles (RAS), virgin aggregate, hydrated lime, and neat asphalt cement.

402.1.01 Definitions

General Provisions 101 through 150.

402.1.02 Related References

A. Standard Specifications

Section 400—Hot Mix Asphaltic Concrete Construction

Section 800—Coarse Aggregate

Section 828—Hot Mix Asphaltic Concrete Mixtures

B. Referenced Documents

SOP 41 *Guidelines for RAP Stockpile Approval*

402.1.03 Submittals

A. Certified Weight Tickets

Notify the Engineer before removing RAP from a stockpile that belongs to the Department. Submit to the Engineer the certified weight tickets of materials removed from the stockpile.

B. Affidavit

Submit to the laboratory an affidavit stating the sources of stockpiled materials to be used on a State project. Include the following information in the letter:

- State project number
- Location from which the material was removed
- Approximate removal dates
- Mix types removed and the estimated quantity of each type in the stockpiles
- Other available information about the stockpiled material such as percentage of local sand in the RAP

Obtain specific approval from the laboratory to use RAP or RAS stockpiles.

Adhere to Guidelines for RAP Stockpile Approval.

402.2 Materials

A. RAP Material Composition

Use RAP materials from any of the following:

- Existing roadway
- Contractor's RAP stockpile that has been approved by the Department

Section 402 – Hot Mix Recycled Asphaltic Concrete

- Department stockpile

NOTE: The location of Department RAP material stockpiles will be given on the plans.

Do not use RAP materials that contain alluvial gravel or local sand in any mixture placed on interstate projects except for mixtures used in shoulder construction. When used in shoulder construction, limit RAP containing local sand or alluvial gravel so that the sand or gravel contributes no more than 20 percent of the total aggregate portion of the mix.

1. RAP Percentage

For non-interstate projects, limit the percentage of RAP allowed in recycled mixes so that the overall amount of alluvial gravel does not exceed 5 percent of the total mix. The percentage of alluvial gravel, local sand, and Group I material in the RAP will be determined through petrographic analysis or available records.

2. RAP furnished to the Contractor but not used in the work remains the Contractor's property.

RAP used in the recycled mixtures for mainline or ramps (if applicable) may make up from 0 to 40 percent of the mixture depending on the amount of RAP available, the production facilities, and whether the mixture meets the requirements in Section 828.

The maximum ratio of RAP material to the recycled mixtures other than SMA is 40 percent for continuous mix type plants and 25 percent for batch type plants. The maximum ratio of RAP material to the recycled mixture is 15 percent for Stone Matrix Asphalt (SMA) mixes.

3. Process RAP Material

Process RAP material to be used in the recycled mixture so that 100 percent will pass the 2 in. (50 mm) sieve. Additional crushing and sizing may be required if the RAP aggregate exceeds the maximum sieve size for the mix type as shown in Section 828. Obtain representative materials from the RAP stockpile for the mix design.

B. RAS Material

RAS materials are produced as a by-product of manufacturing roofing shingles and/or discarded shingle scrap from the reroofing of buildings.

1. Limit the amount of RAS material used in the recycled mixture to no greater than 5 percent of the total mixture weight.
2. Shred the RAS material before incorporating it into the mix to ensure that 100 percent of the shredded pieces are less than 1/2 in. (12.5 mm) in any dimension.
3. Remove all foreign materials such as paper, roofing nails, wood, or metal flashing.
4. Provide test results for Bulk Sample Analysis, known as Polarized Light Microscopy, if post-consumer shingles are used to certify the RAS material is free of asbestos. Test stockpiles at the rate of one test per 1000 tons (megagrams) prior to processing.

Other than as specifically stated in this Subsection, ensure that RAS material is used according to the same requirements as described for RAP material.

C. Asphaltic Concrete Removed from an Existing Roadway

Asphaltic concrete removed from an existing roadway becomes the Contractor's property unless specified otherwise on the plans. RAP material retained by the Department is designated on the plans, and the RAP shall be stockpiled at the location specified on the plans.

D. Local Sand and Group I Material in RAP

Use of local sand in recycled mixes is restricted as stipulated in Section 828 for the Project. However, RAP which contains local sand may be used in surface and intermediate layers of non-interstate projects so long as the RAP percentage used does not contribute more than 5% local sand to the total aggregate portion of the mix. The amount of local sand in the RAP material shall be considered when determining the percentage of local sand in the total mix.

Section 402 – Hot Mix Recycled Asphaltic Concrete

Where Pay Items specify that Group II only aggregate is to be used, RAP which consists primarily of Group II aggregate, but contains some Group I aggregate, shall be limited such that the Group I aggregate makes up no more than 5 percent of the total aggregate portion of the mix. When a Blend I mix is specified, any Group I materials in the RAP will be considered when determining the Group I portion allowed in the total mix as specified in Subsection 828.2.A.2.

E. Asphalt Cement

Using laboratory evaluations, the Department will determine the asphalt cement grade to be used in the recycled mixture. The asphalt cement shall meet the requirements of Section 820.

When the asphalt cement is blended with asphalt cement recovered from the RAP material and after tests on residue from thin film oven tests, the asphalt cement shall have a viscosity of 6,000 to 16,000 poises (600 to 1600 Pa) or as approved by the Engineer. Recover asphalt cement from the recycled mixture to verify that the specified viscosity is being met.

If the Engineer determines during construction that the selected asphalt cement grade is not performing satisfactorily, the Department may change the asphalt cement grade in the mixture, with no change in the Contract Unit Price.

F. Recycled Mixture

The recycled mixture shall be a homogenous mixture of RAP or RAS material, virgin aggregate, hydrated lime, and neat asphalt cement. Ensure that the mixture conforms to an approved mixture design outlined in Section 828.

402.2.01 Delivery, Storage, and Handling

Separate the stockpiles by Project sources and by Group I and Group II aggregate types. Erect a sign on each stockpile to identify the source(s).

If RAP material from different project sources becomes intermixed in a stockpile, only use those materials when approved by the laboratory.

The Department may reject by visual inspection stockpiles that are not clean and free of foreign materials.

402.3 Construction Requirements

402.3.01 Personnel

General Provisions 101 through 150.

402.3.02 Equipment

A. Hot Mix Plant

Use a hot mix plant for the recycling process with necessary modifications approved by the Engineer to process recycled material. Design, equip, and operate the plant so that the proportioning, heating, and mixing yields a uniform final mixture within the job mix formula tolerances.

B. Cold Feed Bin

Proportion the RAP or RAS material using a separate cold feed bin. Ensure that the material meets the size requirements in Subsection 402.2, *Materials*. The ratio of the RAP or RAS to virgin aggregate shall be controlled gravimetrically.

C. Electronic Belt Weighing Devices

Use electronic belt weighing devices to monitor the flow of RAP or RAS and the flow of virgin aggregate. For batch-type plants, the RAP or RAS portion of the mix may be weighed in a weigh hopper before incorporating it into the pugmill. The RAP shall be screened through a 2-inch maximum sized screen prior to crossing the cold feed weigh. Ensure the amount of RAP material incorporated into the asphalt plant does not change after this final measurement is processed by the asphalt plant computer.

Section 402 – Hot Mix Recycled Asphaltic Concrete

D. Feeders and Conveyors

Equip plants with an interlocking system of feeders and conveyors that synchronize the RAP or RAS material flow with the virgin aggregate flow. Ensure that the electronic controls track the flow rates indicated by the belt weighing devices and develop the signal to automatically maintain the desired ratio at varying production rates. Design the RAP or RAS feeder bins, conveyor system, and auxiliary bins (if used) to prevent RAP material from segregating and sticking.

402.3.03 Preparation

General Provisions 101 through 150.

402.3.04 Fabrication

General Provisions 101 through 150.

402.3.05 Construction

Follow the requirements in Section 400 for hot mix recycled asphaltic concrete production and placement, materials, equipment, and acceptance plans except as noted or modified in this specification.

402.3.06 Quality Acceptance

The Department may require additional quality control tests to determine the RAP stockpile consistency and the RAP aggregate quality. In this case, conduct at least three extraction/gradation tests from each individual source. Ensure that aggregate meets the quality standards in Section 800.

402.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

402.4 Measurement

Recycled asphaltic concrete mixture, complete in place and accepted, is measured in tons (megagrams). The weight is determined by recorded weights if an approved recording device is used. Or, the weight is determined by weighing each loaded vehicle on an approved motor truck scale as the material is hauled to the roadway.

402.4.01 Limits

General Provisions 101 through 150.

402.5 Payment

The work performed and the materials furnished as described in this specification will be paid for at the Contract Unit Price per ton (megagram). Payment is full compensation for providing materials, hauling and necessary crushing, processing, placing, rolling and finishing the recycled mixture, and providing labor, tools, equipment, and incidentals necessary to complete the work, including hauling and stockpiling RAP or RAS material.

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Payment will be made under:

Item No. 402	Recycled asphaltic concrete ___ mm Superpave, group-blend, including bituminous materials	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete ___ mm Superpave, group-blend, including bituminous materials and hydrated lime	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete ___ mm Superpave, group-blend, including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete ___ mm Superpave, Type __, group-blend, including bituminous materials and hydrated lime	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete _____mm mix, group-blend, including bituminous materials and hydrated lime	Per ton (megagram)
Item No. 402	_____in. (mm) recycled asphaltic concrete type Superpave, group-blend, including bituminous materials	Per square yard (meter)
Item No. 402	_____in. (mm) recycled asphaltic concrete type Superpave, group-blend, including bituminous materials and hydrated lime	Per square yard (meter)
Item No. 402	_____in. (mm) recycled asphaltic concrete type Superpave, group-blend, including polymer-modified bituminous materials and hydrated lime	Per square yard (meter)
Item No. 402	_____in. (mm) recycled asphaltic concrete _____ mm mix, group-blend, including bituminous materials and hydrated lime	Per square yard (meter)
Item No. 402	Recycled asphaltic concrete patching including bituminous materials	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete patching including bituminous materials and hydrated lime	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete leveling including bituminous materials	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete leveling including bituminous materials and hydrated lime	Per ton (megagram)
Item No. 402	Recycled asphaltic concrete type Stone Matrix Asphalt, group-blend, including polymer-modified bituminous materials and hydrated lime	Per ton (megagram)

A. Materials Produced and Placed During the Adjustment Period

An adjustment period is allowed at the start of mixing operations for each type of mix placed on the Contract. A new adjustment period shall not be granted for a change of producer, mix design or asphalt plant location. The adjustment period is provided to adjust or correct the mix and to establish the construction procedures and sequence of operations.

The adjustment period consists of the tons (megagrams) of the affected mix produced and placed on the first day of operation. If this quantity is less than 500 tons (500 Mg), the Engineer may combine the tons (megagrams) produced and placed on the first day of operation with the tons (megagrams) produced and placed on the next production day of the affected mix for the adjustment period.

Section 402 – Hot Mix Recycled Asphaltic Concrete

The material produced and placed during the mixture adjustment period is one lot. If the mix is adjusted during this period, a new lot may be necessary, but a new adjustment period will not be permitted.

This material shall be paid for at 100 percent of the Contract Unit Price provided it meets the minimum requirements for a 1.00 pay factor for asphalt cement content and a 0.90 pay factor for gradation in the Mixture Acceptance Schedule—Table 9 or 10.

If the material placed during the adjustment period fails to meet the above requirements, it will be paid for using the applicable acceptance schedule. However, when mixture used for leveling at a spread rate of 90 lbs./yd² (50 kg/m²) or less is also used for the surface mix at a spread rate greater than 90 lbs./yd² (50 kg/m²), an additional adjustment period will be allowed for compaction only. This material will be paid for at a 1.00 pay factor provided it:

- Meets the minimum requirements for a 1.00 pay factor in the Mixture Acceptance Schedule—Table 9 or 10 for both asphalt content and gradation.
- Meets the minimum requirements for a 0.90 pay factor in Table 12 of Subsection 400.5.01C, *Calculate Mean Pavement Air Voids*.

Mixture which does not meet these requirements shall be paid for using the applicable acceptance schedule.

B. Determine Lot Acceptance

Pay factor adjustments are based on control sieves and asphalt cement content. The control sieves used in the mixture acceptance schedule for the various types of mix are indicated below:

Control Sieves Used in the Mixture Acceptance Schedule	
Asphaltic concrete 25 mm Superpave	1/2 in., No. 8 (12.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 19 mm SMA	1/2 in., No. 8 (12.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 19 mm Superpave	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm Superpave	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 12.5 mm SMA	3/8 in., No. 8 (9.5 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 9.5 mm Superpave	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 9.5 mm SMA	No. 4, No. 8 (4.75 mm, 2.36 mm) sieves and asphalt cement
Asphaltic concrete 4.75 mm Mix	No. 8 (2.36 mm) sieve and asphalt cement

The Department will perform the following tasks:

1. Using the Mixture Acceptance Schedule—Table 9 or 10, of Subsection 400.3.06 to determine the mean of the deviations from the job mix formula per test results per lot.
2. Determine this mean by averaging the actual numeric value of the individual deviations from the job mix formula; disregard whether the deviations are positive or negative amounts.
3. Use the Asphalt Cement Content and Aggregate Gradation of Asphalt Concrete Mixture Acceptance Schedule—Table 9 or 10 of Subsection 400.3.06 to determine acceptance of surface mixes and the Mixture Acceptance Schedule—Table 10 of Subsection 400.3.06 to determine acceptance of subsurface mixes.

On Contracts involving 1,000 tons (1000 Mg) or less of asphaltic concrete, the mixture is accepted for 100 percent payment of the asphaltic concrete Unit Price provided it meets the following:

4. Minimum requirements for a 1.00 pay factor for asphalt cement content and a 0.90 pay factor for gradation in the applicable Mixture Acceptance Schedule—Table 9 or 10 of Subsection 400.3.06.

Section 402 – Hot Mix Recycled Asphaltic Concrete

5. Minimum requirements for a 0.90 pay factor in Table 12 of Subsection 402.5.01.C, *Calculate Pavement Mean Air Voids*.

If the material placed on Contracts involving 1,000 tons (1000 Mg) or less of asphaltic concrete does not meet the above requirements, the material will be paid for using the applicable acceptance schedule.

C. Calculate Pavement Mean Air Voids

The Department will determine the percent of maximum air voids for each lot by dividing the pavement mean air voids by the maximum pavement mean air voids acceptable.

The Department will determine the payment for each lot by multiplying the Contract Unit Price by the adjusted pay factor shown in the following Air Voids Acceptance schedule:

TABLE 12 - AIR VOIDS ACCEPTANCE SCHEDULE

Pay Factor	Percent of Maximum Air Voids (Lot Average of Tests)	Percent of Maximum Air Voids (Lot Average all Tests) (for Reevaluations)
1.00	≤100	≤100
0.97	100.1 – 105	100.1 – 104
0.95	105.1 – 112	104.1 – 109
0.90	112.1 – 124	109.1 – 118
0.80	124.1 – 149	118.1 – 136
0.70	149.1 – 172	136.1 – 153
0.50	172.1 – 191	153.1 – 166

When the range tolerance is exceeded, the Department will apply a pay factor of 0.95 as described in Subsection 400.3.06.B.2.

D. Asphaltic Concrete for Temporary Detours

Hot mix asphaltic concrete placed on temporary detours that will not remain in place as part of the permanent pavement does not require hydrated lime. Hot mix used for this purpose is paid for at an adjusted Contract Price. The payment for this item shall cover all cost of construction, maintenance and removal of all temporary mix. Hot mix asphaltic concrete placed as temporary mix shall meet requirements established in Subsection 400.3.05.F.

Where the Contract Price of the asphaltic concrete for permanent pavement is let by the ton (megagram), the Contract Price for the asphaltic concrete placed on temporary detours is adjusted by subtracting \$1.75/ton (\$2.00/mg) of mix used.

Where the Contract price of the mix in the permanent pavement is based on the square yard (meter), obtain the adjusted price for the same mix used on the temporary detour by subtracting \$0.09/yd² (\$0.11/ m²) per 1- in. (25-mm) plan depth.

Further price adjustments required in Subsection 400.3.06, *Quality Acceptance*, which are based on the appropriate adjusted Contract Price for mix used in the temporary detour work shall apply should temporary mix be left in place. Hot mix asphalt produced as temporary mix containing no hydrated lime shall be removed and replaced with permanent mix containing hydrated lime.

E. Determine Lot Payment

Determine the lot payment as follows:

Section 402 – Hot Mix Recycled Asphaltic Concrete

1. When one of the pay factors for a specific acceptance lot is less than 1.0, determine the payment for the lot by multiplying the Contract Unit Price by the adjusted pay factor.
2. When two or more pay factors for a specific acceptance lot are less than 1.0, determine the adjusted payment by multiplying the Contract Unit Price by the lowest pay factor.

If the mean of the deviations from the job mix formula of the tests for a sieve or asphalt cement content exceeds the tolerances established in the Mixture Acceptance Schedule—Table 9 or 10 and if the Engineer determines that the material need not be removed and replaced, the lot may be accepted at an adjusted unit price as determined by the Engineer. If the pavement mean air voids exceed the tolerances established in the Air Voids Acceptance Schedule – Table 12, remove and replace the materials at the Contractor’s expense.

If the Engineer determines that the material is not acceptable to leave in place, remove and replace the materials at the Contractor’s expense.

Section 407—Asphalt-Rubber Joint and Crack Seal

407.1 General Description

This work includes filling (Type M) or sealing (Type S) joints and cracks in existing pavements with rubber asphalt mixtures. A polymer-modified asphalt rubber (PMAR) blend may be used in lieu of both Type M and Type S.

407.1.01 Definitions

Type M: Used to fill joints and cracks in Portland cement concrete or asphaltic concrete pavements when required by the plans before placing an overlay.

Type S: Used to seal joints and cracks in Portland cement concrete and asphaltic concrete pavements and shoulders when not placing an overlay.

407.1.02 Related References

A. Standard Specifications

Section 820—Asphalt Cement

B. Referenced Documents

AASHTO T51

ASTM D 4

ASTM D 36

ASTM D 5329

ASTM D 7173

GDT-2

SOP 22

QPL 92

407.1.03 Submittals

Provide a Certificate of Analysis certifying each lot of premixed material meets the requirements of this specification and submit the test results of each lot for each project. Ensure each sealant lot is delivered in containers with the manufacturer's name or trademark and lot number plainly marked.

When instructed by the Engineer, furnish premixed samples and samples of the individual components of premixed material as follows:

- At least 20 lbs. (10 kg) of rubber representative of each lot
- At least 5 gal (18 L) of asphalt containing additives as proportioned
- Proportional quantities of mixing aids or additives not included above
- Packaged premixed sealant material weighing no more than 30 lbs. (14 kg)

407.2 Materials

Ensure the sealant material is a premixed, asphalt-rubber sealant mixture evaluated in accordance with SOP 22 and listed on QPLs 92-A, 92-B and/or 92-C. Ensure the mixture is a blend of asphalt cement, aromatic extender oil(s), and recycled or reclaimed tire crumb rubber with rubber contents meeting the requirements specified in Table 2. The blending will be conducted in a closely controlled manufacturing process as detailed in the manufacturer's submitted Quality Control Plan. Produce a mixture with the following properties:

Section 407 — Asphalt-Rubber Joint and Crack Seal

A. Workability

The mixture pours readily and penetrates a 1/4 in. (6 mm) pavement joint or crack to a depth of at least 1 in. (25 mm) when the application temperature of the fully reacted mixture is 350 °F (177 °C) and the air temperature is 35 °F (2 °C) or higher.

The mixture, when placed in conventional field installation equipment, readily melts to a pumping consistency after being heated to 400 °F (204 °C) for 2 hours maximum. The mixture remains in a pumping consistency when the temperature of the field installation equipment is reduced to the normal operating temperature range of 300 °F to 350 °F (149 °C to 177 °C).

B. Curing

The mixture contains no water or volatile solvents and cures immediately when cooled to a sufficient viscosity to prevent tracking caused by traffic.

C. Softening Point, Flexibility and Rubber Content.

When a fully reacted mixture sample of asphalt-rubber has been heated at 350 °F (177 °C) for one hour, or when a PMAR blend has been heated at 380 °F (194 °C) for one hour, ensure it passes the following laboratory tests:

1. Softening Point

The minimum softening point by ring and ball described in ASTM D 36 is as follows:

TABLE 1 – MINIMUM SOFTENING POINT

PMAR	185 °F (85 °C)
Type S	135 °F (57 °C)
Type M	150 °F (65 °C)

2. Flexibility

Bend a 1/8 in. (3 mm) thick x 1 in. (25 mm) wide x 6 in. (150 mm) long mixture specimen after conditioning to 10 °F (-12 °C) at a minimum bending rate of 9 degrees per second (10 seconds maximum for a 90° bend) over a 1 in. (25 mm) diameter mandrel without cracking.

3. Rubber Content %

Type M and Type S minimum rubber content %.

TABLE 2 – TYPE S AND TYPE M MINIMUM RUBBER CONTENT

Type S	15% minimum
Type M	15% minimum

D. Separation

Test the PMAR blend for phase separation by pouring two representative samples of the mixture into aluminum tubes measuring 1 in. (25 mm) in diameter and 5-1/2 in. (140 mm) long as described in ASTM D 7173. Cure the samples at 325 °F (163 °C) for 48 hours. Take samples from the top and bottom of each tube and determine softening point as described in ASTM D 36. Average the test results from the top and bottom samples. If there is 4 percent or more difference between the average test result and either of the top or bottom test results, reject the mixture due to separation.

E. Adhesion

When cooled, the mixture bonds strongly to both asphalt and concrete pavement surfaces. The mixture contains no materials chemically reactive with these surfaces to reduce the short-term and long-term adhesion bonds.

Section 407 — Asphalt-Rubber Joint and Crack Seal

F. Acceptable Recycled or Reclaimed Tire Crumb Rubber

Before the rubber is added, ensure the asphalt cement used in the mixture conforms to the requirements of Section 820.2.01, PG 58-22 or PG 64-22.

Ensure the recycled, reclaimed tire crumb rubber used in the mixture meets the following requirements:

- Obtained from used pneumatic tires (such as automobile, truck, bus, etc.)—not solid tires and non-tire rubber sources
- Produced from an ambient or cryogenic grinding process (crushes, tears, fractures or grinds, the used rubber tires and produces rubber particles with a ragged, sponge-like surface). Tire buffings are prohibited.
- Contains recycled, vulcanized crumb rubber and/or reclaimed (devulcanized) rubber
- Contains at least 25 percent natural rubber by weight of the total rubber portion of the mixture
- Contains no more than 0.1 percent fabric
- Free of wire and other contaminating materials, except up to four percent calcium carbonate or talc to prevent rubber particles from sticking
- Contains no rubber particles greater than 1/4 in. (6 mm) long
- Meets the following gradation requirements:

TABLE 3 – RECYCLED OR RECLAIMED TIRE CRUMB RUBBER GRADATION

Sieve Size	Percent Passing
No. 10 (2.0 mm)	100%
No. 16 (1.18 mm)	95 to 100%
No. 30 (600 µm)	40 to 80%
No. 80 (180 µm)	0 to 5%

G. Polymer-modified Asphalt Rubber

If a PMAR blend is used, ensure it meets the following additional requirements:

TABLE 4 – POLYMER-MODIFIED ASPHALT RUBBER PROPERTIES (PMAR)

PROPERTY	SPECIFICATION LIMITS
Cone Penetration, 77 °F (25 °C) (ASTM D 5329)	30 - 60 dmm
Resilience, 77 °F (25 °C), % Recovery (ASTM D 5329)	30% minimum
Ductility, 77 °F (25 °C), 50 mm/minute (ASSHTO T-51)	300 mm minimum
Asphalt Compatibility (ASTM D 5329)	Pass
Bitumen Content (ASTM D 4)	60 – 70 %
Tensile Adhesion (ASTM D 5329)	350 % minimum
Rotational Viscosity (Brookfield), No. 5 spindle, 20 RPM, 400 °F (205 °C)	3,000 – 15,000 cp
Rubber Content % (GDT-2)	12% minimum

407.2.01 Delivery, Storage, and Handling

Package the premixed sealant material in units weighing no more than 30 lbs. (14 kg) with a maximum of two 30 lb. (14 kg) units per shipping container. Ensure the plastic film used to package the units melts at normal application temperatures when placed in the installation equipment.

407.3 Construction Requirements

407.3.01 Personnel

General Provisions 101 through 150.

407.3.02 Equipment

A. Field Installation Equipment

Use field installation equipment that produces or maintains specified temperatures, even if filled to capacity.

Ensure the equipment produces or maintains a homogenous mixture of asphalt and rubber at a uniform temperature without hot or cool spots or rubber and asphalt segregation in the mixture.

B. Crack Filling Equipment

Ensure the equipment for filling the joints and cracks directs the sealant into the crack. Seal large cracks from the bottom up. Provide squeegees as necessary.

C. Air Compressor(s)

Ensure the air compressors are satisfactory to the Engineer.

407.3.03 Preparation

A. Joint and Crack Preparation

Use compressed air to thoroughly clean the joints and cracks to be sealed.

Clean the pavement surface and check the joints and cracks to ensure they are free of vegetation, dirt, dust, moisture, and other foreign material.

407.3.04 Fabrication

General Provisions 101 through 150.

407.3.05 Construction

A. Restrictions

Do not seal joints and cracks if:

- The joint or crack surface to be treated is not thoroughly dry.
- Rain is imminent.
- The air temperature is below 35 °F (2 °C).

B. Procedure

Follow this procedure to seal joints and cracks:

1. Place the prepackaged sealant mixture in the field installation equipment.
2. Heat the sealant mixture for the proper time and temperature to provide a full reaction between the asphalt and rubber.
3. Apply the mixture at the specified application temperature according to the manufacturer's recommendations or the laboratory's approval.
4. Carefully fill the joint or cracks, slightly overfull. Strike off the excess with a V-shaped squeegee to feather the sealant out to a width of approximately 2 in. (50 mm).

Section 407 — Asphalt-Rubber Joint and Crack Seal

407.3.06 Quality Acceptance

If the packaged units are bonded or stuck together or to the shipping container, or if packaging staples or fasteners cause sealant contamination, the material may be rejected as determined by the Engineer.

The manufacturer must meet the requirements of this Specification and furnish evidence of successful field installation and performance under similar environmental and project conditions.

407.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

407.4 Measurement

Joints and cracks will be measured by the linear foot (meter) by surface measure.

407.4.01 Limits

General Provisions 101 through 150.

407.5 Payment

Joints and cracks sealed according to the plans and this specification will be paid for at the Contract Unit Price bid.

Payment is full compensation for furnishing all materials and performing the work.

Payment will be made under:

Item No. 407	Polymer-modified asphalt-rubber joint and crack seal	Per linear foot (meter)
Item No. 407	Asphalt-rubber joint and crack seal, type "S"	Per linear foot (meter)
Item No. 407	Asphalt-rubber joint and crack seal, type "M"	Per linear foot (meter)

407.5.01 Adjustments

General Provisions 101 through 150.

Section 413—Bituminous Tack Coat

413.1 General Description

This work includes furnishing and applying a bituminous tack coat on a prepared road surface including cleaning the road surface.

413.1.01 Definitions

General Provisions 101 through 150.

413.1.02 Related References

A. Standard Specifications

Section 109—Measurement and Payment

Section 400—Hot Mix Asphaltic Concrete Construction

Section 424—Bituminous Surface Treatment

Section 427—Emulsified Asphalt Slurry Seal

Section 820—Asphalt Cement

Section 822 – Emulsified Asphalt

Section 824—Cationic Asphalt Emulsion

SOP 4

B. Referenced Documents

General Provisions 101 through 150.

413.1.03 Submittals

A. Invoices

Furnish formal written invoices from a supplier for the bituminous materials for sole use of tack coat when requested by the Department. Show the following on the Bill of Lading:

- Date Manufactured for emulsified asphalt materials.
- Date shipped
- Quantity in gallons
- Included with or without additives

Section 413 — Bituminous Tack Coat

413.2 Materials

Ensure materials meet the following specifications:

TABLE 1 – BITUMINOUS MATERIALS

Material	Section
Asphalt cement, performance grade PG 58-22, PG 64-22, or PG 67-22	820.2.01
Approved non-tracking Anionic Emulsified Asphalt	822.2.01
Cationic emulsified asphalt CSS-1h, CRS-1h, CRS-2h, CRS-3, CQS-1h and other approved non-tracking cationic emulsified asphalt products listed on QPL 7	824.2.01

Use any of the materials shown in Table 1 as bituminous tack coat for work performed under Section 400 as directed by the Engineer.

The Department may change the grade or type of bituminous materials without a change in the Contract Unit Price if the Engineer determines the grade or type selected is not performing satisfactorily.

413.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

Emulsified Asphalt

Maintain all equipment used for the delivery, storage, and handling of anionic emulsified asphalt or cationic emulsified asphalt to prevent contamination of the emulsion. Transfer anionic emulsified asphalt or cationic emulsified asphalt directly to the pressure distributor from the transport tanker. Emulsified asphalt may be stored in an onsite bituminous storage tank in accordance with Note 1.

Provide and maintain temperature measuring devices to continuously monitor the temperature of anionic emulsified asphalt or cationic emulsified asphalt in storage and in the pressure distributor. Do not allow anionic emulsified asphalt or cationic emulsified asphalt to freeze.

Note 1: Asphalt emulsion that has been stored longer than 30 days from the time of initial manufacture shall be tested and approved for compliance with specified requirements prior to being used as tack coat for work performed under Section 400

413.3 Construction Requirements

413.3.01 Personnel

General Provisions 101 through 150.

413.3.02 Equipment

Provide equipment in good repair, including the following units that meet the requirements of Subsection 424.3.02, *Equipment*.

- Power broom and blower
- Pressure distributor

Provide a properly cleaned distributor to avoid contamination with incompatible materials.

413.3.03 Preparation

General Provisions 101 through 150.

Section 413 — Bituminous Tack Coat

413.3.04 Fabrication

General Provisions 101 through 150.

413.3.05 Construction

A. Seasonal and Weather Limitation

Do not apply tack coat if the existing surface is wet or frozen. Do not place emulsified asphalt if the air temperature in the shade is less than 40 °F (4 °C).

B. Application

Coat the entire areas to be paved with the tack coat unless directed otherwise by the Engineer. Apply tack coat with distributor spray bars instead of hand hoses, except in small areas inaccessible to spray bars.

Table 2 - Application Rates for Anionic Emulsified Asphalt or Cationic Emulsified Asphalt, gal/yd² (L/m²)

Tack-Uses	Minimum	Maximum
New Asphaltic Concrete Pavement to New Asphaltic Concrete Pavement or Thin Lift Leveling	0.05 (0.23)	0.08 (0.36)
New Asphaltic Concrete Pavement (≤ 25 % RAP) to Aged Existing Pavement or Milled Surface	0.06 (0.27)	0.10 (0.45)
New Asphaltic Concrete Pavement (> 25 % RAP) to Aged Existing Pavement or Milled Surface	0.08 (0.36)	0.12 (0.54)

- Allow standard anionic emulsified asphalt or cationic emulsified asphalt to break per emulsion manufacturer's recommendation. Proceed with paving only after the anionic emulsified asphalt or cationic emulsified asphalt has cured to the satisfaction of the Engineer.
- Do not use anionic emulsified asphalt or cationic emulsified asphalt under OGFC or PEM on interstates or limited access state routes.

Note: Application rates for PG Binder Asphalt Cement are specified in Section 400.3.03.A.3.C.

C. Temperature of Material

Apply bituminous materials within the temperature ranges specified below.

TABLE 3 – BITUMINOUS MATERIALS AND APPLICATION TEMPERATURES

Bituminous Materials	Temperature of Application °F (°C)
Asphalt cement	350 - 400 (175 - 205)
Approved non-tracking Anionic Emulsified Asphalt	140 - 180 (60 - 80)
Cationic Emulsified Asphalt CSS-1h, CRS- 1h, CRS-2h, CRS-3, CQS-1h and other approved non-tracking cationic emulsified asphalt products listed on QPL 7	140 - 180 (60 - 80)

D. Cleaning

Immediately before applying the tack coat, clean the entire area free of loose dirt, clay, and other foreign materials.

Section 413 — Bituminous Tack Coat

E. Application Rate

The Engineer will determine the application rate of the bituminous tack coat.

F. Limitations and Areas Coated

Apply only enough tack coat to the prepared road surface that can be covered with the new pavement course the same working day the tack coat is applied.

G. Maintenance and Protection

After applying a standard emulsified asphalt tack coat material, allow it to break per emulsion manufacturer's recommendation. Do not allow construction equipment or traffic on the tack. When directed by the Engineer, provide a revised paving plan when excessive tracking of the tack material by construction related traffic is evident.

413.3.06 Quality Acceptance

General Provisions 101 through 150.

413.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150 shall apply with specific consideration given to General Provision Sections 105.12, 105.14, and 105.16.

413.4 Measurement

Bituminous materials for tack coat applied and accepted are measured as outlined in Subsection 109.02, *Measurement of Bituminous Materials*.

Diluting emulsified tack coat is not ordinarily allowed except when used underneath slurry seal and approved by the Engineer. The composition of diluted emulsified tack coat defined in Subsection 427.3.05, *Construction* is measured by the gallon (liter) of diluted mix.

413.4.01 Limits

General Provisions 101 through 150.

413.5 Payment

The accepted volume of bituminous material will be paid for at the Contract Unit Price per gallon (liter) for bituminous tack coat of the type and grade and approved by the Engineer, complete in place. Payment is full compensation for preparing, cleaning, furnishing, hauling, applying material, and providing incidentals to complete the work.

Payment will be made under:

Item No. 413	Tack coat	Per gallon (liter)
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Section 432—Mill Asphaltic Concrete Pavement

432.1 General Description

This work includes milling existing asphaltic concrete pavement to restore proper grade and/or transverse slope, removing structurally unsound material, providing clearance for overlay in curb and gutter sections, or other purposes deemed necessary due to existing conditions. Perform the work according to these Specifications and Plan details.

432.1.01 Definitions

General Provisions 101 through 150.

432.1.02 Related References

A. Standard Specifications

Section 109—Measurement and Payment

B. Referenced Documents

GDT 126

432.1.03 Submittals

General Provisions 101 through 150.

432.2 Materials

432.2.01 Delivery, Storage, and Handling

When specified, stockpile the milled material at locations shown on the plans.

1. Uniformly stockpile the materials approximately 6 – 8 ft. (1.8 – 2.4 m) high.
2. Maintain the existing drainage pattern of water from the stockpile storage area.
3. Dress the reclaimed asphalt area to drain rainwater from the material.
4. Obtain the Engineer's approval of the stockpile locations and the method used to prevent milled material degradation, segregation, and reconsolidation.

432.3 Construction Requirements

432.3.01 Personnel

General Provisions 101 through 150.

432.3.02 Equipment

A. Conventional Milling Equipment

Use power-driven, self-propelled milling equipment that is the size and shape that allows traffic to pass safely through areas adjacent to the work. Also, use equipment that is:

- Designed to mill and remove a specified depth of existing asphalt paving
- Equipped with grade and slope controls operating from a string line or ski and based on mechanical or sonic operation
- Capable of removing pavement to an accuracy of 1/8 in. (3 mm)
- Furnished with a lighting system for night work, as necessary
- Provided with conveyors capable of side, rear, or front loading to transfer the milled material from the roadway to a truck

B. Micro-milling Equipment

When micro-milling is specified, use power-driven, self-propelled micro-milling equipment possessing the size and shape to allow traffic safe passage through areas adjacent to the work. Also, ensure the micro milling is equipped as follows:

- Equipped with a cutting mandrel with carbide or equivalent tipped cutting teeth designed for micro-milling bituminous pavement full lane width to close tolerances. Micro-milling heads with less than full lane widths may be used for non-mainline travel way when approved by the engineer and milled surface meets all specified acceptance criteria.
- Equipped with grade and slope controls operating from a string line or ski and based on mechanical or sonic operation
- Capable of removing pavement to an accuracy of 1/16 in. (1.6 mm.)
- Furnished with a lighting system for night work, as necessary
- Provided with conveyors capable of side, rear, or front loading to transfer the milled material from the roadway to a truck.

C. Dust Control

Provide power brooms, vacuum sweepers, power blowers, or other means to remove loose debris or dust. Do not allow dust control to restrict visibility of passing traffic or to disrupt adjacent property owners.

432.3.03 Preparation

General Provisions 101 through 150.

432.3.04 Fabrication

General Provisions 101 through 150.

432.3.05 Construction

A. Conventional Milling Operation

Follow the plans to mill the designated areas and depths including bridge decks, shoulders, and ramps, as required. Ensure the following requirements are met:

1. Schedule the construction operation. Use milling methods that will produce a uniform finished surface and maintain a constant cross slope between extremities in each lane.
2. Provide positive drainage to prevent water accumulation on the milled pavement, as shown on the plans or directed by the Engineer.
3. Bevel back the longitudinal vertical edges greater than 2 in. (50 mm.) that are produced by the removal process and left exposed to traffic. Bevel them back at least 3 in. for each 2 in. (75 mm. for each 50 mm.) of material removed. Use an attached mold board or other approved method.
4. When removing material at ramp areas and ends of milled sections, taper the transverse edges 10 ft. (3 m) to avoid creating a traffic hazard and to produce a smooth surface.
5. Protect with a temporary asphaltic concrete tie-in (paper joint) vertical edges at other areas such as bridge approach slabs, drainage structures, and utility appurtenance greater than 1/2 in. (12.5 mm) that are left open to traversing vehicles. Place the temporary tie-in at taper rate of at least 6 to 1 horizontal to vertical distance.
6. Remove dust, residue, and loose milled material from the milled surface. Do not allow traffic on the milled surface and do not place asphaltic concrete on the milled surface until removal is complete.

The reclaimed asphaltic pavement becomes the Contractor's property unless otherwise specified.

B. Micro-milling Operation

Ensure the micro-milling operations comply with Subsection 432.3.05.B, when micro-milling is specified in the contract to remove aged open-graded mix types, remove wheel ruts and other surface irregularities; restore proper grade and/or transverse slope of pavement as indicated in the Plans and as directed by the Engineer. The micro-milled surface shall provide a texture suitable for use as a temporary riding surface or an immediate overlay with OGFC or PEM with no further treatment or overlays. Micro-milling is required when placing OGFC or PEM mixtures on a milled surface. The use of the micro-milled pavement as a temporary riding surface shall be a maximum of five (5) Available days. Perform the work according to these Specifications and Plan details.

1. Micro-milling Process

- a. Follow the Plans to micro-mill the designated areas and depths including bridge decks, shoulders, and ramps, as required. Ensure the following requirements are met:
 - Prior to commencement of the work, construct a test section that is 1000 ft. (305 m) in length with a uniformly textured surface and cross section as approved by the Engineer.
 - The final pavement surface shall have a transverse pattern of 0.2 in. (5 mm) center to center of each strike area. The targeted difference between the ridge and valley (RVD) measurement of the mat surface shall not exceed 1/16 in. (1.6 mm).
 - Milled surface acceptance testing will be performed using the Laser Road Profiler in accordance with GDT-126. Ensure the measured indices meet a target of 825 mm/km in the test section.
 - Work shall be halted and the contractor shall submit a written plan of action detailing what steps will be taken to improve operations if any of these requirements are exceeded in the test section. If approved by the Engineer, the contractor will construct another 1000 ft. (305 m) test section. This test section shall be located in a different area than the initial section using the approved corrective action. This designated section shall be micro-milled to conform to the same requirements as those required in the initial test section. The contractor shall not be allowed to start continual micro-milling until an acceptable test section is obtained.

Section 432 — Mill Asphaltic Concrete Pavement

- b. Ensure micro-milling methods produce a uniform finished surface and maintain a constant cross slope between extremities in each lane.
- c. Provide positive drainage to prevent water accumulation on the micro-milled pavement, as shown on the Plans or directed by the Engineer.
- d. Bevel back the longitudinal vertical edges greater than 2 in. (50 mm) produced by the removal process and left exposed to traffic. Bevel the vertical edges back at least 3 in. for each 2 in. (75 mm for each 50 mm) of material removed. Use an attached mold board or other approved method.
- e. Taper the transverse edges 10 ft. (3 m) to avoid creating a traffic hazard and to produce a smooth surface when removing material at ramp areas and ends of milled sections.
- f. Protect with a temporary asphaltic concrete tie-in (paper joint) vertical edges at other areas such as bridge approach slabs, drainage structures, and utility appurtenances greater than 1/2 in areas left open to traversing vehicles. Place the temporary tie-in at taper rate of at least 6 to 1 horizontal to vertical distance.
- g. Remove dust, residue, and loose milled material from the micro-milled surface. Do not allow traffic on the milled surface and do not place asphaltic concrete on the milled surface until removal is complete.

432.3.06 Milling Quality Acceptance

A. Conventional Milling Acceptance Criteria

Ensure that the milling operation produces a uniform pavement texture that is true to line, grade, and cross-section.

Milled pavement surface acceptance testing will be performed using the Laser Road Profiler method in GDT 126. Milled pavement will be evaluated on individual test sections, normally 1 mile (1 km) long.

When the milled surface is to be left as the final wearing surface, ensure that indices do not exceed:

- 1025 on milled pavement surfaces on interstates when the milled surface will be the final wearing surface
- 1175 for other on-system routes when the milled surface will be the final wearing surface
- 1175 on Interstates and 1325 for other on-system routes if the milled surface will be overlaid

Remill mile (kilometer) areas to meet the specified limits when the indices are exceeded. Remill at no additional cost to the Department.

Milled pavement surfaces are subject to visual and straightedge inspection. Keep a 10 ft. (3 m) straightedge near the milling operation to measure surface irregularities of the milled pavement surface. Remill irregularities greater than 1/8 in. per 10 ft. (3 mm in 3 m) at no additional cost to the Department.

Ensure that the cross slope is uniform and that no depressions or slope misalignments greater than 1/4 in. per 12 ft. (6 mm in 3.6 m) exist when the slope is tested with a straightedge placed perpendicular to the center line.

Section 432 — Mill Asphaltic Concrete Pavement

B. Micro-Milling Acceptance Criteria

Ensure the micro-milling operation produces a uniform pavement texture true to line, grade, and cross section.

Micro-mill additional depth to eliminate excessive scabbing of the in place material as directed by the Engineer.

Micro-milled pavement surface acceptance testing will be performed using the Laser Road Profiler method in GDT 126.

Micro-milled pavement will be evaluated on individual test sections, measuring 0.50 mile (0.50 km). Ensure micro-milled pavement meets specified measured tolerances for RVD and profile surface smoothness indices of Target 825 mm/km and not exceed the Correction index of 900 mm/km

- Micro-milled pavement surfaces are subject to visual and straightedge inspections. Ensure a 10 ft. (3 m). straightedge is kept at the micro-milling operation to measure surface irregularities of the milled pavement surface.
- Any areas exceeding 1/8 in. (3.2 mm) between the ridge and valley of the mat surface or fail to meet pavement surface acceptance testing using the Laser Road Profiler shall subject the micro-milled surface to a pay reduction of 20% based on the micro-milling unit cost per square yd. at the recommendation of the Office of Materials and Testing.
- Any areas exceeding 3/16 in. (4.8 mm) between the ridge and valley of the mat surface or fail to meet pavement surface acceptance testing using the Laser Road Profiler shall subject the locations to being removed and replaced with acceptable material as directed by the Engineer at no additional cost to the Department. All corrective work shall be performed in a minimum 500 ft. section.
- Ensure the cross slope is uniform and no depressions or slope misalignments greater than 1/4 in. per 12 ft. (6 mm in 3.6 m) exist when the slope is tested with a straightedge placed perpendicular to the center line.

432.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

432.4 Measurement

Conventional milling and micro-milling existing asphaltic concrete pavement is measured by the square yard (meter) as described in Subsection 109.01, *Measurement and Quantities*.

432.4.01 Limits

General Provisions 101 through 150.

432.5 Payment

Conventional milling and micro-milling asphaltic concrete pavement, measured as specified, will be paid for at the Contract Unit Price bid per square yard (meter). The price bid for this item includes the credit value of all Reclaimed Asphalt Pavement (RAP) recovered, and no adjustment in the unit price for this item or other items will be considered for variations in the amount of RAP actually recovered.

Payment is full compensation for furnishing equipment, milling, hauling, stockpiling milled material, and satisfactorily performing the work.

Payment will be made under:

Item No. 432	Mill asphaltic concrete pavement, ___ in (mm) depth	Per square yard (meter)
Item No. 432	Mill asphaltic concrete pavement, variable depth	Per square yard (meter)
Item No. 432	Micro-mill asphaltic concrete pavement, variable depth	Per square yard (meter)

432.5.01 Adjustments

General Provisions 101 through 150.

Section 441—Miscellaneous Concrete

441.1 General Description

This work includes placing Portland cement concrete as follows:

- As slope paving on end rolls, cut slopes, paved ditches, spillways, and ditch slopes
- In median pavement
- As sidewalks
- In concrete curbs, gutters, curb and gutters, and valley gutters
- As nonreinforced headwalls
- As velocity dissipators and concrete slope drains
- As concrete spillways
- Curb cut wheel chair ramps
- At other locations designated on the Plans or as directed

This work includes subgrade preparations including:

- Fine grading and backfilling
- Forming, furnishing, placing, and finishing concrete
- Constructing weep holes and furnishing and placing the coarse aggregate
- Furnishing and placing preformed joint fillers as shown on the plans
- Placing driveway concrete as shown on the Plans. Nominal 4 in. (100 mm) or 6 in. (150 mm) thick as specified or to match existing pavement.

441.1.01 Definitions

General Provisions 101 through 150.

441.1.02 Related References

A. Standard Specifications

Section 209—Subgrade Construction

Section 430—Portland Cement Concrete Pavement

Section 500—Concrete Structures

Section 832—Curing Agents

Section 833—Joint Fillers and Sealers

Section 853—Reinforcement and Tensioning Steel

B. Referenced Documents

General Provisions 101 through 150.

441.1.03 Submittals

General Provisions 101 through 150.

Section 441 — Miscellaneous Concrete

441.2 Materials

Use concrete that conforms to the minimum requirements for Class “B,” as specified in Section 500, except that a one-bag mixer may be used. The requirements of Subsection 500.1.03.G, *Cold Weather Concrete Curing and Protection Plan* and Subsection 500.3.05.X, *Pour Concrete in Cold Weather* for cold weather concrete placement are deleted.

Place miscellaneous concrete only when the air temperature is 40 °F (4 °C) and rising. Protect concrete from freezing for the first 24 hours. Hand finishing is allowed.

Other materials and their Specifications are as follows:

Material	Section
Steel Bars for Concrete Reinforcement	853.2.01
Membrane Curing Compound, Type 2	832.2.03
Dowel and Tie Bars and Reinforcing Steel	853.2.03
Joint Fillers and Sealers	833
Welded Steel Wire for Concrete Reinforcement	853.2.07

441.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

441.3 Construction Requirements

441.3.01 Personnel

General Provisions 101 through 150.

441.3.02 Equipment

A. Forms

Forms are subject to the Engineer’s approval. Use forms that are:

- Wood or metal that is readily available
- Straight and oiled before each use

Use metal divider plates and templates.

Use the slip form placement method when applicable. If the slip form method does not produce a product with the proper quality, shape, grade, or alignment, the Engineer may require using fixed forms.

B. Weep Holes

Provide weep hole drain pockets filled with coarse aggregate to use with weep hole drain pipe or formed openings according to the plan details.

441.3.03 Preparation

Before placing the concrete, excavate for toe walls, edge walls, and weep hole drain pockets; place coarse aggregate in weep hole drain pockets; and grade, finish, and compact the subgrade surface. Use mechanical tamps for compaction if necessary.

441.3.04 Fabrication

General Provisions 101 through 150.

441.3.05 Construction

A. Extent and Thickness of Pavement

See the plans to determine the areas to be paved and the dimensions.

Thicknesses are subject to a minus tolerance of 0.5 in. (13 mm). Do not perform overlay pours.

B. Preparation of Subgrade

Finish the subgrade for miscellaneous concrete to the line and grade on the Plans and the following:

1. Compact the subgrade to the same degree as the roadway on which it is placed. Compact the subgrade according to Section 209.
2. If a Contract involves a Roadway and a Bridge Contractor, the Roadway Contractor shall complete the grading for the slope paving.
The Bridge Contractor shall complete final grading, compacting, dressing, placing, and maintenance to the structures until completion.
3. When placing paving on the front slopes of ditches and shoulders, place any required special materials during the roadway construction.
4. Do not excavate for velocity dissipators, spillways, and slope drains below the foundation elevation. Do not excavate wider than necessary to provide working space or to remove soft, unsuitable material. Backfill with selected material.
5. When fitting spillways to concrete pavement, set the specified dowel bars into the pavement when it is laid. Use metal parting strips to hold the ends of dowels bent into the grooves.

C. Concrete

1. Mixing

Mix Class B concrete as specified in Section 500 with the following exceptions:

- a. Use of small capacity job-site batchers and one-bag mixers is allowed. The rate of concrete placement in Subsection 500.3.05.P, *Meet the Minimum Placement Rates* is waived for miscellaneous concrete.
- b. Proportion concrete ingredients volumetrically if the Engineer has approved equipment calibration and operation and the operator is certified by the Office of Materials.

2. Placing and Finishing

Place and finish concrete as follows:

- a. Deposit concrete within forms or against other pavements on a compacted and wetted subgrade to the depth to produce the specified thickness.

NOTE: Do not place concrete on a muddy or frozen surface.

- b. Vibrate the headwalls.
- c. Strike off the concrete to a plane surface and finish it with a Type IV or Type V finish as defined in Subsection 500.3.05.AB, *Finish Concrete* and complete the following:
 - 1) **Concrete Slope Paving.** Give a final finish with a stiff-bristle broom. With the Engineer's approval, mechanically convey the concrete to the forms.
 - 2) **Concrete Sidewalks.** Give a Type V finish unless otherwise noted on the Plans. Test the surface with a 10 ft. (3 m) straightedge laid parallel to the center line. Eliminate irregularities greater than 0.25 in. (6 mm) per 10 ft. (3 m) while the concrete is still plastic.
Ensure that concrete sidewalk constructed as curb cut (wheelchair) ramps has a rough or textured finish.

- 3) Concrete Paved Ditches.** Ensure that the surface of the bottom and sides of paved ditches are uniform and true to grade and cross section.

Ensure that straight-grade tangents do not deviate more than 1 in. (25 mm) within 10 ft. (3 m) when tested with a 10 ft. (3 m) straightedge. Do not allow deviation if it reduces the ditch paving thickness, causes water to pond, or alters the direction of flow.

Finish the ditch paving by floating with wood or metal floats to bring mortar to the surface to cover the coarse aggregate.

Use reinforcing that conforms to Plan details if required.
- 4) Concrete Curbs, Gutters, and Median.** Finish according to Subsection 441.3.05.C.2, *Placing and Finishing*. Remove face forms as soon as possible and finish the exposed surfaces with a wood float. Use a straightedge to test the edge of the gutter and top of the curb and median to conform to the requirements for the adjacent pavement. Irregularities shall not exceed 0.25 in. (6 mm) in 10 ft. (3 m). Place the curb and gutter using a machine as long as the results are satisfactory.
- 5) Curb Cut Wheel chair Ramps.** Construct a Type I, II, or III ramp according to Georgia Standard 9031W. Tie ramps into adjacent paved or unpaved sidewalk and use a rough or textured finish.

3. Joints

Follow these procedures to construct joints on slopes, ditches, sidewalks, and curbs, gutters, and medians.

a. Slope Paving

Place paving on slopes in horizontal or vertical courses, but not a mixture of both.

- 1)** Construct horizontal courses approximately level and at least 3 ft. (1 m) but no more than 6 ft. (1.8 m) wide measured along the slope.

When needed, construct trapezoidal courses at the top and bottom to accommodate sloping berm and ditch line conditions.

- 2)** Edge the paving at construction joints between courses with a 0.25 in. (6 mm) radius tool.
- 3)** Provide vertical contraction or construction joints spaced along the horizontal course at right angles to the horizontal construction joints at approximately 40 ft. (12 m) intervals, in line not staggered. No other vertical lines will be required in horizontal courses.

When using vertical contraction joints, cut them with a tool one-third the depth of the paving during the finishing operation. Edge the contraction joints the same as construction joints.

Vertical courses approximately equal and at least 3 ft. (1 m) but no more than 5 ft. (1.5 m) wide across the plane of the slope. The desired width is 4 ft. (1.2 m). Horizontal lines are not required in vertical courses.

Separate slope paving from the masonry of structures, sidewalks, curbs, and rigid-type roadway pavements of preformed joint filler that are 0.5 in. (13 mm) thick.

b. Concrete Paved Ditches

Form joints in concrete paved ditches as follows:

- 1)** Space contraction joints at 30 ft. (9 m) intervals.
- 2)** Place expansion joints only where the paved ditch joins the roadway pavement or some other structure.
- 3)** Do not use joint sealers for expansion or contraction joints.

c. Concrete Sidewalk

Form transverse contraction joints using a tool designed to form a groove one-third the depth of the sidewalk at intervals shown on the Plans.

Where sidewalks abut the curb and gutter, ensure that alternate joints coincide. Round the edges with a 0.25 in. (6 mm) edger. Make expansion joints according to the materials, dimensions, and locations specified on the plans.

Section 441 — Miscellaneous Concrete

d. Concrete Curbs, Gutters, and Medians

Form contraction joints or expansion joints on curbs, gutters, and medians.

1) Contraction Joints. Ensure that joints in curb, gutters, and medians are spaced the same as the joints in paving. Form joints by using metal divider plates or sawing them as in Section 430.

Form joints at least one-fifth but not greater than one-fourth the depth of the concrete. Except for sawed joints, finish the joints with a 0.25 in. (6 mm) edging tool.

For curbs, gutters, and medians adjacent to pavement other than concrete, contraction joints shall be as follows:

- For header curb and combination curb and gutter, install contraction joints spaced no more than 20 ft. (6 m) apart.
- For gutter median, install a contraction joints spaced no more than 20 ft. (6 m) apart.

2) Expansion Joints. Form expansion joints according to the plan details or as directed. Ensure that they coincide with the expansion joints in the adjoining pavement or gutter.

Cut the joint fillers to the same cross section as the construction. Trim flush the material that protrudes after the concrete is finished.

When miscellaneous concrete items are not adjacent to concrete construction, provide expansion joints at an interval of at least 500 ft. (150 m).

e. Curb Cut Wheelchair Ramps

Locate and form expansion joints for curb cut wheelchair ramps according to the Special Details for ramp Type A, B, C, or D.

4. Curing

Use curing methods specified in Subsection 430.3.05.L, *Cure the Concrete*. Ensure that the membrane curing compound is Type 2, if used. Pack honeycombed areas immediately after removing the forms.

D. Backfilling

Backfill the areas as soon as possible without damaging the work.

E. Clean-Up

When concrete work is complete, clean each surface. Protect the work from stains or other damage until Final Acceptance.

441.3.06 Quality Acceptance

General Provisions 101 through 150.

441.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

441.4 Measurement

A. Concrete Slope Paving

Concrete slope paving is measured for payment in square yards (meters) of accepted surface area of paving of the specified thickness. Concrete in toe or edge walls, excavation, backfill, weep holes, and aggregates are not measured for separate payment.

B. Concrete Sidewalks

Concrete sidewalks are measured in square yards (meters) of the specified thickness, complete in place and accepted. The length is the actual measured length along the surface. The width is the plan width or as directed. Excavation and backfill are not measured separately for payment.

C. Concrete Paved Ditches

The area measured for payment is the square yards (meters) of exposed surface area, exclusive of top edges, of the specified thickness placed according to the plans or as directed. Reinforcing steel, excavation, preparation of subgrade including Type I backfill, forms, and concrete in toe or edge walls are not measured separately for payment.

Type II backfill, when required, will be paid according to Section 207.

D. Concrete Curbs, Gutter, Median, Pavement, and Combination Curb and Gutter

The following are measured by the linear foot (meter) along the face of the curb:

- Concrete curb and gutter
- Concrete curb
- Concrete header curb

The following are measured by the square yard (meter) or by the linear foot (meter), whichever is specified:

- Concrete gutter
- Concrete valley gutter
- Concrete valley gutter with curb
- Concrete median pavement
- Concrete gutter with raised edge

The length used to compute the square yards (meters) or linear foot (meter) is measured along the center line of the gutter. The width is the total width of the gutter including the curb or raised edge. Concrete doweled integral curb includes dowels.

E. Concrete Headwalls

Headwalls are measured for payment according to Subsection 500.4.01.B, *Payment per Cubic Yard (Meter)* and Subsection 500.5.01.E, *Filler Concrete*. Filler concrete, where required, will be paid for at 60 percent of the Contract Unit Price for Class B concrete.

F. Concrete Spillways

Concrete spillways regardless of the type specified are measured by the actual number poured complete and accepted.

G. Concrete Slope Drains

Concrete slope drains are measured in square yards (meters) along the surface, complete and accepted.

H. Velocity Dissipators

Velocity dissipators are measured in square yards (meters), surface measure, complete and accepted.

I. Concrete Driveways

Driveway pavement is measured along the surface from the paving edge or back of the curb to where old and new concrete join. The width is the average width constructed.

Section 441 — Miscellaneous Concrete

J. Curb Cut Wheelchair Ramps

For new construction, curb cut wheelchair ramps will not be measured. For new construction, linear feet (meters) of curb and gutter will include the transitioned curb in front of ramps and square yards (meters) of concrete sidewalk will include ramps. No additional payment will be made for curb cut ramps.

For existing sidewalks, curb cut wheelchair ramps are measured as the actual number formed and poured, complete and accepted. No additional payment will be made for sawing existing sidewalk and removal and disposal of removed material for new ramp construction.

441.4.01 Limits

General Provisions 101 through 150.

441.5 Payment

These Items, measured as specified above, will be paid for at the Contract Unit Price per each, per square yard (meter), per linear foot (meter), or per cubic yard (meter).

Payment will be made under:

A. Slope Paving

Item No. 441	Concrete slope paving (<u>thick</u>) in. (mm)	Per square yard (meter)
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B. Sidewalks

Item No. 441	Concrete sidewalk (<u>thick</u>) in. (mm)	Per square yard (meter)
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C. Concrete Ditches

Item No. 441	Plain concrete ditch paving (<u>thick</u>) in. (mm)	Per square yard (meter)
Item No. 441	Reinforced concrete ditch paving (<u>thick</u>) in. (mm), including reinforcing steel	Per square yard (meter)

D. Curbs, Gutters, Combination Curb and Gutter, Headers, and Medians

Item No. 441	Concrete curb and gutter, (<u>thick</u>) in. (mm)x (<u>width</u>) in. (mm) type___	Per linear foot (meter)
Item No. 441	Concrete header curb, [<u>height</u>] in. (mm), type___	Per linear foot (meter)
Item No. 441	Concrete valley gutter, [<u>thick</u>] in. (mm)	Per square yard (meter)
Item No. 441	Concrete valley gutter with curb, [<u>thick</u>] in. (mm)	Per square yard (meter)
Item No. 441	Concrete gutter with raised edge, [<u>thick</u>] in. (mm)	Per square yard (meter)
Item No. 441	Concrete median [<u>thick</u>] in. (mm)	Per square yard (meter)
Item No. 441	Concrete median, corrugated [<u>thick</u>] in. (mm)	Per square yard (meter)
Item No. 441	Concrete doweled integral curb, type___ including dowels	Per linear foot (meter)

Section 441 — Miscellaneous Concrete

E. Spillways, Drains and Velocity Dissipators

Item No. 441	Concrete spillway type___	Per each
Item No. 441	Concrete slope drain	Per square yard (meter)
Item No. 441	Velocity dissipators	Per square yard (meter)

F. Headwalls

Item No. 441	Concrete headwalls	Per cubic yard (meter)
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G. Driveway Concrete

Item No. 441	Driveway concrete___ in. (mm) thick	Per square yard (meter)
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H. Curb Cut Wheelchair Ramps

Item No. 441	Curb cut wheelchair ramps, Type__	Per each
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441.5.01 Adjustments

General Provisions 101 through 150.

Section 550—Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

Replace Section 550 with the following:

550.1 General Description

This work includes furnishing and installing the following:

- Storm drain pipe
- Side drain pipe
- Pipe-arch culverts
- Elliptical pipe
- Flared end sections
- Safety end sections
- Tapered pipe inlets

Install structures according to the Specifications and the details shown on the Plans, or as directed by the Engineer.

550.1.01 Definitions

Side Drain – All driveway pipes (commercial, non-commercial, residential, utility, farm, logging, and mining).

Storm Drain Pipe –All pipe used in the highway drainage system that receives surface water through inlets and conveys the water through conduits to a pipe outlet

Thermoplastic Pipe – High Density Polyethylene (HDPE), Polypropylene (PP) and Polyvinyl Chloride (PVC).

General Provisions 101 through 150.

550.1.02 Related References

A. Standard Specifications

- Section 161 –Control of Soil Erosion and Sedimentation
- Section 205 –Roadway Excavation
- Section 207 –Excavation and Backfill for Minor Structures
- Section 208 –Embankments
- Section 645 –Repair of Galvanized Coatings
- Section 812 –Backfill Materials
- Section 815 –Graded Aggregate
- Section 834 –Masonry Materials
- Section 840 –Corrugated Aluminum Alloy Pipe
- Section 841 –Iron Pipe
- Section 843 –Concrete Pipe
- Section 844 –Steel Pipe
- Section 845 –Thermoplastic Pipe
- Section 847 –Miscellaneous Pipe
- Section 848 –Pipe Appurtenances

Section 550 — Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

B. Referenced Documents

General Provisions 101 through 150.
GDOT Manual on Drainage Design for Highways
Ga. Std. 1030D
Ga. Std. 1030P
GDT 136
ASTM C 1479
ASTM D 2321

550.1.03 Submittals

General Provisions 101 through 150.

550.2 Materials

Ensure materials meet the requirements of the following Specifications:

Material	Section
Backfill Materials	207
Graded Aggregate	815
Reinforced Concrete Pipe	843.2.01
Nonreinforced Concrete Pipe	843.2.02
Mortar And Grout	834.2.03
Bituminous Plastic Cement	848.2.05
Rubber Type Gasket Joints (Concrete Pipe)	848.2.01
Preformed Plastic Gaskets	848.2.06
Corrugated Steel Pipe	844.2.01
Bituminous Coated Corrugated Steel Pipe	844.2.02
Corrugated Aluminum Alloy Pipe	840.2.01
Bituminous Coated Corrugated Aluminum Pipe	840.2.03
Aluminized Type 2 Corrugated Steel Pipe	844.2.06
Ductile Iron Pipe, Fittings and Joints	841
Precoated, Galvanized Steel Culvert Pipe	844.2.05
Smooth Lined Corrugated High Density (HDPE) Polyethylene Culvert Pipe	845.2.01
Polyvinyl Chloride (PVC) Profile Wall Drain Pipe	845.2.02
Polyvinyl Chloride (PVC) Corrugated Smooth Interior Drain Pipe	845.2.03
Smooth Lined Corrugated Polypropylene (PP) Pipe	845.2.05
Miscellaneous Pipe	847

Use any of the following types of pipe:

Rigid Pipe Types

Section 550 — Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

- Reinforced concrete
- Nonreinforced concrete
- Ductile Iron

Flexible Pipe Types

- Corrugated steel or Aluminum
- Smooth-lined corrugated high density polyethylene (HDPE)
- Polyvinyl Chloride (PVC) Profile Wall Drain Pipe
- Polyvinyl Chloride (PVC) Corrugated Smooth Interior Drain Pipe
- Precoated, Galvanized Steel Culvert Pipe (Polymer)
- Smooth Lined Corrugated Polypropylene (PP) Pipe

Use the type of pipe designated on the Plans, or acceptable alternate types when applicable. For a listing of acceptable alternate pipe types see the GDOT Approved Material Selections List in Chapter 7— Storm Drain Design of the Department’s Manual on Drainage Design for Highways. This document summarizes general applications for pipe.

For concrete, corrugated steel and aluminum pipes see Ga. Std. 1030D for minimum thicknesses, minimum cover, maximum fill, allowable pipe diameters and trench construction detail.

For thermoplastic pipes see Ga. Std. 1030P for minimum cover, maximum fill, allowable pipe diameters and trench construction details.

A. Thermoplastic Pipe Project Restrictions

Thermoplastic pipe is restricted to the following project conditions:

1. Storm Drain
 - a. Travel Bearing: ADT less than 15,000
 - b. Non-Travel Bearing: Non-Interstate
2. Side Drain
 - a. Allowed on all projects

550.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

550.3 Construction Requirements

550.3.01 Personnel

General Provisions 101 through 150.

550.3.02 Equipment

General Provisions 101 through 150.

550.3.03 Preparation and Backfill

Before installing pipe, shape the foundation material as shown on the Plans.

Prepare structure excavations, foundation and backfill according to Section 207. Except, use the following foundation and backfill material requirements for thermoplastic pipe installations:

1. For storm drain applications (cross and longitudinal) use graded aggregate material meeting Section 815.
 - a. 20 ft. (6.1 m) maximum fill height for High Density (HDPE) Polyethylene Culvert Pipe.
 - b. 25 ft. (7.6 m) maximum fill height for Polyvinyl Chloride (PVC) and Polypropylene (PP) Pipe.

Section 550 — Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

2. For side drain applications (driveway) use backfill material based on fill height.
 - a. Fill heights up to 10 ft (3 m), use normal backfill material meeting the following soil classes per Subsection 810.2.01.
 - High Density (HDPE) Polyethylene Culvert Pipe use Class II B2 soil or better.
 - Polyvinyl Chloride (PVC) and Polypropylene (PP) Pipe use Class II B3 soil or better.
 - If the required soil Class is not available use graded aggregate material meeting Section 815.
 - b. Fill heights above 10 ft. (3 m), use graded aggregate material meeting Section 815.
3. Other structures and pipes shall be at least 2 ft (600 mm) from installed pipe.

550.3.04 Fabrication

General Provisions 101 through 150.

550.3.05 Construction

A. Drainage

Provide necessary temporary drainage. Periodically remove any debris or silt constricting the pipe flow to maintain drainage throughout the life of the Contract.

B. Damage

Protect the structure by providing sufficient depth and width of compacted backfill before allowing construction traffic over a culvert. Repair damage or displacement from traffic or erosion occurring after installing and backfilling at no additional cost to the Department.

C. Installation

Check vertical and horizontal alignment of the pipe culvert or pipe barrel by sighting along the crown, invert and sides of the pipe, and by checking for sagging, faulting and invert heaving. Repair any issues involving incorrect horizontal and/or vertical alignment before backfilling pipe.

1. Concrete Pipe

Install Concrete Pipe according to ASTM C 1479 and as per plans. Lay sections in a prepared trench with the socket ends pointing upstream. Join section using rubber gasket installed according to Subsection 848.2.01 and the manufacturer's recommendations.

2. Ductile Iron Pipe

Lay pipe sections in a prepared trench, with bells pointing upstream. Construct joints according to Subsection 841.2.02.A.

3. Corrugated Metal

Lay pipe sections in a prepared trench, with outside laps of circumferential joints pointing upstream and longitudinal joints at the sides. Join the sections with coupling bands, fastened by two or more bolts. Before backfilling the structure:

- a. Repair areas of damaged coatings and exposed base metal according to applicable AASHTO Standard Specification specified in Section 844.

4. Thermoplastic Pipe

Install smooth-lined corrugated HDPE, PVC, and smooth-lined polypropylene pipe according to ASTM D 2321 and as per plans using backfill requirements in Subsection 550.3.03. Use fitting and couplings that comply with the joint performance criteria of AASHTO Standard Specifications for Highway Bridges, Division II. Ensure all joints are "silt tight" as stated in the AASHTO bridge specifications.

5. Specials (Wyes, Tees, and Bends)

Install wyes, tees, and bends as shown on the Plans or as directed.

6. Tapered Pipe Inlets

Locate and install tapered pipe inlet end sections as shown on the Plans or as directed.

Section 550 — Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

7. Elongation

Elongate metal pipe as shown on the Plans. Order the elongation of the vertical axis of the pipe to be done in the shop.

Ensure the manufacturer ships metal pipe with wire ties in the pipe ends. Remove wire-ties immediately after completing the fill.

8. Flared End Sections

Use flared end sections on the inlet, outlet, or on both ends of storm drain pipe, according to Plan details.

550.3.06 Quality Acceptance

The Engineer will visually inspect all pipe for alignment, deflection, cracking, joint separation, sagging, or other exterior damage.

The Department may elect to conduct Quality Assurance verifications of any pipe inspections. These verifications will be performed by Department personnel.

The Department will require video inspection on projects that have more than 500 linear feet of storm drain pipe and on routes with an AADT greater than 3,000 vehicles. Conduct video inspection in accordance with the requirements of this Specification and GDT 136 on 20% of all storm drain pipe and 10% of all side drain pipe installations. The Engineer will randomly select installations to be tested.

Unless the Engineer directs otherwise, schedule the video inspections for the selected locations no sooner than 30 days after completing pipe installations to be tested.

A. Post Installation Inspection

Before post installation inspection, dewater installed pipe (if necessary) and provide the Engineer with a post installation inspection schedule. Notify the Engineer at least seven days in advance of beginning inspection. Perform post installation inspections after compacted backfill has reached a depth of 8 feet or after completion of the pipe installation and final cover, which includes the embankment and all non-asphalt bases and/or subgrades. Notify the Engineer if distresses or locations of improper installation are discovered. When camera testing shows distresses or improper installation in the installed pipe, the Engineer may require additional sections to be tested or may require corrective action.

Video and laser profiling and measurement technology must be certified by the company performing the work to meet the requirements of GDT 136. Inspection contractor personnel completing remote inspections shall be NASSCO – PACP Certified Technicians. Testing performed by a company failing to meet these requirements will result in non-payment of the pipeline video inspection and non-certification of the pipe tested.

For video recorded, laser profiled pipe indicating deflection is in excess of Specification requirements, the Contractor may elect to further test the pipe with the use of a mandrel. Ensure mandrel meets requirements of GDT 136 and the Engineer has approved before use.

Mandrel or manual post installation inspection allowed for pipe diameters greater than 48 inches.

B. Requirements for Rigid Pipe – Concrete

1. **Joints:** Note differential movement, cracks, spalling, improper gasket placement, movement or settlement of pipe sections, and leakage in the inspection report. Repair or replace pipe sections to the satisfaction of the Engineer where joint separation is greater than 1 inch (25 mm). Repair or replace pipe sections where soil migration through the joint is occurring.
2. **Longitudinal and Transverse Cracks:** Cracks with a width less than 0.01 inch (0.25 mm) are considered hairline and minor and only need to be noted in the inspection report, no corrective action is necessary. When cracks exceed the cracking and installation thresholds indicated in the Rigid Pipe Remediation Table in Section 550.5.01.B, regardless of position in the wall of the pipe, measure the width, length, and locations of the cracks and diameter of the pipe, both horizontally and vertically, use remediation methods in accordance with recommendations of the pipe manufacturer and submit to the Engineer for review and approval an evaluation utilizing a Professional Engineer registered in the State of Georgia that takes into

Section 550 — Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

consideration structural integrity, environmental conditions, and the design service life of the pipe. Based on the evaluation, the Department may allow the pipe to remain in place if the cracking is remediated according to an approved remediation plan submitted in writing to the Engineer. Provide 10 business days for the Department to review the evaluation. When the pipe shows cracking 0.01 inch (0.25 mm) or greater and extending for a length of 12 inches (300mm), remediate or replace as directed by the Engineer. When the camera/video cracking results are called into question, the Department may require manual inspection measurements.

C. Requirements for Flexible Pipe – Thermoplastic, Corrugated Metal

1. Joints: Remediate pipe showing evidence of crushing at the joints. Note differential movement, improper joint sealing, movement or settlement of pipe sections, and leakage in the inspection report. Remediate joint separation of greater than 1 inch (25 mm) per manufacturer's recommendation. Repair or replace pipe sections where soil migration through the joint is occurring.
2. Cracks: Remediate cracks or splits in the interior wall of the pipe. Use remediation methods in accordance with recommendations of the pipe manufacturer and accepted and authorized by the Engineer.
3. Buckling, bulging, and racking: Note in the inspection report flat spots or dents at the crown, sides or flowline of the pipe due to racking. Note areas of wall buckling and bulging in the inspection report. The Engineer will determine if corrective action is necessary.
4. Deflection: If flexible pipes exceed the deflection and installation thresholds indicated in the Flexible Pipe Deduction Table in Section 550.5.01.C, provide the Department with an evaluation of each location conducted by a Professional Engineer registered in the State of Georgia addressing the severity of the deflection, structural integrity, environmental conditions, and design service life. Based on the evaluation, the Department may allow the pipe to remain in place at a reduced unit price as shown in the Flexible Pipe Deduction Table. Provide 10 business days for the Department to review the evaluation. When the pipe shows deflection 10 percent or greater, remove and replace. When the laser deflection results are problematic, the Department may require mandrel or manual testing.
5. Coating on Corrugated Metal: Note areas of the pipe where the original coating has been scratched, scoured or peeled.

550.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

550.4 Measurement

A. Excavation and Backfill

Foundation backfill materials Types I, II and III are measured according to Subsection 207.4, *Measurement*.

Normal backfill is not measured separately.

No measurement will be made for graded aggregate used for structural backfill of thermoplastic pipe.

B. Flat Bottom and Circular Pipe (All Types)

The overall length of pipe installed, excluding tapered inlets, is measured in linear feet (meters), along the central axis of the diameter of the pipe. Wyes, tees, and bends are included in this measurement.

C. Pipe-Arches

The overall length of pipe-arch installed is measured in linear feet (meters), along the bottom center line of the pipe.

D. Multiple Installations

In multiple installations, each single line of culvert structure is measured separately.

E. Tapered Pipe Inlets

Tapered pipe inlet sections are measured as a unit; do not include them in the overall length of the pipe.

Section 550 — Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

F. Flared-End Sections

Flared-end sections are measured separately by the unit and not included in the overall pipe length.

G. Smooth-Flow Pipe

Smooth-flow pipe is measured by the linear foot (meter) along the pipe invert.

H. Elliptical Pipe

Elliptical pipe is measured in linear feet (meters) along the bottom center line of the pipe.

I. Video Inspection

Video Inspection is measured by the linear feet of quantity of pipe inspected. When inspection above the quantity specified in the Contract is performed due to the possibility of additional distresses or non-compliance noted by the Department and the pipe is found to be in compliance, the Department will measure this quantity as Extra Work as per Specification 104.04. However, if additional distresses are found, the additional linear feet of video inspection will not be measured for payment.

J. Deduction for Pipe Deflection

Quantity of deflected pipe will be determined using the pipe inspection summarization report in accordance with GDT 136. Deductions and possible replacement of pipe will be made for pipe sections that do not meet the requirements of this specification in accordance with the table in sub-section 550.5.01. The section length is determined by the length of the pipe between joints where the failure occurred.

550.4.01 Limits

Excavation and normal backfill are not measured for payment.

550.5 Payment

A. Backfill

Foundation backfill material Type II and III will be paid for according to Section 207.

Foundation backfill material Type I will be paid for according to Section 205 or Section 206.

Graded aggregate used for structural backfill of thermoplastic pipe will not be paid for separately, payment will be included in the overall price bid for pipe.

B. Pipe Installations

Pipe installations complete in place and accepted will be paid for at the Contract Price for each item.

This payment is full compensation for excavating, furnishing, and hauling materials; installing, cutting pipe where necessary; repairing or replacing damaged sections; making necessary connections; strutting, elongating, providing temporary drainage; joining an extension to an existing structure where required; and removing, disposing of, or using excavated material as directed by the Engineer.

1. Smooth Flow Pipe

The quantity of each diameter and steel thickness of smooth flow pipe as measured will be paid for at the Contract Unit Price per linear foot (meter) bid for the various sizes. Payment is full compensation for furnishing labor, materials, tools, O-ring mechanical joints, equipment, and incidentals to complete this Item, including removing and disposing excavation material.

2. Flared-End Sections

Flared-end sections, measured as specified above, will be paid for at the Contract Unit Price for each section of the specified size.

Payment will also include sawing, removing, and replacing existing pavement removed to install a new drainage structure.

Payment for this item is made as follows:

Section 550 — Storm Drain Pipe, Pipe-Arch Culverts, and Side Drain Pipe

One hundred percent of the Contract Price bid per linear foot (meter) is paid when the pipe is installed per the specifications including the required material documentation. The Contract Price is paid before post installation inspection.

C. Video Inspection

Include the cost of Video Inspection in the bid submitted for this pay item. Video Inspection will be paid for up to the maximum number of linear feet included in the contract. Testing performed by a company failing to meet the requirements of GDT 136 will result in non-payment of the pipeline video inspection and non-certification of the pipe tested. Failure to perform the video inspection may result in a deduction of payment for pipe installed until video inspection is complete.

D. Temporary Drainage

Temporary Drainage items will be paid for at 75% of contract price for each item when installed. The final 25% will be paid when the temporary drainage item is removed or filled with flowable fill as specified in the plans.

Payments will be made under:

Item No. 550	Storm drain pipe ___ in (mm), Class ___	Per linear foot (meter)
Item No. 550	Side drain pipe ___ in (mm), H=___	Per linear foot (meter)
Item No. 550	Pipe arch (span) ___ in (mm) x (rise) ___ in (mm)	Per linear foot (meter)
Item No. 550	Tapered pipe inlet ___ in (mm),	Per each
Item No. 550	Flared-end section ___ in (mm),	Per each
Item No. 550	Elliptical pipe ___ in (mm) wide x ___ in (mm) high	Per linear foot (meter)
Item No. 550	Video Inspection	Per linear foot (meter)
Item No. 550	Storm drain pipe ___ in (mm), Class ___, Temporary	Per linear foot (meter)
Item No. 550	Side drain pipe ___ in (mm), H= ___, Temporary	Per linear foot (meter)
Item No. 550	Flared-end section ___ in (mm), Temporary	Per each

550.5.01 Adjustments

A. Excavation

Excavation will not be paid for separately, but the other provisions of Section 205 and Section 208 shall govern.

B. Rigid Pipe

RIGID PIPE REMEDIATION TABLE	
Crack Width (inches)	Payment
Greater than or equal to 0.01 (0.25mm) and extend 12 in. (300 mm) but less than or equal to 0.1 in. (2.5 mm)	Remediate - 100% of the Unit Bid Price ⁽¹⁾
Greater than 0.1 in. (2.5 mm)	Remediate or Replace ⁽¹⁾

(1) Provide in writing a method for repairing the observed cracking. Do not begin work until the method has been approved.

C. Flexible Pipe

FLEXIBLE PIPE DEDUCTION TABLE	
Amount of Deflection (%)	Payment
0.0 to 5.0	100% of the Unit Bid Price
5.1 to 7.5	75% of the Unit Bid Price ⁽¹⁾
7.6 to 9.9	50% of the Unit Bid Price ⁽¹⁾
10 or greater	Remove and Replace

(1) Provide Structural Analysis for Flexible Pipe. Based on the structural analysis, the pipe may be allowed to remain in place at the reduced price.

Section 603—Rip Rap

603.1 General Description

This work includes placing protective coverings of sand-cement bag rip rap or stone rip rap.

When required, this work includes placing crushed stone filter material or plastic filter fabric beneath stone rip rap on:

- Fill slopes
- Cut slopes
- End rolls
- Shoulders
- Ditches
- Stream banks
- Channel banks
- Other locations

603.1.01 Definitions

General Provisions 101 through 150.

603.1.02 Related References

A. Standard Specifications

Section 800—Coarse Aggregate

Section 801—Fine Aggregate

Section 805—Rip Rap and Curbing Stone

Section 815—Graded Aggregate

Section 830—Portland Cement

Section 832—Curing Agents

Section 880—Water

Section 881—Fabrics

B. Referenced Documents

AASHTO T 134

QPL 28

603.1.03 Submittals

General Provisions 101 through 150.

Section 603 — Rip Rap

603.2 Materials

Ensure that the materials meet the requirements of the following specifications:

Material	Specification
Portland cement	830.2.01
Rip Rap (Stone)	805.2.01
Membrane Curing Compound	832.2.03
Stone Filter Blanket	815.2.01 or 800.2.01_(Size No. 467*)
Fine Aggregate for Sand Cement Rip Rap	801.2.03
Water	880.2.01
Woven Plastic Filter Fabric	881.2.05

*Except that up to 10% is allowed to pass the No. 4 (4.75 mm) sieve.

A. Bags for Sand-Cement Bag Rip Rap

Use cotton, burlap, or fiber reinforced paper bags that can contain the sand-cement mixture without leaking during handling and placing. Do not use bags that previously held sugar or other material that will adversely affect the sand-cement mixture.

Ensure that the capacity is at least 0.75 ft.³ (0.02 m³) but not greater than 2 ft.³ (0.5 m³).

B. Stone Dumped Rip Rap

Stone dumped rip rap is designated on the Plans as Type 1 or Type 3 as defined in Subsection 805.2.01.

603.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

603.3 Construction Requirements

603.3.01 Personnel

General Provisions 101 through 150.

603.3.02 Equipment

General Provisions 101 through 150.

603.3.03 Preparation

General Provisions 101 through 150.

603.3.04 Fabrication

General Provisions 101 through 150.

603.3.05 Construction

Construct this Work according to the following requirements:

Section 603 — Rip Rap

A. Preparing the Foundations

Prepare the ground surface where the rip rap will be placed to conform with the correct lines and grades before beginning the placement.

1. When filling depressions, compact the new material with hand or mechanical tampers.
Dispose of excess material by spreading it neatly within the right-of-way as an incidental part of the work.
2. Unless otherwise shown or provided below, begin placing the rip rap in a toe ditch constructed in original ground around the toe of the fill or the cut slope.
Ensure that the toe ditch is 2 ft. (600 mm) deep in original ground and the side next to the fill or cut has the same slope.
3. After placing the rip rap, backfill the toe ditch and spread the excess dirt neatly within the right-of-way as an incidental part of the work.
4. When beginning rip rap in water or below normal water level, substitute an apron of rip rap for the toe ditch.
Ensure that the width and thickness of this apron is as shown on the plans or determined by the Engineer.

B. Placing Stone Rip Rap

Place rip rap to the limits shown on the Plans or as directed by the Engineer. Place and classify rip rap as follows:

1. Stone Plain Rip Rap
Dump and handle stone plain rip rap into place to form a compact layer to the design thickness.
Ensure that the thickness tolerance for the course is plus 12 in. (300 mm) with no under-tolerance. If the plans do not show a thickness, place stone rip rap to at least 12 in. (300 mm) thick, but no greater than 2 ft. (600 mm) thick.
2. Stone Dumped Rip Rap
Dump stone dumped rip rap into place to form a uniform surface as thick as specified in the Plans.
 - a. Ensure that the thickness tolerance for the course is minus 6 in. (150 mm) and plus 12 in. (300 mm). If the plans or proposal do not specify a thickness, place the course to at least 2 ft. (600 mm) thick.
 - b. Recycled concrete that meets the requirements of Subsection 805.2.01 may be used instead of stone when shown on the plans or approved by the Engineer.
Use recycled concrete only when materials do not contain steel after processing.

NOTE: Do not use recycled concrete in aesthetically sensitive areas.

3. Stone Grouted Rip Rap
Place stone grouted rip rap according to specifications for stone plain rip rap and these guidelines:
 - a. Prevent earth from filling the spaces between the stones.
 - b. After placing the stone, fill the spaces between them with 1:3 grout composed of Portland cement and sand mixed thoroughly with enough water to make a thick, creamy consistency.
 - c. Place the grout beginning at the toe. Finish it by sweeping with a stiff bristle broom.
 - d. After grouting, cover the rip rap and keep it wet for 5 days, or cover and keep wet for 24 hours and then coat with white pigmented membrane curing compound.

Section 603 — Rip Rap

C. Placing Filter

Place woven plastic filter fabric under all rip rap. Follow these requirements for placing the filter fabric:

1. Prepare the surface to receive the fabric until it is smooth and free from obstructions, depressions, and debris.
2. Place the fabric with the long dimension running up the slope. Minimize the number of overlaps.
3. Place the strips to provide a width of at least 1 ft. (300 mm) of overlap for each joint.
4. Anchor the filter fabric in place with securing pins of the type recommended by the fabric manufacturer. Place the pins on or within 3 in. (75 mm) of the centerline of the overlap.
5. Place the fabric so that the upstream strip will overlap the downstream strip.
6. Loosely place the fabric to prevent stretching and tearing during stone placement.
Do not drop the stones more than 3 ft. (1 m) during construction.
7. Always protect the fabric during construction from clogging due to clay, silts, chemicals, or other contaminants.
8. Remove contaminated fabric or fabric damaged during installation or rip rap placement. Replace with uncontaminated or undamaged fabric at no expense to the Department.

D. Placing Sand-Cement Bag Rip Rap

Place rip rap to the limits shown on the plans or as directed by the Engineer.

1. Proportioning Materials

Mix sand and Portland cement at the maximum ratio of 5:1 by weight.

- a. Obtain a minimum compressive strength of 500 psi (3 MPa) in 7 days.
- b. For sand-cement bag rip rap, use enough water to make up the optimum moisture content of the aggregate and cement as determined by AASHTO T 134.
- c. When sand-cement rip rap is to be prebagged, mix the sand cement dry. After placing each course, wet the bags until the bags are wet enough for proper cement hydration.

2. Placement

Before placing sand-cement bag rip rap, fill the bags full, but allow room to tie the bags.

- a. Place the bagged rip rap by hand with the tied ends facing the same direction. Produce close, broken joints.
- b. Place header courses when directed by the Engineer or required by the plans.
- c. After placing the bags, ram or pack them against one another to produce the required thickness and form a consolidated mass.
- d. Do not allow the top of each bag to vary more than 3 in. (75 mm) above or below the required plane.

E. Placing Stone Blanket Protection

Ensure that the stone blanket protection meets the materials Specifications for stone filter blanket as specified in Subsection 603.2, *Materials*, except stone size No. 357 will be allowed instead of size No. 467.

Place stone blanket protection to the limits shown on the plans, or as directed by the Engineer.

Uniformly place this material to the thickness shown on the plans and to a thickness tolerance of 0.5 in. (\pm 15 mm).

Do not use stone blanket protection on slopes steeper than two horizontal to one vertical or in areas highly susceptible to erosion. Do not use plastic filter fabrics with stone blanket protection.

603.3.06 Quality Acceptance

General Provisions 101 through 150.

603.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

Section 603 — Rip Rap

603.4 Measurement

This work is measured for payment in square yards (meters) of accepted material of the specified thickness. Area measurements are made parallel to the surface on which the material is placed. Plastic filter fabric will be measured as the area of rip rap placed and accepted. No separate measurement will be made for fabric overlap joints, seams, or vertical sections at toe of slopes. No separate measurement is made for grout or cushioning sand.

Plan dimensions are figured by the use of filled bags 12 by 18 by 6 in. (300 by 450 by 150 mm) thick.

When filled bags are less than plan dimensions or are of varying lengths or width, plan square yards (meters) will be used to determine pay quantities, if overall dimensions are equal to or greater than those shown on the plans.

603.4.01 Limits

General Provisions 101 through 150.

603.5 Payment

This work will be paid for at the Contract Price per square yard (meter) of material complete in place.

Payment will be made under:

Item No. 603	Stone plain rip rap ___ in. (mm) thick	Per square yard (meter)
Item No. 603	Stone dumped rip rap (<u>type</u>) ___ in. (mm) thick	Per square yard (meter)
Item No. 603	Stone grouted rip rap (<u>thick</u>)	Per square yard (meter)
Item No. 603	Filter blanket	Per square yard (meter)
Item No. 603	Sand-cement bag rip rap, ___ in. (mm) thick	Per square yard (meter)
Item No. 603	Stone blanket protection, ___ in. (mm)	Per square yard (meter)
Item No. 603	Plastic filter fabric	Per square yard (meter)

603.5.01 Adjustments

General Provisions 101 through 150.

Section 611—Relaying, Reconstructing, or Adjusting to Grade of Miscellaneous Roadway Structures

611.1 General Description

This work includes relaying, reconstructing, resetting, adjusting to grade, capping minor structures, resetting guard rail, or adjusting other miscellaneous roadway structures as specified in the proposal or on the plans.

611.1.01 Definitions

General Provisions 101 through 150.

611.1.02 Related References

A. Standard Specifications

Section 610—Removal of Miscellaneous Roadway Items

Section 641—Guard Rail

Section 668—Miscellaneous Drainage Structures

Section 854—Castings and Forgings

B. Referenced Documents

General Provisions 101 through 150.

611.1.03 Submittals

General Provisions 101 through 150.

611.2 Materials

Most materials for the work in this specification are salvaged from the removal of existing structures. The Engineer will determine the suitability of the salvaged material for use.

Use other materials to complete the structure, such as mortar, sand-cement grout, sand for sand cushion, bituminous filler, brick, and other materials that meet the requirements of the applicable specifications for such materials for use in new structures of the same character and type.

611.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

611.3 Construction Requirements

611.3.01 Personnel

General Provisions 101 through 150.

611.3.02 Equipment

General Provisions 101 through 150.

611.3.03 Preparation

General Provisions 101 through 150.

611.3.04 Fabrication

General Provisions 101 through 150.

611.3.05 Construction

A. Miscellaneous Roadway Items

Follow these procedures to construct miscellaneous roadway items:

1. Remove existing structures to be rebuilt according to Section 610.
2. Clean the material salvaged for use in the rebuilt structure and stockpile it in convenient places. Protect it from damage until it is used.
3. Dispose of the portions of structures not suitable for reuse as provided in Section 610. Replace them with suitable new material.
4. Relay or rebuild the structures according to the Specifications for new structures of the same type.
5. Adjust to the required grade miscellaneous structures specified in the proposal or on the plans by raising or lowering the upper portion of the fixture, including sleeve extensions, adjustable manhole rings, gaskets, mastic, mortar, masonry, and other material.
6. Furnish materials such as mortar, sand-cement grout, sand cushion, bituminous filler, brick, castings, and other materials to excavate, trench, prepare earth foundation, backfill, and other work necessary to complete the Item.

B. Capping an Existing Structure

When capping an existing structure requires removing adjacent existing pavement, sidewalk, curb, gutter, or other improvement not otherwise affected by the work, follow these guidelines:

1. Remove the improvements to expose only the portion of the structure to be modified.
2. Replace the removed improvements to the Engineer's satisfaction without additional compensation.
3. Remove enough existing masonry to lower the top elevation to a point not less than the thickness of the cap plus 3 ft. (1 m) below subgrade elevation, unless otherwise indicated.
4. Cap the remaining portion of the structure with a fitted reinforced concrete cover constructed to the general details shown on the plans.

Grates, rings, plates, covers, hoods, or other castings or fittings removed while capping and not re-used become the property of the Department unless otherwise indicated on the plans.

C. Resetting Guard Rail

When resetting the guard rail is specified in the Proposal:

1. Reset guard rail removed according to Section 610 where the plan indicates and to the required post spacing.
2. Furnish materials, including additional hardware, offset blocks, and posts.
3. Replace posts that do not conform to the plans.
4. Follow the applicable provisions of Section 641.

D. Raising Manholes

When raising manholes:

1. Adjustments may be made by using adjustable extension rings that do not require removing the existing manhole frame.
2. Ensure that the extension device locks to the existing frame and permits height and diameter adjustment. The adjustable extension ring to be used shall have the Engineer's prior approval.
3. Choose an extension ring compatible with the existing casting and cover. Ensure that the adjustment range conforms to the finished pavement surface.

Section 611 — Relaying, Reconstructing, or Adjusting to Grade of Miscellaneous Roadway Structures

- a. Use an adjustable extension ring made of materials that meet the requirements of Subsection 854.2.01 or are manufactured from ASTM A 36/A 36M steel and approved by the Office of Materials and Research.
- b. Ensure that the extension ring and cover are machine ground to reduce contact irregularity. Ensure that the grates are rattle proof.
- c. Obtain the Engineer’s approval for the type of adjustable extension ring used.

E. Replacing Fences

Replace fences removed under Section 610 in kind, using the removed materials as far as possible. Unless the Plans provide for new fence at the particular location, include new materials required in the Bid Price for resetting fence.

611.3.06 Quality Acceptance

General Provisions 101 through 150.

611.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

611.4 Measurement

Relaying, reconstructing, or adjusting to grade, capping minor structures, resetting guard rail, or adjusting other miscellaneous roadway structures is measured to determine the unit or units of each type completed and accepted.

Manhole tops to be raised or lowered 2 ft. (600 mm) or less are considered “Adjust to Grade.”

Manhole tops to be raised between 2 ft. (600 mm) and 6 ft. (1.8 m), or tops to be lowered more than 2 ft. (600 mm), are considered “Reconstruct Manhole” and are paid as shown in Subsection 611.5, *Payment*.

Remove manholes to be raised more than 6 ft (1.8 m) as clearing and grubbing and construct a new manhole in its place according to Section 668.

611.4.01 Limits

General Provisions 101 through 150.

611.5 Payment

Relaying, reconstructing, resetting, adjusting to grade, capping minor structures, resetting guard rail, or adjusting other miscellaneous roadway structures will be paid for at the Contract Unit price. Payment is full compensation for relaying, resetting, reconstructing, or adjusting to grade the structures as specified in this Specification.

Excavation and backfill necessary for capping is considered incidental to the Item and is not paid for separately.

Tapping a new pipeline into an existing structure is not considered reconstruction of the existing structure.

Payment will be made under:

Item No. 611	Relay	Per unit shown in Proposal
Item No. 611	Reconstruct	Per unit shown in Proposal
Item No. 611	Reset	Per unit shown in Proposal
Item No. 611	Adjust to grade	Per unit shown in Proposal
Item No. 611	Cap minor structures	Per unit shown in Proposal

611.5.01 Adjustments

General Provisions 101 through 150.

Section 636—Highway Signs

636.1 General Description

This work includes fabricating and installing highway signs according to the details on the plans and the Manual on Uniform Traffic Control Devices (MUTCD).

636.1.01 Definitions

General Provisions 101 through 150.

636.1.02 Related References

A. Standard Specifications

Section 500—Concrete Structures

Section 830—Portland Cement

Section 855—Steel Pile

Section 870—Paint

Section 910—Sign Fabrication

Section 911—Sign Posts

Section 912—Sign Blanks and Panels

Section 913—Reflectorizing Materials

Section 914—Sign Paint

Section 915—Mast Arm Assemblies

Section 916—Delineators

Section 917—Reflective and Nonreflective Characters

B. Referenced Documents

Manual on Uniform Traffic Control Devices

636.1.03 Submittals

Before fabricating overhead panel type signs, submit to the Engineer the Shop Drawings to approve the sign bracing and method of attaching to sign supports.

Before driving piles, furnish a list of proposed pile lengths to the Engineer.

Section 636 — Highway Signs

636.2 Materials

Ensure that materials meet the requirements of the following specifications:

Material	Section
Sign Fabrication and Accessories	910
Steel Sign Posts and Bolts (Drive Type)	911.2.01
Galvanized Steel Structural Shape Posts	911.2.02
Delineator Posts	
Galvanized Steel	911.2.04.A.4
Aluminum "U" Flange	911.2.04.A.5
Wood	911.2.04.A.6
Flexible	911.2.04.A.7
Aluminum Sign Blanks	912.2.01
Extruded Aluminum Sign Panels	912.2.02
Reflective Sheeting	913.2.01
Silk Screen Lettering Paint	914.2.01
Steel Posts and Arms for Mast Arm Assembly	915.2.01
Guy Wires for Mast Arm Assembly	915.2.02
Center Mount Reflector	916.2.01
Demountable Characters with Reflective Sheeting	917.2.01
Fittings, bolts, nuts, washers, clips, molding, etc., for panel signs shall conform to the requirements shown on the Plans.	
Class A Concrete Footings for Signs	500
Piling	855.2.03
Portland Cement	830.2.01
Sign Paint, Enamel	870.2.03

636.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

636.3 Construction Requirements

636.3.01 Personnel

General Provisions 101 through 150.

636.3.02 Equipment

General Provisions 101 through 150.

636.3.03 Preparation

General Provisions 101 through 150.

636.3.04 Fabrication

General Provisions 101 through 150.

636.3.05 Construction

A. Finished Signs

Ensure that the finished signs are clear cut and that the lines of letters and details are true, regular, and free of waviness, unevenness, furry edges or lines, scaling, cracking, blistering, pitting, dents, or blemishes.

Only one type of demountable characters (letters, numerals, symbols, and borders) is permitted on special roadside signs on each project.

B. Erecting the Signs

1. Drive Type Posts

Drive type posts may be driven in place or placed in prepared holes.

- a. Use driven posts only in firm and stable soil. If the soil is sandy or unstable, place each drive type post in a prepared dry hole of at least a 4 in. (100 mm) diameter.
- b. When placing posts in prepared holes:
 - 1) Backfill the holes with a mixture of damp, clean friable soil and 8 percent by volume Portland cement.
 - 2) Thoroughly tamp the mixture in place around the posts.
- c. Erect posts vertically as deep and at an angle to the roadway as shown on the Plans or as directed.
- d. Do not penetrate posts in the coastal plain region less than 4 ft. (1.2 m) or 3 ft. (1 m) for posts in the Piedmont and the Valley and Ridge Regions when no guard rail is present.

When erecting signs behind a guard rail, penetrate at least 3 ft. (1 m) for posts 14 ft. (4.2 m) or less long, or 4 ft. (1.2 m) for posts over 14 ft. (4.2 m) long.

2. Single-Plate Signs

Erect single-plate signs 9 ft.² (0.84 m²) or less on one drive-type post unless otherwise specified on the plans.

Erect single-plate signs greater than 9 ft.² (0.84 m²) on two drive-type posts.

Leave enough distance between the two posts to fit the mounting holes in the sign plate.

3. Steel Posts for Mast Arm Assemblies

- a. Erect steel posts for mast arm assemblies in a concrete foundation according to the plans. Erect at the place, height, and angle to the roadway specified.
- b. After curing the concrete foundation for at least 24 hours, securely fasten the specified signs into place on the mast arm.

4. Ground-Mounted Panel-Type Signs

- a. Erect the supporting members of ground-mounted panel-type signs where shown on the plans or as directed by the Engineer at the specified angle to the roadway.
- b. Securely fasten the panels into place.

5. Milepost Signs

Erect milepost signs including posts as specified on the plans.

6. Delineator Posts

Use delineator posts made of galvanized steel, aluminum, or an alloy that conforms to the requirements of Subsection 911.2.04.A.4 or 911.2.04.A.5.

- a. Erect the posts where shown on the plans.
- b. Mount reflectors for galvanized steel or aluminum posts on the flange side of the post.
- c. When signs are attached to supports, torque the bolts to at least 20 ft.-lbs. (27 N•m).

Section 636 — Highway Signs

7. Overhead Panel-Type Signs

Erect overhead panel type signs on sign supports where shown on the Plans or as directed by the Engineer.

- a. Ensure that the bottom of the sign is 18 in. (450 mm) above the top of the lighting fixture.
- b. Ensure that the sign has ample bracing for mounting the sign support so that each sign can withstand 1 in. (25 mm) of ice accumulated on the entire sign and wind pressures shown on the plans.
- c. Ensure that the top of each sign is three degrees off perpendicular from the bottom of the sign. Use the three-degree slant to lean the sign toward the approaching traffic.

C. Foundations (for Special Roadside Signs)

Do not disturb the natural ground adjacent to a foundation more than necessary to construct the footing.

1. Excavate for the footings to the lines and elevations shown on the Plans or established by the Engineer. Do not disturb or loosen the foundation below these elevations.
2. Use forms of the necessary shape and dimensions to construct the footings to the lines and elevations shown on the plans.
3. Cure the concrete foundations, constructed in conformance with Section 500 and the plan details, at least 7 days before erecting the sign.
4. Ensure that the minimum lengths of steel H piling used in the foundations of ground-mounting signs are accepted and meet the plan penetration requirements.

The Plan quantity of steel H piling is shown for estimating purposes only; determine and provide the necessary lengths of piles.

5. Before driving the piles, furnish a list of proposed pile lengths to the Engineer.
 - a. Use full-length piles or built-up piles with a maximum of two splices that are made in the presence of the Engineer.
 - b. Furnish satisfactory identification for all piles or portions thereof.
6. When rock prevents the penetration required on the plans, construct according to the notes and details shown on the plans.
7. The minimum energy ratings required by Section 520 for pile hammers will be waived for constructing ground-mounted sign supports. Jetting is not permitted.
8. Place required backfilling in layers no greater than 6 in. (150 mm) thick and thoroughly compact it to the approximate density of the undisturbed soil in the area.

D. Sign Panels

Use extruded, panel-type aluminum. Ensure that the sign type used meets the requirements of Subsection 912.2.02.

E. Legends and Borders

Place legends and borders according to Subsection 917.2.01, *Demountable Characters*, with Type XI reflective sheeting.

636.3.06 Quality Acceptance

General Provisions 101 through 150.

636.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

636.4 Measurement

A. Type-1 or Type-2 Highway Signs

Type 1 or Type 2 highway signs with reflective sheeting of Type IX or XI as specified on the plans to be paid for are measured for payment by the actual number of square feet (meters) and fraction thereof of sign type and sheeting specified. The measurement includes providing the message and furnishing and placing signs complete and accepted. The plan quantity will be the pay quantity.

B. Extruded Aluminum Panels

Extruded aluminum panels to be paid for are the number of square feet (meters) or portion of square feet (meters) furnished, including legend components, border material, fittings, nuts, washers, clamps, molding, etc., furnished, erected, completed, and accepted.

C. Galvanized Steel Posts

Galvanized steel posts, types 7, 8, or 9 to be paid for are the actual number of linear feet (meters) and fraction thereof of the type specified, furnished, erected, completed, and accepted.

Galvanized steel to be paid for is the number of pounds (kilograms) furnished, erected, and accepted. Weights are computed from theoretical weights listed in the plans for each post size. Base plates, connections, anchors, stub post, etc., are not measured for payment but are considered incidental to the Item.

D. Delineators

Delineators (reflectorized guide markers) to be paid for are the number of the type specified, including posts, rivets, and spacers, that are furnished, placed, and completed and accepted.

E. Mast Arm Assemblies

Mast arm assemblies to be paid for are the actual number furnished and erected, including concrete footing, sign, and post, completed and accepted.

F. Special Roadside Signs

Class A concrete for special roadside signs to be paid for are measured by the cubic yard (meter), neat measurement according to Section 500.5 *Payment*. No deductions are made for the volume of concrete displaced by steel piling, anchor bolts, or posts.

G. Portland Cement

Portland cement stabilized material used for backfilling holes is not measured for payment.

H. Steel H—Piling

Steel H—piling is measured for payment by the linear foot (meter) of accepted piling in place (signs), remaining in the completed work.

636.4.01 Limits

General Provisions 101 through 150.

Section 636 — Highway Signs

636.5 Payment

Highway signs, galvanized steel posts, I-beam posts, delineators, mast arm assemblies, Class A concrete, and piling for signs are paid for at the Contract Unit Price for the various items. Payment is full compensation for furnishing and erecting the Item complete in place according to this specification.

Separate payment will not be made for piling splices, the cost of cutting, or the cutoff portions. Pile cutoffs remain the Contractor's property.

Piles eliminated due to authorized revisions will be paid for according to Subsection 109.06, *Eliminated Items*. These piles become Departmental property. Except for the above provision, no payment will be made for piles delivered to the project that are not used in the work.

Payment will be made under:

Item No. 636	Highway signs, type 1 material, reflective sheeting type___,	Per square foot (meter)
Item No. 636	Highway signs, type 2 material, reflective sheeting type___,	Per square foot (meter)
Item No. 636	Galvanized steel posts, type ___	Per linear foot (meter)
Item No. 636	Galvanized steel structural shape posts	Per pound (kilogram)
Item No. 636	Highway signs, aluminum extruded panels, reflective sheeting type ___	Per square foot (meter)
Item No. 636	Plastic Flexible Delineator, type___	Per each
Item No. 636	Delineator, Type___	Per each
Item No. 636	Piling in place, signs, steel H, HP 12x53 (HP 310x79)	Per linear foot (meter)

636.5.01 Adjustments

General Provisions 101 through 150.

Section 652—Painting Traffic Stripe

652.1 General Description

This work includes furnishing and applying reflectorized high build standard and high build wet weather traffic line paint according to the plans and these specifications.

This Item also includes applying words and symbols according to plan details, specifications, and the current Manual on Uniform Traffic Control Devices.

652.1.01 Definitions

Painted Stripes: Solid or broken (skip) lines. The location and color are designated on the plans.

Skip Traffic Stripes: Painted segments with unpainted gaps as specified on the plans. The location and color are designated on the plans.

652.1.02 Related References

A. Standard Specifications

- General Provisions 101 through 150.
- Section 656—Removal of Pavement Markings
- Section 870 – Paint
- EPA Method 3052
- EPA Method 6010

B. Referenced Documents

ASTM	ASTM	Other
D711	E4941	AASHTO M 247
D3335	E1710	QPL 46, QPL 71
D3718	E2177	SOP 39
D4144		TT-P-1952E

652.1.03 Submittals

General Provisions 101 through 150.

652.2 Materials

Ensure that materials for painting traffic stripe, words, and symbols meet the following requirements:

A. Traffic Line Paint

Material	Section
Traffic Line Paint 6A and 6B	870.2.02.A.4 and 870.2.02.A.5

Section 652 — Painting Traffic Stripe

B. Glass Spheres and Reflective Composite Optics

Use glass spheres and/or reflective composite optics for the reflective media system that ensures the high build paint pavement markings meet the reflectance performance requirements in Subsection 652.3.06. Do not use glass spheres and/or reflective composite optics containing greater than 200 ppm total arsenic, 200 ppm total antimony, or 200 ppm total lead when tested according to the most recent US EPA Methods 3052 and 6010, or other approved methods.

Ensure glass spheres meet the requirements of AAHTO M 247. Use glass spheres produced from an approved source listed on QPL 71. Glass beads conforming to an alternative gradation may be used provided all other requirements of AASHTO M 247 and this specification are met. Obtain approval from the Office of Materials and Research to use alternate gradations.

652.2.01 Delivery, Storage, and Handling

A. Storage

Ensure the paint does not cake, liver, thicken, curdle, gel, or show any other objectionable properties after storage for six months above 32 °F (0 °C).

B. Handling

Mix thoroughly before use.

652.3 Construction Requirements

652.3.01 Personnel

General Provisions 101 through 150.

652.3.02 Equipment

A. Traveling Traffic Stripe Painter

Use a traffic stripe painter that can travel at a predetermined speed both uphill and downhill, applying paint uniformly. Ensure that the painter feeds paint under pressure through nozzles spraying directly onto the pavement.

Use a paint machine equipped with the following:

1. Three adjacent spray nozzles capable of simultaneously applying separate stripes, either solid or skip, in any pattern.
2. Nozzles equipped with the following:
 - Cutoff valves for automatically applying broken or skip lines
 - A mechanical bead dispenser that operates simultaneously with the spray nozzle to uniformly distribute glass spheres and/or reflective composite optics at an application rate to meet the reflectance performance requirements in Subsection 652.3.06.
 - Line-guides consisting of metallic shrouds or air blasts
3. Tanks with mechanical agitators
4. Small, portable applicators or other special equipment as needed

B. Hand Painting Equipment

Use brushes, templates, and guides when hand painting.

C. Cleaning Equipment

Use brushes, brooms, scrapers, grinders, high-pressure water jets, or air blasters to remove dirt, dust, grease, oil, and other foreign matter from painting surfaces without damaging the underlying pavement.

Section 652 — Painting Traffic Stripe

652.3.03 Preparation

Locate approved paint manufacturers on QPL 46.

Before starting each day's work, thoroughly clean paint machine tanks, connections, and spray nozzles, using the appropriate solvent.

Thoroughly mix traffic stripe paint in the shipping container before putting it into machine tanks.

Before painting, thoroughly clean pavement surfaces of dust, dirt, grease, oil, and all other foreign matter.

652.3.04 Fabrication

General Provisions 101 through 150.

652.3.05 Construction

A. Alignment

Ensure that the traffic stripe is the specified length, width, and placement. On sections where no previously applied markings are present, ensure accurate stripe location by establishing control points at spaced intervals. The Engineer will approve control points.

B. Application

Apply traffic stripe paint by machine. If areas or markings are not adaptable to machine application, use hand equipment.

1. Application Rate

Paint will be subject to application rate checks.

Apply 5 in (125 mm) wide traffic stripe at the following minimum rates:

- a. Solid Traffic Stripe Paint: At least 34 gal/mile (80 L/km)
- b. Skip Traffic Stripe Paint: At least 10 gal/mile (24 L/km)

NOTE: Change minimum rate proportionately for varying stripe widths.

2. Thickness

Maintain 25 mils (0.58mm) minimum wet average thickness above the surface of the pavement.

3. Do not apply paint to areas of pavement when:

- The surface is moist or covered with foreign matter.
- Air temperature in the shade is below 50 °F (10 °C)
- Wind causes dust to land on prepared areas or blows paint and glass spheres and/or reflective composite optics around during application

4. Apply a layer of glass spheres and/or reflective composite optics immediately after laying the paint. Apply glass spheres and/or reflective composite optics at a rate to meet the reflectance performance requirements in Subsection 652.3.06.

C. Protective Measures

Protect newly applied paint as follows:

1. Traffic

Control and protect traffic with warning and directional signs during painting. Set up warning signs before beginning each operation and place signs well ahead of the painting equipment. When necessary, use a pilot car to protect both the traffic and the painting operation.

Section 652 — Painting Traffic Stripe

2. Fresh Paint

Protect the freshly painted stripe using cones or drums. Repair stripe damage or pavement smudges caused by traffic according to Subsection 652.3.06.

D. Appearance and Tolerance of Variance

Continually deviating from stated dimensions is cause for stopping the work and removing the nonconforming stripe. (See Section 656—Removal of Pavement Markings.) Adhere to the following measurements:

1. Width

Do not lay stripe less than the specified width. Do not lay stripe more than 1/2 in. (13 mm) over the specified width.

2. Length

Ensure that the 10 ft. (3 m) painted skip stripe and the 30 ft. (10 m) gap between painted segments vary no more than ± 1 ft. (300 mm) each.

3. Alignment

- a. Ensure that the stripe does not deviate from the intended alignment by more than 1 in. (25 mm) on straight lines or curves of 1 degree or less.
- b. Ensure that the stripe does not deviate by more than 2 in. (50 mm) on curves exceeding 1 degree.

652.3.06 Quality Acceptance

A. General

For a minimum of 30 days from the time of placement, ensure the high build traffic paint pavement marking material shows no signs of failure due to blistering, excessive cracking, shipping, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil, diesel fuel, or gasoline drippings, spilling, poor adhesion to the pavement material, vehicular damage, and normal wear. In the event that failures mentioned above occur, ensure corrective work is completed at no additional cost to the Department.

Obtain pavement marking retro-reflectivity values with a 30-meter geometry retro-reflectometer.

B. Initial Retro-reflectivity

1. Longitudinal Lines

Within 30 days of installation, ensure the in-place markings meet the following minimum reflectance values:

a. High Build Wet Weather Traffic Paint

	White	Yellow
Dry (ASTM E 1710)	300 mcd/lux/m ²	250 mcd/lux/m ²
Wet recovery (ASTM E 2177)	150 mcd/lux/m ²	100 mcd/lux/m ²

b. High Build Standard Traffic Paint

	White	Yellow
Dry (ASTM E 1710)	300 mcd/lux/m ²	250 mcd/lux/m ²

For each center line, edge line, and skip line, measure retro-reflectivity 9 times for each mile; 3 times within the first 500 feet, 3 times in the middle, and 3 times within the last 500 feet. For projects less than one mile in length, measure retro-reflectivity 9 times as above.

Record all retro reflectivity measurements on the form OMR CVP 66 in SOP 39.

Section 652 — Painting Traffic Stripe

2. Messages, Symbols, and Transverse Lines

Within 30 days of installation, ensure the in-place markings when tested according to ASTM E 1710 meet the following minimum reflectance value of 275 mcd/lux/m².

Perform at a minimum, one retro-reflectivity measurement at one message, one symbol and one transverse line per intersection. Take one measurement per mile for locations other than intersections (i.e. school messages, railroad messages, bike symbols etc.)

C. Six Month Retro-reflectivity (Longitudinal Lines)

Maintain the following minimum reflectance values for 180 days after installation:

a. Wet Weather High Build Wet Weather Traffic Paint

	White	Yellow
Dry (ASTM E 1710)	300 mcd/lux/m ²	250 mcd/lux/m ²
Wet recovery (ASTM E 2177)	150 mcd/lux/m ²	100 mcd/lux/m ²

b. High Build Standard Traffic Paint

	White	Yellow
Dry (ASTM E 1710)	300 mcd/lux/m ²	250 mcd/lux/m ²

Retest the in-place markings according to Subsection 652.3.06.B.1, 180 days after installation to ensure these minimum retroreflectance values are maintained.

NOTE: The Contractor is responsible for retro-reflectivity testing. Furnish initial test results to the Engineer within 30 days of application. Furnish 6-month test results to the Engineer within 180 days of application or prior to final acceptance, whichever comes first.

D. Thickness

At the time of installation, check the thicknesses on all skip lines, edge lines and center lines according to ASTM D 4114.

For each center line, edge line, and skip line, measure thickness above the pavement 3 times for each mile; once within the first 500 ft., once in the middle, and once within the last 500 ft. For projects less than one mile in length, measure the thickness above the pavement 3 times.

Record thickness measurements on the form OMR CVP 66 in SOP 39.

Submit results to the Engineer.

E. Corrective Work

For each mile section, if paint stripe fails to meet plan details or specifications or deviates from stated dimensions, correct it at no additional cost to the Department. If removal of pavement markings is necessary, perform it according to Section 656 and place it according to this specification. No additional payment will be made for removal and replacement of unsatisfactory striping. Ensure corrective work is completed at no additional cost to the Department. Perform testing according to this specification. Any retest due to failures will be performed at no additional cost to the Department. Furnish all test reports to the Department.

Retro-reflectivity and Thickness Longitudinal Line Deficiency: A deficiency will ensue when two or more Location Average results as recorded on form OMR CVP 66 within a One-Mile Section do not meet the performance criteria herein. The entire line within this one-mile section will be determined to be deficient. If the evaluated section is less than 1.0 mile, a single Location Average result not meeting the performance criteria herein will result in the entire line to be determined to be deficient.

Section 652 — Painting Traffic Stripe

Retro-reflectivity Transverse Markings and Symbol Deficiency: A single Location Average result on the marking or symbol not meeting the performance criteria herein will result in the marking or symbol to be determined to be deficient.

F. Acceptance Criteria

Ensure that stripes and segments of stripes are clean-cut and uniform. Markings that do not appear uniform or satisfactory, either during the day or night, or do not meet specifications, will be corrected at the Contractor's expense. Paint will be subject to application rate checks.

1. Correction of Alignment

When correcting a deviation that exceeds the permissible tolerance in alignment, do the following:

- a. Remove the affected portion of stripe, plus an additional 25 ft. (8 m) in each direction according to Section 656—Removal of Pavement Markings.
- b. Paint a new stripe according to these specifications.

2. Removal of Excess Paint

Remove misted, dripped, or spattered paint to the Engineer's satisfaction. Do not damage the underlying pavement during removal.

Refer to the applicable portions of Section 656—Removal of Pavement Markings.

652.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

652.4 Measurement

When traffic stripe is paid for by the square yard (meter), the number of square yards (meters) painted is measured and the space between stripes is included in the overall measurement.

Linear measurements are made on the painted surface by an electronic measuring device attached to a vehicle. On curves, chord measurements, not exceeding 100 linear feet (30 linear meters), are used.

Traffic stripe and markings, complete in place, are measured and accepted for payment as follows:

A. Solid Traffic Stripe

Solid traffic stripe is measured by the linear foot (meter), linear mile (kilometer), or square yard (meter). Breaks or omissions in solid lines or stripes at street or road intersections are not measured.

B. Skip Traffic Stripe

Skip traffic stripe is measured by the gross linear foot (meter) or gross linear mile (kilometer). Unpainted spaces between the stripes are included in the overall measurements if the plan ratio of 1 to 3 remains uninterrupted. Measurement begins and ends on a stripe.

C. Pavement Markings

Markings are words and symbols completed according to plan dimensions. Markings are measured by the unit.

652.4.01 Limits

General Provisions 101 through 150.

Section 652 — Painting Traffic Stripe

652.5 Payment

Payment will be full compensation for the work under this section, including the following:

- Cleaning and preparing surfaces
- Furnishing materials, including paints, beads, and thinners
- Applying, curing, and protecting paints
- Protecting traffic, including providing and placing necessary warning signs
- Furnishing tools, machines, and other equipment necessary to complete the Item

Payment will be made under:

Item No. 652	Solid traffic stripe, ____ in. (mm), (<u>color</u>)	Per linear mile (kilometer)
Item No. 652	Skip traffic stripe, ____ in. (mm), (<u>color</u>)	Per gross linear mile (kilometer)
Item No. 652	Solid traffic stripe, ____ in. (mm), (<u>color</u>)	Per linear foot (meter)
Item No. 652	Skip traffic stripe, ____ in. (mm), (<u>color</u>)	Per gross linear foot (meter)
Item No. 652	Pavement markings, words, and symbols, (<u>color</u>)	Per each
Item No. 652	Traffic stripe, ____ in. (mm), (<u>color</u>)	Per square yard (meter)
Item No. 652	Solid traffic stripe, High Build Wet Weather, ____ in. (mm), (<u>color</u>)	Per linear mile (kilometer)
Item No. 652	Skip traffic stripe, High Build Wet Weather, ____ in. (mm), (<u>color</u>)	Per gross linear mile (kilometer)
Item No. 652	Solid traffic stripe, High Build Wet Weather, ____ in. (mm), (<u>color</u>)	Per linear foot (meter)
Item No. 652	Skip traffic stripe, High Build Wet Weather, ____ in. (mm), (<u>color</u>)	Per gross linear foot (meter)
Item No. 652	Pavement markings, High Build Wet Weather, words, and symbols, (<u>color</u>)	Per each
Item No. 652	Traffic stripe, High Build Wet Weather, ____ in. (mm), (<u>color</u>)	Per square yard (meter)

652.4.01 Adjustments

General Provisions 101 through 150.

Section 653—Thermoplastic Traffic Stripe

653.1 General Description

This work includes furnishing and applying standard, wet weather, and audible profiled thermoplastic reflectorized pavement marking compound. Ensure markings conform to plan details and locations, these specifications, and the Manual on Uniform Traffic Control Devices.

Thermoplastic traffic stripe consists of solid or broken (skip) lines, words, and symbols according to plan color, type, and location.

653.1.01 Definitions

Thermoplastic Marking Compound: A heated compound extruded or mechanically sprayed on the pavement that cools to pavement temperature. When combined with glass spheres and/or reflective composite optics it produces a reflectorized pavement marking.

Short Lines: Crosswalks, stop bars, arrows, symbols, and crosshatching. Extrude short lines rather than spraying them on.

653.1.02 Related References

A. Specifications

Section 656—Removal of Pavement Markings

B. Referenced Documents

QPL 46

QPL 71

SOP 37

SOP 38

SOP 39

Federal Test Standard Number 595B

Federal Test Standard Number 695B

AASHTO M 247

AASHTO M 249

ASTM D 92

ASTM D 476

ASTM D 2240

ASTM D 4960

ASTM E 1710

ASTM E 2177

40 CFR 261.24

EPA Method 3050

EPA Method 3052

EPA Method 6010

EPA Method 7000A

653.1.03 Submittals

Ensure the producers of the thermoplastic compound and the producers of both the intermix and drop-on glass spheres furnish to the Department copies of certified test reports showing results of all tests specified in this Section. Also ensure that producers certify that the materials meet the other requirements of this Section by submitting copies of certification at the time of sampling.

653.2 Materials

A. General Characteristics of Thermoplastic

Use thermoplastic material produced from an approved source listed on QPL 46. Use thermoplastic material that meets the requirements of AASHTO M 249 with the following exceptions:

1. Material Composition

Ensure the resin of the thermoplastic material is an alkyd binder. Ensure the alkyd binder consists of a mixture of synthetic resins and a high boiling point plasticizer. Ensure at least one synthetic resin is a solid at room temperature. Ensure at least 50 percent of the binder composition is 100 percent maleic-modified glycerol ester resin. Ensure at least 18 percent by weight of the entire material formulation consists of binder. Do not use alkyd binder that contains petroleum-based hydrocarbon resins. Ensure the finished thermoplastic material is not adversely affected by contact with pavement materials or by petroleum droppings from traffic. Use thermoplastic material that has been evaluated (2-year field evaluation) by the National Transportation Product Evaluation Panel (NTPEP) test facility or other approved test facility.

2. Suitability for Markings

Use thermoplastic material that is especially compounded for traffic markings and has the following characteristics:

- Prevents markings from smearing or spreading under normal traffic conditions at temperatures below 120 °F (49 °C)
- Gives a uniform cross section, with pigment evenly dispersed throughout the material
- Has a uniform material density and character throughout its thickness
- Allows the stripe to maintain its original dimensions and placement
- Ensures that the exposed surface is free from tack and is not slippery when wet
- Does not lift from the pavement in freezing weather
- Has cold ductility properties that permit normal movement with the road surface without chipping or cracking

Section 653 — Thermoplastic Traffic Stripe

3. Color

Confirm the color of thermoplastic by providing data from the manufacturer to the Area Manager as follows:

- a. White – Use titanium dioxide that meets the requirements of ASTM D 476, Type II, Rutile, as the pigment for white thermoplastic material. Do not use anatase titanium dioxide pigment. Ensure thermoplastic material is free from dirt or tint. Ensure white thermoplastic material heated for 240 ± 5 minutes at 425 ± 3 °F (218 ± 3 °C) and cooled to 77 ± 3 °F (25 ± 2 °C) matches Federal Test Standard Number 695B-Color 17925. Ensure that the Y tristimulus value is measured to be a minimum value of 45. Ensure the material, when compared to the magnesium oxide standard using a standard color spectrophotometer according to ASTM D 4960, meets the following:

Scale	Definition	Magnesium Oxide Standard	Sample
Rd	Reflectance	100	75 min.
a	Redness-Greenness	0	-5 to + 5
b	Yellowness-Blueness	0	-10 to + 10

- b. Yellow – Use only non-hazardous pigments as defined by the Resource Conservation and Recovery Act (RCRA) Subarticle C rules, table 1 of 40 CFR 261.24 “Toxicity Characteristic”. Do not use yellow thermoplastic containing more than 3.0 ppm lead by weight when tested in accordance with the most recent

EPA Methods 3050 and 6010 or 7000. Ensure yellow thermoplastic material heated for 240 ± 5 minutes at 425 ± 3 °F (218 ± 2 °C) and cooled to 77 ± 3 °F (25 ± 2 °C) matches AMS-STD-595. Ensure that the Y tristimulus value is measured to be a minimum value of 45. Ensure the material, when compared to PR#1 Chart using a standard color spectrophotometer according to ASTM D 4960, plots within the following chromaticity coordinates:

	1	2	3	4
X	0.455	0.510	0.472	0.530
Y	0.444	0.485	0.400	0.456

- c. Black – The black pigment must produce a completely opaque, black stripe when applied on the road and after 70 hr of weatherometer exposure in accordance with ASTM G 155 using Exposure Cycle 1 with a quartz inner filter glass and Type “S” Borosilicate outer filter glass. Ensure that Y tristimulus value is measured to be a maximum value of 5.
- d. Ensure the in-service daytime chromaticity for yellow, white, and black material plots within the following coordinates after a period of 30 days:

	1		2		3		4	
	x	y	x	y	x	y	x	y
White	0.290	0.315	0.310	0.295	0.350	0.340	0.330	0.360
Yellow	0.435	0.429	0.510	0.485	0.449	0.377	0.530	0.456
Black	0.355	0.355	0.305	0.305	0.285	0.325	0.335	0.375

Section 653 — Thermoplastic Traffic Stripe

4. Indentation Resistance

Measure the hardness by a Shore Durometer, Type A2, as described in ASTM D 2240. Maintain the temperature of the Durometer, 4.4 lb. (2 kg) load and the specimen for 2 hours at 115 °F (45 °C). Apply the Durometer and 4.4 lb. (2 kg) load to the specimen. The reading must fall between 50 to 75 units, after 15 seconds.

5. Reheating

Ensure that the compound does not break down, deteriorate, scorch, or discolor if held at application temperature of 425 °F (218 °C) for 6 hours and if reheated up to 4 times to the application temperature. Ensure that the color of white and yellow thermoplastic comply with Subsection 653.2.A.3.a and Subsection 653.2.A.3.b after prolonged heating or reheating.

6. Intermixed Glass Spheres and Reflective Composite Optics

Ensure glass spheres meet the requirements of AASHTO M 247.

Do not use glass spheres and /or reflective composite optics containing greater than 200 ppm total arsenic, 200 ppm total antimony, or 200 ppm total lead when tested according to US EPA Methods 3052 and 6010C, or other approved methods.

7. Flashpoint

Ensure the thermoplastic flashpoint is not less than 500 °F (260 °C) as determined by ASTM D 92.

B. Drop-On Glass Spheres and Reflective Composite Optics

Ensure glass spheres meet the requirements of AASHTO M 247. Use spheres produced from an approved source listed on QPL 71. Glass spheres conforming to an alternative gradation may be used provided all other requirements of AASHTO M 247 and this specification are met. Do not use glass spheres and /or reflective composite optics containing greater than 200 ppm total arsenic, 200 ppm total antimony, or 200 ppm total lead when tested according to US EPA Methods 3052 and 6010C, or other approved methods.

C. Sealing Primer

Place the particular type of binder-sealer at the application rate as recommended in writing by the thermoplastic material manufacturer.

653.2.01 Delivery, Storage, and Handling

Use material delivered in 50 lb (22.7 kg) unit cardboard containers or bags strong enough for normal handling during shipment and on-the-job transportation without loss of material.

Ensure that each unit container is clearly marked to indicate the following:

- Color of the material
- Process batch number or similar manufacturer's identification
- Manufacturer's name
- Address of the plant
- Date of manufacture

653.3 Construction Requirements

653.3.01 Personnel

General Provisions 101 through 150.

653.3.02 Equipment

Depending on the marking required, use hand equipment or truck-mounted application units on roadway installations.

A. Application Machine

Ensure that each application machine is equipped with the following features:

- Parts continuously mix and agitate the material.
- Truck-mounted units for lane, edge, and center lines operate at a uniform, predetermined rate of speed, both uphill and downhill, in order to produce a uniform application of striping material and capable of following straight lines and making normal curves in a true arc.
- Conveying parts between the main material reservoir and the shaping die or gun prevent accumulation and clogging.
- Parts that contact the material are easily accessible and exposable for cleaning and maintenance.
- Mixing and conveying parts, including the shaping die or gun, maintain the material at the plastic temperature with heat transfer oil or electrical element-controlled heat. Do not use an external source of direct heat.
- Parts provide continuously uniform stripe dimensions.
- Applicator cleanly and squarely cuts off stripe ends and applies skip lines. Do not use pans, aprons, or similar appliances that the die overruns.
- Parts produce varying widths of traffic markings.
- Applicator is mobile and maneuverable enough to follow straight lines and make normal curves in a true arc.

B. Automatic Bead Dispenser

Apply glass spheres and/or reflective composite optics to the surface of the completed stripe using a dispenser attached to the striping machine to automatically dispense the beads/optics instantaneously upon the installed line. Synchronize the glass sphere/optics dispenser cutoff with the automatic cutoff of the thermoplastic material.

C. Special Kettles

Use special kettles for melting and heating the thermoplastic material. Use kettles equipped with automatic thermostatic control devices that provides positive temperature control and prevents overheating. Ensure that the applicator and kettles are equipped and arranged according to the requirements of the National Fire Underwriters.

D. Hand Equipment

Use hand equipment for projects with small quantities of lane lines, edge lines, and center lines, or for conditions requiring the equipment. Use hand equipment approved by the Engineer.

Ensure hand equipment can hold 150 lbs. (68 kg) of molten material and is maneuverable to install crosswalks, arrows, legends, lane, edge, and center lines.

E. Auxiliary Vehicles

Supply the necessary auxiliary vehicles for the operation.

653.3.03 Preparation

For asphaltic concrete pavement, do not begin placement of thermoplastic striping until 15 calendar days after completion of the final surface course.

653.3.04 Fabrication

General Provisions 101 through 150.

653.3.05 Construction

A. General Application

Notify the Engineer prior to the placement of the thermoplastic materials. Furnish the Engineer with the manufacturer's name and batch numbers of the thermoplastic materials and glass spheres to be used. Ensure that the approved batch numbers appear on the thermoplastic materials and glass spheres packages.

Thoroughly clean pavement areas to be striped. Use hand brooms, rotary brooms, air blasts, scrapers, or other approved methods that leave the pavement surface clean and undamaged. Take care to remove all vegetation and road film from the striping area. Ensure all new Portland cement concrete pavement surfaces are mechanically wire brushed or abrasive cleaned to remove all laitance and curing compound before being striped.

Lay stripe with continuous uniform dimensions.

Apply the type of stripe at each location according to the Plans, using one of the following methods:

- Spray techniques
- Extrusion methods wherein one side of the shaping die is the pavement and the other three sides are contained by or are part of the suitable equipment to heat and control the flow of material.
- Extrusion methods using a pressurized ribbon gun to control the application of material.

1. Temperature

Apply thermoplastic traffic stripe only when the pavement temperature in the shade is above 40 °F (4 °C).

To ensure optimum adhesion, install the thermoplastic material in a melted state at the manufacturer's recommended temperature but not at less than 375 °F (190 °C).

2. Moisture

Do not apply when the surface is moist. When directed by the Engineer, perform a moisture test on the Portland cement concrete pavement surface. Perform the test as follows:

- a. Place approximately 1 yd² (1m²) of roofing felt on the pavement surface.
- b. Pour approximately 1/2 gallon (2 L) of molten thermoplastic onto the roofing felt.
- c. After 2 minutes, lift the roofing felt and inspect to see if moisture is present on the pavement surface or underside of the roofing felt.
- d. If moisture is present, do not proceed with the striping operation until the surface has dried sufficiently to be moisture free.

3. Sealing Primer

To ensure optimum adhesion, apply a binder-sealer material before installing the thermoplastic in each of the following cases:

- Where directed by the Engineer for sprayed thermoplastic
- Old asphaltic concrete pavements with exposed aggregates
- Portland cement concrete pavements
- Bridge Deck Polymer Overlay

Ensure that the binder-sealer material forms a continuous film that mechanically adheres to the pavement and dries rapidly. Use a binder-sealer currently in use and recommended by the thermoplastic material manufacturer according to QPL 46.

Apply the binder-sealer immediately in advance of, but concurrent with, the application of the thermoplastic material. Apply in a continuous film over the pavement surface.

4. Bonding to Old Stripe

If the old stripe is to be renewed by overlaying with new material, ensure the new material bonds to the old line without splitting or cracking.

5. Offset from Construction Joints

Off-set longitudinal lines at least 2 in (50 mm) from construction joints of Portland cement concrete pavements.

Section 653 — Thermoplastic Traffic Stripe

6. Crosswalks, Stop Bars, and Symbols

Make crosswalks, stop bars, and symbols at least 3/32 in (2.4 mm) thick at the edges and no more than 3/16 in (4.8 mm) thick at the center.

7. Thickness

a. Maintain the following minimum average dry thicknesses above the surface on all types of pavements

- 0.090 in. (2.3 mm) * for lane lines
- 0.060 in. (1.5 mm) * for edge lines
- 0.120 in. (3.0 mm) * for gore area lines
- 0.120 in. (3.0 mm) * for polymer overlay edge lines and lane lines

(See below for "*" reference.)

Compute the minimums by the amount of material used each day, as follows:

(For 6 in wide stripe)	
* Average Thickness (in) =	$[(\text{lbs. used}) \div (\text{total linear feet})] \times 0.236$
(For 150 mm wide stripe)	
*Average Thickness (mm) =	$[(\text{kg used}) \div (\text{total linear meters})] \times 4.0$
(For 10 in wide stripe)	
* Average Thickness (in) =	$[(\text{lbs. used}) \div (\text{total linear feet})] \times 0.118$
(For 250 mm wide stripe)	
* Average Thickness (mm) =	$[(\text{kg used}) \div (\text{total linear meters})] \times 2.0$

b. Audible Profiled Thermoplastic – Apply a flat edge line having a thickness of 0.100 inches – 0.150 inches (100 mils – 150 mils) above the surface on all types of pavements, exclusive of bumps.

8. Glass Spheres and Reflective Composite Optics

- a. Apply glass spheres and/or reflective composite optics to installed stripe surface above the minimum rate recommended by the thermoplastic material manufacturer to produce the required retro-reflectivity value in accordance with Subsection 653.3.06.
- b. Apply the glass sphere and/or reflective composite optics top-coating with a pressure-type gun specifically designed for applying glass spheres and/or reflective composite optics that will embed at least one-half of the sphere's and optic's diameter into the thermoplastic immediately after the material has been applied to the pavement.
- c. Audible Profiled Thermoplastic– Apply glass sphere and/or reflective composite optics to all markings at the rates determined by the manufacturer's recommendations as identified in the APL system.

9. Dimensions of Raised Bumps:

- a. Apply the raised bumps with a profile such that the leading and trailing edges are sloped at a sufficient angle to create an audible and vibratory warning.
- b. Bumps on the edge line and centerline marking shall be at least 0.45 in. (11 mm) at the highest point of the bump, above the pavement surface including the base line. The height measures after the application of the drop-on retroreflective elements or glass spheres.
- c. Bumps shall have a minimum baseline coverage dimension of 2.5 in. (65 mm) in both the transverse and longitudinal directions.
- d. The bumps may have a drainage channel. The width of each drainage channel will not exceed 0.25 in. (6 mm) at the bottom of the channel. The longitudinal distance between bumps shall be approximately 30 in. (762 mm).

Section 653 — Thermoplastic Traffic Stripe

B. Removing Existing Stripe

Remove existing stripe according to Section 656.

Remove 100 percent of existing traffic stripe from:

- Portland cement concrete pavement where the new stripe will be placed at the same location as the existing marking
- Pavement where the new stripe will be placed at a different location from the existing markings

C. Tolerance and Appearance

- a. No traffic stripe shall be less than the specified width and shall not exceed the specified width by more than 1/2 in. (13 mm). The length of the 15 ft. (4.5 m) segment for skip stripe and the 25 ft. (7.5 m) gap between segments may vary plus or minus 1 ft. (300 mm). The alignment of the stripe shall not deviate from the intended alignment by more than 1 in. (25 mm) on straight lines. On curves up to and including 1 degree (radius of 1745 m or greater), the alignment of the stripe shall not deviate from the intended alignment by more than 1 in. (25 mm). On curves exceeding 1 degree (radius less than 1745 m), the alignment of the stripe shall not deviate from the intended alignment by more than 2 in. (50 mm).
- b. Stop work when deviation exceeds the above dimensions and remove the nonconforming stripe.
- c. No more than 1 percent of the bumps or more than three consecutive bumps are missing or broken (less than half a bump remaining) within the first 45 days under traffic, replace all failed bumps at no cost to the Department.
- d. If the bumps are replaced and more than 2 percent of the replaced bumps fail within the first 45 days under traffic, the replacement period will be extended an additional 45 days from the date all replacement bumps were installed.
- e. If at the end of the additional 45 days more than 2 percent of all bumps (initial and replacement) fail, replace all failed bumps at no expense to the Department.

D. Traffic Marking Protection (Audible Profile Thermoplastic)

Do not allow traffic onto or permit vehicles to cross newly applied pavement markings until they are sufficiently dry. Remove and replace any portion of the pavement markings damaged by passing traffic or from any other cause, at no additional cost to the Department.

653.3.06 Quality Acceptance

A. General

For a minimum of 30 days from the time of placement, ensure the thermoplastic pavement marking material and/or audible profiled thermoplastic shows no signs of failure due to blistering, excessive cracking, chipping, bleeding, staining, discoloration, oil content of the pavement materials, smearing or spreading under heat, deterioration due to contact with grease deposits, oil, diesel fuel, or gasoline drippings, spilling, poor adhesion to the pavement material, vehicular damage, and normal wear. In the event that failures mentioned above occur, ensure corrective work is completed at no additional cost to the Department.

Obtain pavement marking retroreflectivity values with a 30-meter geometry retro-reflectometer.

B. Initial Retroreflectivity

1. Longitudinal Lines

Within 30 days of installation, ensure the in-place markings meet the following minimum reflectance values:

a. Standard

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m ²	300mcd/lux/m ²

b. Wet Weather

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m ²	300 mcd/lux/m ²
Wet recovery (ASTM E 2177)	150 mcd/lux/m ²	125 mcd/lux/m ²

Section 653 — Thermoplastic Traffic Stripe

c. Audible Profile Thermoplastic

	White	Yellow
Dry (ASTM E 1710)	300 mcd/lux/m ²	250 mcd/lux/m ²

For each center line, edge line, and skip line, measure retroreflectivity 9 times for each mile; 3 times within the first 500 ft. (152 m), 3 times in the middle, and 3 times within the last 500 ft. (152 m). For projects less than one mile (1600 m) in length, measure retroreflectivity 9 times as above.

Record all retroreflectivity measurements on the form OMR CVP 66 in SOP 39.

2. Messages, Symbols, and Transverse Lines

At the time of installation, ensure the in-place markings when tested according to ASTM E 1710 meet the following minimum reflectance value of 275 mcd/lux/m².

Perform at a minimum, one retroreflectivity measurement at one message, one symbol and one transverse line per intersection. Take one measurement per mile (1600 m) for locations other than intersections (i.e. school messages, railroad messages, bike symbols etc.)

C. Six Month Retroreflectivity (Longitudinal Lines)

Maintain the following minimum reflectance values for 180 days after installation:

1. Standard

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m ²	300 mcd/lux/m ²

2. Wet Weather

	White	Yellow
Dry (ASTM E 1710)	400 mcd/lux/m ²	300 mcd/lux/m ²
Wet recovery (ASTM E 2177)	150 mcd/lux/m ²	125 mcd/lux/m ²

3. Audible Profile Thermoplastic

	White	Yellow
Dry (ASTM E 1710)	300 mcd/lux/m ²	250 mcd/lux/m ²

Retest the in-place markings according to Subsection 653.3.06.B.1, 180 days after installation to ensure these minimum retro-reflectance values are maintained.

NOTE: The Contractor is responsible for retro-reflectivity testing. Furnish initial test results to the Engineer within 30 days of application. Furnish additional testing for a period that totals 180 days from initial application or the stoppage of contract time, whichever comes first.

D. Thickness

1. New Striping

Check the thicknesses on all skip lines, edge lines and center lines with an approved traffic marking thickness gage consisting of 3 dials as follows:

For each center line, edge line, and skip line, measure thickness above the pavement 3 times for each mile (1600 m); once within the first 500 ft. (150 m), once in the middle, and once within the last 500 ft. (150 m). For projects less than one mile (1600 m) in length, measure the thickness above the pavement 3 times.

Record all thickness measurements on the form OMR CVP 66 in SOP 39.

2. Recapping Refurbishment Thermoplastic

Place durable tape, film, or metal plate of known and uniform thickness on an area to be striped. After the striper has passed over, remove the sample and measure the thickness with calipers or a micrometer.

For each center line, edge line, and skip line, measure thickness above the pavement 3 times for each mile (1600 m); once within the first 500 ft. (150 m), once in the middle, and once within the last 500 ft. (150 m). For projects less than one mile (1600 m) in length, measure the thickness above the pavement 3 times.

Submit results to the Engineer.

Section 653 — Thermoplastic Traffic Stripe

3. Audible Profiled Thermoplastic

Ensure the thickness of white and yellow pavement marking conform to Subsection 653.3.05.A.7.b

Record all thickness measurements on the form OMR CVP 66 in SOP 39 and submit to the Engineer.

The Engineer will verify the thickness of the pavement marking in accordance with Subsection 653.3.05.A.7.b within 30 days of receipt of the Contractor's certification.

Thickness measurement may be performed using a strong adhesive tape to install a metal plate (approximately 6 inches (150 mm) wide by 8 inches (200 mm) long, the thickness of the plate can be 1/8 inch (3 mm) as long as the plate does not deform) to the roadway where the pavement marking will be placed.

After the material has dried remove the plate and check the thickness of the pavement marking material on the plate with a micrometer.

E. Corrective Work

For each mile (1600 m) section, if the thermoplastic traffic stripe fails to meet Plan details or specifications or deviates from stated dimensions, correct it at no additional cost to the Department. If removal of pavement markings is necessary, perform it according to Section 656 and place it according to this specification. No additional payment will be made for removal and replacement of unsatisfactory striping. Ensure corrective work is completed at no additional cost to the Department. Perform testing according to this specification. Any retest due to failures will be performed at no additional cost to the Department. Furnish all test reports to the Department.

Retro-reflectivity and Thickness Longitudinal Line Deficiency: A deficiency will ensue when two or more Location Average results as recorded on form OMR CVP 66 within a One-Mile (1600 m) Section do not meet the performance criteria herein. The entire line within this one-mile (1600 m) section will be determined to be deficient. If the evaluated section is less than 1.0 mile (1600 m), a single Location Average result not meeting the performance criteria herein will result in the entire line to be determined to be deficient.

Retro-reflectivity Transverse Markings and Symbol Deficiency: A single Location Average result on the marking or symbol not meeting the performance criteria herein will result in the marking or symbol to be determined to be deficient.

653.3.07 Verification

See SOP 39

653.4 Measurement

When stripe will be paid for by the square yard (meter), the actual number of square yards (meters) painted will be measured. The space between the stripes will be included in the overall measurement.

Linear measurements may be made by electronic measuring devices attached to a vehicle.

Thermoplastic traffic stripe, complete in place and accepted, is measured as follows:

A. Solid Traffic Stripe (Including Audible Stripe)

Stripe is measured by the linear foot (meter), linear mile (kilometer), or square yard (meter). Breaks or omissions in solid lines or stripes at street or road intersections are not measured for payment.

B. Skip Traffic Stripe

Skip stripe is measured by the gross linear mile (kilometer) as specified. The unpainted space between the painted stripes is included in the overall measurement if the plan ratio of one to three (15 ft. [4.5 m] segment and 25 ft. [7.5 m] gap or other patterns as designated on the plans) remains uninterrupted. Measurement begins and ends on a stripe.

C. Words and Symbols

Each word or symbol complete according to plan dimensions is measured by the Unit.

653.4.01 Limits

General Provisions 101 through 150.

Section 653 — Thermoplastic Traffic Stripe

653.5 Payment

Payment is full compensation for the Work under this section, including:

- Cleaning and preparing surfaces
- Furnishing all materials
- Applying, curing, and protecting stripe
- Protecting traffic, including providing necessary warning signs
- Furnishing tools, machines, and other equipment necessary to complete the Item

Measurement and payment for removing pavement markings will be according to Section 656 when shown in the Proposal as a payment Item. Otherwise, removal will not be paid for separately, but will be included in the payment for other Work under this section.

Payment will be made under:

Item No. 653	Thermoplastic solid traffic stripe, __ in. (mm), (color)	Per linear foot (meter)
Item No. 653	Thermoplastic solid traffic stripe, __ in. (mm), (color)	Per linear mile (kilometer)
Item No. 653	Thermoplastic skip traffic stripe, __ in. (mm), (color)	Per gross linear foot (meter)
Item No. 653	Thermoplastic skip traffic stripe, __ in. (mm), (color)	Per gross linear mile (kilometer)
Item No. 653	Audible profiled thermoplastic solid traffic stripe, __ in. (mm), (color)	Per linear foot (meter)
Item No. 653	Audible profiled thermoplastic solid traffic stripe, __ in. (mm), (color)	Per linear mile (kilometer)
Item No. 653	Audible profiled thermoplastic skip traffic stripe, __ in. (mm), (color)	Per gross linear foot (meter)
Item No. 653	Audible profiled thermoplastic skip traffic stripe, __ in. (mm), (color)	Per gross linear mile (kilometer)
Item No. 653	Thermoplastic pavement markings, words, and symbols (color), type _____	Per each
Item No. 653	Thermoplastic traffic stripe	Per square yard (meter)
Item No. 653	Wet Weather Thermoplastic solid traffic stripe, __ in. (mm), (color)	Per linear foot (meter)
Item No. 653	Wet Weather Thermoplastic solid traffic stripe, __ in. (mm), (color)	Per linear mile (kilometer)
Item No. 653	Wet Weather Thermoplastic skip traffic stripe, __ in. (mm), (color)	Per gross linear foot (meter)
Item No. 653	Wet Weather Thermoplastic skip traffic stripe, __ in. (mm), (color)	Per gross linear mile (kilometer)
Item No. 653	Wet Weather Thermoplastic pavement markings, words, and symbols (color), type _____	Per each
Item No. 653	Wet Weather Thermoplastic traffic stripe	Per square yard (meter)

653.5.01 Adjustments

General Provisions 101 through 150.

Section 668—Miscellaneous Drainage Structures

668.1 General Description

This work includes constructing catch basins, drop inlets, manholes, junction boxes, spring boxes, drain inlets, special inlets with safety grates, and vertical tee sections.

Construct according to these specifications and the lines and grades shown on the plans, or as established by the Engineer.

668.1.01 Definitions

General Provisions 101 through 150.

668.1.02 Related References

A. Standard Specifications

Section 207—Excavation and Backfill for Minor Structures

Section 500—Concrete Structures

Section 607—Rubble Masonry

Section 608—Brick Masonry

Section 801—Fine Aggregate

Section 830—Portland Cement

Section 834—Masonry Materials

Section 843—Concrete Pipe

Section 853—Reinforcement and Tensioning Steel

Section 854—Castings and Forgings

Section 866—Precast Concrete Catch Basin, Drop Inlet, and Manhole Units

B. Referenced Documents

General Provisions 101 through 150.

668.1.03 Submittals

General Provisions 101 through 150.

Section 668 — Miscellaneous Drainage Structures

668.2 Materials

The structures in this section may be constructed of brick, cast-in-place concrete, or pre-cast concrete, unless the plans or proposal specifies a specific type of construction.

Use rubble masonry only when specified on the plans. Ensure that materials meet the following specifications:

Material	Section
Class “A” or “B” Concrete	500
Sand for Bedding Material	801.2.01
Fine Aggregate for Mortar	801.2.02
Portland Cement	830.2.01
Brick	834
Masonry Stone	834
Mortar and Grout	834
Nonreinforced Concrete Pipe	843
Steel Bars for Reinforcement	853.2.01
Gray Iron Castings	854.2.01
Precast Reinforced Concrete Catch Basin, Drop Inlet, and Manhole Units	866

Ensure that the materials for fabricating special inlets and their safety grates are according to plan details.

Construct the following manholes and drainage structures from pre-cast or cast-in-place concrete:

- Structures within the backfill limits of mechanically stabilized embankment retaining walls
- Structures within 5 ft. (1.5 m) of the wall foundation’s front.

668.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

668.3 Construction Requirements

668.3.01 Personnel

General Provisions 101 through 150.

668.3.02 Equipment

General Provisions 101 through 150.

668.3.03 Preparation

General Provisions 101 through 150.

668.3.04 Fabrication

General Provisions 101 through 150.

668.3.05 Construction

A. Excavation and Backfill

Excavate and prepare foundations for the structures included in this section; place pipe through the structures according to Section 207.

B. Concrete

Concrete units may be either poured-in-place or precast. Construct units as follows:

1. Poured-in-Place Units

The throat or other nonreinforced portions of catch basins may be Class B concrete. Use Class A concrete for the top slab. Construct units according to Section 500.

2. Pre-Cast Reinforced Concrete Units

Construct pre-cast reinforced concrete units as follows:

a. Holes for Pipe

Cast each unit with the number and dimensions of pipe holes necessary to incorporate the unit into the drainage system according to plan details.

Installation conditions may require additional pipe for which no holes have been cast. If so, make the holes and repair or replace, to the Engineer's satisfaction, pipe damaged during the process.

b. Pipe Connections

Use mortar or Class A concrete to connect pipe to units.

c. Installation of Pre-cast Concrete

1) Pre-cast Reinforced Units: Set these units to within 1/2 in. (\pm 13 mm) of grade on a bed of compacted sand 2 in. to 3 in. (50 mm to 75 mm) thick.

2) Sectional Precast Reinforced Units: When using these units to build-up extra-depth catch basins or drop inlets, fill the joints between sections with mortar and wipe smooth.

C. Brick Masonry

Construct brick masonry structures according to Section 608.

D. Mortar Rubble Masonry

Construct rubble masonry structures according to Section 607.

E. Castings

Hold frame castings securely in place to proper line and grade. Make castings an integral part of the complete structure. After completion, ensure that castings subject to traffic use are firm and stable under traffic.

F. Maintenance

Thoroughly clean fallen masonry, silt, debris, and other foreign matter from structures.

G. Safety Grates

Fabricate safety grates according to plan details.

Section 668 — Miscellaneous Drainage Structures

H. Sanitary Sewer Manholes

Ensure that sanitary and combination sanitary and storm sewer manholes conform to the following requirements and the related specifications.

1. Form Invert Channels

Shape invert channels to the lines and grades shown on the plans, or as established by the Engineer. Ensure that channel surfaces are smooth.

Form invert channels by one of the following methods:

- Directly form the invert channel in the concrete base of the manhole.
- Construct the invert channel of brick and mortar.
- Lay half-round tile in the concrete base of the manhole.
- Lay round sewer pipe through the manhole and cut out the top half of the pipe after the concrete base has set. Do not use this method if the plans provide for an offset drop in the invert.

2. Plaster Outside Walls

Plaster outside walls as follows:

- a. Saturate the outside wall of each brick manhole with water.
- b. Plaster the wall smooth with a mortar coat at least 1/2 in. (13 mm) thick. Manufacture the mortar according to Section 834 with the following exceptions:
 - Manufacture the mortar with one-part cement to two parts mortar sand.
 - Do not add hydrated lime.

3. Connections to Manholes

Complete manhole connections to the Engineer's satisfaction and as follows:

- a. Carefully connect existing sewer lines to new manholes to prevent infiltration of foreign substances.
- b. Construct manholes in or adjacent to existing sewer lines according to Section 660 to maintain continuous sewage flow in existing lines.

668.3.06 Quality Acceptance

General Provisions 101 through 150.

668.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

668.4 Measurement

Catch basins, drop inlets, manholes, junction boxes, drain inlets, special inlets, and safety grates, complete in place and accepted, are measured for payment according to the following:

A. Catch Basins and Drop Inlets

Each catch basin or drop inlet is grouped for measurement as follows:

- Group 1: Structures connected to pipe 36 in. (900 mm) or less in diameter, regardless of the pipe skew
- Group 2: Structures connected to pipe over 36 in. (900 mm) diameter regardless of the pipe skew

Catch basins or drop inlets, complete in place and accepted, are measured by the unit.

In addition, each catch basin or drop inlet deeper than 6 ft. (1.8 m) is measured for additional payment. The extra depth is measured in linear feet (meters).

Section 668 — Miscellaneous Drainage Structures

B. Manholes

Manholes are measured for payment as follows:

1. Sanitary and Storm Sewer Manholes

Sanitary sewer manholes and storm sewer manholes are measured separately and divided into two types:

- Type 1: Structures connected to pipe 42 in. (1050 mm) or less in diameter regardless of the pipe skew
- Type 2: Structures connected to pipe 48 in. to 84 in. (1200 mm to 2100 mm) diameter regardless of the pipe skew

Each manhole is measured by the unit.

2. Manhole Additional Depth

In addition to Types 1 and 2 above, each Manhole deeper than 6 ft. (1.8 m) is measured for additional payment, termed “manhole additional depth.” This additional depth is measured in linear feet (meters) and does not include the upper 6 ft. (1.8 m). Manhole additional depth is classed as follows:

- Manhole Additional Depth, Class 1: Applies to each manhole deeper than 6 ft. (1.8 m), but not deeper than 10 ft. (3.0 m) Class 1 payment is for the manhole depth between 6 ft. and 10 ft. (1.8 m and 3.0 m).
- Manhole Additional Depth, Class 2: Applies to each manhole deeper than 10 ft. (3.0 m), but not deeper than 20 ft. (6.1 m). Class 2 payment is for the manhole depth between 6 ft. and 20 ft. (1.8 m and 6.1 m).
- Manhole Additional Depth, Class 3: Applies to each manhole deeper than 20 ft. (6.1 m), but not deeper than 30 ft. (9 m). Class 3 payment is for the manhole depth between 6 ft and 30 ft. (1.8 m and 9.1 m).
- Manhole Additional Depth, Class 4: Applies to each manhole deeper than 30 ft. (9.1 m), but not deeper than 45 ft. (13.7 m). Class 4 payment is the manhole depth between 6 ft. and 45 ft. (1.8 m and 13.7 m).

Manhole additional depth is measured for payment at the class that includes the greatest depth below the original 6 ft. (1.8 m).

For example, a manhole 32 ft. (9.8 m) deep would be measured and paid for as follows:

Storm (or sanitary) sewer manhole, type _____	Per each
Storm (or sanitary) sewer manhole, type _____, additional Depth Class 4	26 linear feet (9 linear meters)

C. Junction Boxes, Spring Boxes, and Drain Inlets

Junction boxes, spring boxes, and drain inlets are measured by the unit.

1. Each junction box will be complete according to plan details.
2. Each drain inlet will consist of a pipe elbow or tee, concrete collar, and casting of the required diameter.
3. Each spring box will be complete according to plan details.

D. Safety Grates

Safety grates fabricated and installed according to plan details are measured by the square foot (meter), computed from the overall surface dimensions of each grate.

E. Special Inlets for Safety Grates

Special inlets, complete in place, are measured for payment in cubic yards (meters) according to Section 500.

F. Vertical Tee Sections (or Saddles)

Vertical tee sections are not measured for separate payment.

668.4.01 Limits

General Provisions 101 through 150.

668.5 Payment

Payment for the various structures under this Section will be made as follows:

A. Catch Basins and Drop Inlets

Catch basins or drop inlets will be paid for at the Contract Price per each.

Depth in excess of 6 ft. (1.8 m) will be paid for at the Contract Price per linear foot (meter).

Payment is full compensation for the following:

- Furnishing castings
- Making pipe connections regardless of skew
- Providing materials, making forms, and disposing of surplus material

B. Manholes

Sanitary sewer and storm sewer manholes, complete in place, will be paid for at the Contract Price per each.

Manhole additional depth of the appropriate class will be paid for at the Contract Price per linear foot (meter).

Payment is full compensation for the following:

- Furnishing castings, fittings, and other appurtenances called for on the plans to complete the Item
- Making pipe connections regardless of skew
- Providing materials, making forms, and disposing of surplus material

NOTE: No additional payment will be made for connecting manholes to existing or new sewer lines. Include costs related to connections in the Contract Price for the structure.

C. Junction Boxes, Spring Boxes, and Drain Inlets

Junction boxes, spring boxes, or drain inlets will be paid for at the Contract Price per each. Payment is full compensation for the following:

- Furnishing castings, fittings, and other appurtenances called for on the plans to complete the Item
- Making pipe connections regardless of skew
- Providing materials, making forms, and disposing of surplus material

D. Pipe

Pipe entering or exiting catch basins, drop inlets, manholes, junction boxes, spring boxes, or drain inlets, will be paid for under the section of the specifications governing the pipe.

E. Sand Bedding Material for Precast Structures

No separate payment will be made for this material. Its cost is included in the Contract Price for the structure under which it is used.

F. Excavation and Normal Backfill

No separate payment will be made for excavation and normal backfill. Their cost is included in the Contract Price for the structure being excavated.

G. Safety Grates

Safety grates will be paid for at the Contract Price per square foot (meter).

H. Inlets for Safety Grates

Inlets for safety grates will be paid for at the Contract Price per cubic yard (meter) of Class "A" concrete, including reinforcing steel.

I. Vertical Tee Sections (or Saddles)

Vertical tee sections will be included in payment for the section of structure they are incorporated in.

Section 668 — Miscellaneous Drainage Structures

No separate payment will be made for excavation, backfill, and disposal of surplus material.

Payment will be made under:

Item No. 668	Catch basin, group_____	Per each
Item No. 668	Catch basin, group_____ additional depth	Per linear foot (meter)
Item No. 668	Drop inlet, group_____	Per each
Item No. 668	Drop inlet, group_____ additional depth	Per linear foot (meter)
Item No. 668	Sanitary sewer manhole, type_____	Per each
Item No. 668	Sanitary sewer manhole, type_____, additional depth class_____	Per linear foot (meter)
Item No. 668	Storm sewer manhole, type_____	Per each
Item No. 668	Storm sewer manhole, type_____, additional depth class_____	Per linear foot (meter)
Item No. 668	Junction box	Per each
Item No. 668	Spring box	Per each
Item No. 668	Drain inlet, __ in (mm)	Per each
Item No. 668	Safety grate, type_____	Per square foot (meter)
Item No. 500	Class A concrete, including bar reinforcing steel	Per cubic yard (meter)

668.5.01 Adjustments

General Provisions 101 through 150.

Section 700—Grassing

700.1 General Description

This work includes preparing the ground, furnishing, planting, seeding, fertilizing, sodding, and mulching disturbed areas within the Right-of-Way limits and easement areas adjacent to the right-of-way as shown on the plans except as designated by the Engineer to remain natural.

700.1.01 Definitions

General Provisions 101 through 150.

700.1.02 Related References

A. Standard Specifications

Section 160—Reclamation of Material Pits and Waste Areas

Section 163—Miscellaneous Erosion Control Items

Section 718—Wood Fiber

Section 822—Emulsified Asphalt

Section 882—Lime

Section 890—Seed and Sod

Section 891—Fertilizers

Section 893—Miscellaneous Planting Materials

Section 895—Polyacrylamide

B. Referenced Documents

QPL 33

QPL 84

700.1.03 Submittals

Submit manufacturer's product expiration date along with written instructions to ensure proper application, safety, storage, and handling of Polyacrylamide products used in the work.

700.2 Materials

Use materials that meet the requirements of the following specifications:

Material	Section
Wood Fiber Mulch	718.2
Agricultural Lime	882.2.01
Seed	890.2.01
Sod	890.2.02
Fertilizer	891.2.01
Plant Topsoil	893.2.01
Mulch	893.2.02
Inoculants	893.2.04

Section 700 — Grassing

Material	Section
Tackifiers	QPL 33
Anionic Polyacrylamide	QPL 84 & Section 895

A. Seeds

Whenever seeds are specified by their common names, use the strains indicated by their botanical names.

B. Water

Obtain the water for grassing from an approved source. Use water free of harmful chemicals, acids, alkalies, and other substances that may harm plant growth or emit odors. Do not use salt or brackish water.

C. Agricultural Lime

Agricultural lime rates will be based on a laboratory soil test report. The Contractor is responsible for ensuring the tests are performed by an approved laboratory. Provide a copy of test results to the Engineer. Refer to Section 882 Lime and GSP 18 of the Sampling and Testing Inspection manual for additional information on rates, use, handling and sampling procedures.

D. Fertilizer Mixed Grade

Fertilizer analysis and rates will be based on a laboratory soil test report. The Contractor is responsible for ensuring the tests are performed by an approved laboratory. Provide a copy of test results to the Engineer. Refer to Section 891 Fertilizer and GSP 18 of the Sampling and Testing Inspection manual for additional information on rates, use, handling and sampling procedures.

E. Mulch

Use straw or hay mulch according to Subsection 700.3.05.G.

Use wood fiber mulch in hydroseeding according to Subsection 700.3.05.F.1.

700.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

700.3 Construction Requirements

700.3.01 Personnel

General Provisions 101 through 150.

700.3.02 Equipment

Use grassing equipment able to produce the required results.

Never allow the grading (height of cut) to exceed the grassing equipment's operating range.

A. Mulch Material Equipment

Use mulching equipment that uniformly cuts the specified materials into the soil to the required control depth.

B. Hydroseeding Equipment

For hydroseeding equipment, see Subsection 700.3.05.F.

700.3.03 Preparation

General Provisions 101 through 150.

700.3.04 Fabrication

General Provisions 101 through 150.

700.3.05 Construction

Follow the planting zones, planting dates, types of seed, seed mixtures, and application rates described throughout this Section. The Engineer has the authority to alter the planting dates as set forth by a period of 2 weeks. This 2-week period may be applied to either the beginning of the specified planting and/or to the end of the end of the specified planting season.

In general:

- Obtain the Engineer's approval before changing the ground cover type.
- Do not use annual rye grass seeds with permanent grassing.
- Follow the planting zones indicated on the Georgia State Planting Zone Map, below.
- Sod may be installed throughout the year, weather permitting.
- For permanent grassing, apply the combined amounts of all seeds for each time period within each planting zone and roadway location listed in the Seeding Table, below. Do not exceed the amounts of specified seed.

Planting Zone Map



Section 700 — Grassing

NON-NATIVE GRASS SEEDING TABLE 1

(Temporary and Permanent Seed Types for Shoulders, Medians and Slopes 3:1 or Flatter)

Common Name	Botanical Name	Class/Type	Rate/Acre	Planting Zone	Planting Dates
Common Bermuda Grass (Hulled)	<i>Cynodon dactylon</i>	Required Permanent Grass	10 (11)	1	April 16 – August 31
Common Bermuda Grass (Unhulled)			10 (11)		
Common Bermuda Grass (Hulled)	<i>Cynodon dactylon</i>	Required Permanent Grass	10 (11)	2,3,4	April 1 – October 15
Common Bermuda Grass (Unhulled)			10 (11)		
Bahaia Grass	<i>Paspalum motatum</i>		10 (11)		
Rye Grass, Millet, Cereal Grass (Oats)	<i>Lolium penne</i> ssp. <i>Multiflorum</i> , <i>Echinochloa cursgalli</i> , <i>Avena sativa</i>	Temporary Grass	50 (56)	1	September 1- April 15
Rye Grass, Millet, Cereal Grass (Oats)	<i>Lolium penne</i> ssp. <i>Multiflorum</i> , <i>Echinochloa cursgalli</i> , <i>Avena sativa</i>	Temporary Grass	50 (56)	2,3,4	October 16- March 31

Section 700 — Grassing

NON-NATIVE SEEDING TABLE 2

(Temporary and Permanent Seed Types for back slopes, fill slopes and areas which will not be subject to frequent mowing, slopes steeper than 3:1)

Common Name	Botanical Name	Class/Type	Rate/Acre	Planting Zone	Planting Dates
Interstate Lespedeza	<i>Lespedeza sericea</i>	Permanent Grass	50(56)	1,2	March 1 – August 31
Weeping Lovegrass	<i>Eragrostis curvula</i>	Temporary Grass	10(11)		
Interstate Lespedeza	<i>Lespedeza sericea</i>	Permanent Grass	75(84)	1,2	September 1- February 28
Tall Fescue	<i>Festuca arundinacea</i>	Temporary Grass	50(56)		
Interstate Lespedeza	<i>Lespedeza sericea</i>	Permanent Grass	50(56)	3,4	April 1 – October 31
Weeping Love Grass	<i>Eragrostis curvula</i>	Temporary Grass	10(11)		
Interstate Lespedeza	<i>Lespedeza sericea</i>	Permanent Grass	50(56)	3,4	November 1 – March 31
Weeping Love Grass	<i>Eragrostis curvula</i>	Temporary Grass	10(11)		

Section 700 — Grassing

NATIVE GRASS SEEDING TABLE 3

For Non-mowable Slopes or Areas Designated as Permanent Native Grass Plots.

(Plant native seed mixes on back slopes, fill slopes and areas which will not be subject to frequent mowing (slopes steeper than 3:1).

Common Name	Botanical Name	Class/Type	Rate/Acre	Planting Zone	Planting Dates
Canada Wild Rye	<i>Elymus canadensis</i>	Cool Season	Minimum 2 (2)	1,2,3,4	October 31 - March 31
Virginia Wild Rye	<i>Elymus virginicus</i>	Cool Season	Minimum 2 (2)	1,2,3,4	October 31 - March 31
Bottle-brush Grass	<i>Hystrix patula</i>	Cool Season	Minimum 2 (2)	1,2,3,4	October 31 - March 31
Little Bluestem	<i>Schizachyrium scoparium</i> (<i>Andropogon scoparius</i>)	Warm Season	Minimum 2 (2)	1,2,3,4	March 31- August 31
Indiangrass	<i>Sorghastrum nutans</i>	Warm Season	Minimum 2 (2)	1,2,3,4	March 31- August 31
Eastern Gama Grass	<i>Tripsacum dactyloides</i>	Warm Season	Minimum 2 (2)	1,2,3,4,1,2,3,4	March 31- August 31
Rice Cut Grass	<i>Leersia oryzoides</i>	Warm Season	Minimum 2 (2)	1,2,3,4	March 31- August 31
Deertongue	<i>Panicum clandestinum</i>	Warm Season	Minimum 2 (2)	1,2,3,4	March 31- August 31
Switchgrass	<i>Panicum virgatum</i>	Warm Season	Minimum 2 (2)	1,2,3,4	March 31- August 31
Woolgrass	<i>Scirpus cyperinus</i>	Cool Season	Minimum 2 (2)	1,2,3,4	October 31 - March 31
River Oats	<i>Chasmanthium latifolium</i>	Cool Season	Minimum 2 (2)	1,2,3,4	October 31 - March 31
Purple Top	<i>Tridens flavus</i>	Warm Season	Minimum 2 (2)	1,2,3,4	March 31- August 31

See plan sheets/plant lists for detailed native restoration and riparian mitigation seed mix combinations to be applied at a minimum rate total of 10 (11) lbs. per acre (kg/hectare) for each combined mix. If the mix is not provided in the plan sheets, use a minimum of 3 species based on planting dates shown above.

Section 700 — Grassing

HERBACEOUS PLANT SEEDING TABLE 4

(Approved for Riparian Mitigation or for Seed Mixes on Slopes Steeper than 3:1-Requiring Permanent Planting)

Common name	Botanical name	Class/type	Rate/Acre	Planting Zone	Planting Dates
Joe Pye Weed	<i>Eupatorium fistulosum</i>	Herbaceous Perennial	Minimum 2 (2)	1,2,3,4	September 1 – May 1
Ironweed	<i>Vernonia novaboracensis</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	March 1 - August 31,
White snakeroot	<i>Ageratina altissima</i> (<i>Eupatorium rugosum</i>)	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Swamp milkweed	<i>Asclepias incarnata</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	March 1 - August 31,
Frost aster	<i>Aster pilosus</i> (<i>Symphotrichum pilosum</i>)	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Partridge pea	<i>Chamaecrista fasciculata</i> (<i>Cassia fasciculata</i>)	Herbaceous Perennial	Up to 10(11)	1,2,3,4	March 1 - August 31,
Lance-leaf coreopsis	<i>Coreopsis lanceolata</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Tall coreopsis	<i>Coreopteris tripteris</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Boneset	<i>Eupatorium perfoliatum</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Sneezeweed	<i>Helenium autumnale</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Swamp sunflower	<i>Helianthus angustifolius</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	March 1 - August 31,
Fringed loosestrife	<i>Lysimachia ciliata</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1

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Wild bergamot	<i>Monarda fistulosa</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Mountain mint	<i>Pycnanthemum tenuifolium</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Black-eyed susan	<i>Rudbeckia hirta</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Goldenrod	<i>Solidago nemoralis</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	September 1 – May 1
Butterfly Weed	<i>Aesclepias tuberosa</i>	Herbaceous Perennial	Up to 10(11)	1,2,3,4	March 1 - August 31,

Species	Rates per 1000 sq. ft.	Rates per Acre	Planting Date By Zone		
			1 & 2	2	3 & 4
Rye (Grain)	3.9 lbs	168 lbs	8/1 - 11/30	8/15 - 12/1	9/1 - 2/28
Ryegrass	0.9 lbs	40 lbs	8/1 - 11/30	9/1 - 12/15	9/15 - 1/1
Rye & Annual Lespedeza	0.6 lbs 0.6 lbs	28 lbs 24 lbs	3/1 - 4/1	2/1 - 3/1	2/1 - 3/1
Weeping Lovegrass	0.1 lbs	4 lbs	3/15 - 6/15	3/15 - 7/15	3/15 - 7/15
Sudangrass	1.0 lbs	60 lbs	4/1 - 8/31	4/1 - 8/31	3/15 - 8/1
Browntop Millet	1.1 lbs	50 lbs	4/1 - 6/30	4/1 - 7/15	4/1 - 7/15
Wheat	3.9 lbs	168 lbs	9/1 - 12/31	9/1 - 12/31	9/15 - 1/31

For native restoration and riparian mitigation seed mix combinations, use Table 4 for approved native herbaceous seed types in combination with Table 3 of native grass seeds. Native restoration and riparian seed mixes should incorporate a mix of 60% native grass types (see Table 3) and 40% native herbaceous types (see Table 4) applied at a minimum rate total of 10 (11) lbs. per acre (kg/hectare) for each combined mix.

TABLE 5: TEMPORARY GRASS - SPECIES, SEEDING RATES AND PLANTING DATES

When stage construction or other conditions prevent completing a roadway section continuously, apply temporary grassing to control erosion. Temporary grassing is used to stabilize disturbed areas for more than sixty (60) calendar days. Temporary grass may be applied any time of the year, utilizing the appropriate seed species and application rate as shown in the chart above. Apply mulch to areas planted in temporary grass at the rate of ¼ inch to 1.5 inches. Do not place slope mats on areas planted in temporary grass.

Section 700 — Grassing

A. Ground Preparation

Prepare the ground by plowing under any temporary grass areas and preparing the soil as follows:

1. Slopes 3:1 or Flatter

On slopes 3:1 or flatter, plow shoulders and embankment slopes to between 4 in. and 6 in. (100 mm and 150 mm) deep.

Plow front and back slopes in cuts to no less than 6 in. (150 mm) deep. After plowing, thoroughly disk the area until pulverized to the plowed depth.

2. Slopes Steeper Than 3:1

Serrate slopes steeper than 3:1 according to plan details when required.

On embankment slopes and cut slopes not requiring serration (sufficient as determined by the Engineer), prepare the ground to develop an adequate seed bed using any of the following methods as directed by the Engineer:

- Plow to a depth whatever depth is practicable.
- Use a spiked chain.
- Walk with a cleated track dozer.
- Scarify.

Disking cut slopes and fill slopes is not required.

3. All Slopes

a. Obstructions

Remove boulders, stumps, large roots, large clods, and other objects that interfere with grassing or may slide into the ditch.

b. Topsoil

Spread topsoil stockpiled during grading evenly over cut and fill slopes after preparing the ground.

Push topsoil from the top over serrated slopes. Do not operate equipment on the face of completed serrated cuts.

4. Native Restoration Areas, Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas.

For Permanent Grassing in native restoration areas, multitrophic native planting areas, riparian areas, stream restoration areas, and wetland and stream mitigation areas, provide the minimum ground preparation necessary to provide seed to soil contact. Riparian areas may also be seeded using the no-till method. The no-till method is defined by planting permanent grass seeds using a drill-type seeder over existing vegetation without plowing or tilling soil. Ensure that existing vegetation is less than 3 inches in height (this may be achieved by mowing or using a mechanical string trimmer).

B. Grassing Adjacent to Existing Lawns

When grassing areas adjacent to residential or commercial lawns, the Engineer shall change the plant material to match the type of grass growing on the adjacent lawn. The Contract Unit Price will not be modified for this substitution.

C. Temporary Grassing

Apply temporary grassing according to Subsection 163.3.05.F. Determine lime requirements by a laboratory soil test. Refer to seeding Table 5 for species, amounts of seed and planting dates.

In March or April of the year following planting and as soon as the weather is suitable, replace all areas of temporary grass with permanent grass by plowing or overseeding using the no-till method. If the no-till method is used, ensure that temporary grass is less than 3 in. in height (this may be achieved by mowing). Additional mulch will be required only if the temporary grass does not provide adequate mulch to meet the requirements of Subsection 700.3.05.G, *Mulching*.

Temporary grass, when required, will be paid for according to Section 163.

Projects that consist of asphalt resurfacing with shoulder reconstruction and/or shoulder widening: Type II Wood Fiber Blanket is used to stabilize disturbed areas, no till seeding will be used when permanent grassing is applied and the areas will not be re-disturbed.

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D. Applying Agricultural Lime and Fertilizer Mixed Grade

Apply and mix lime and fertilizer as follows:

1. Agricultural Lime

Uniformly spread agricultural lime on the ground at the approximate rate determined by the laboratory soil test.

- a. Agricultural Lime may be used as filler material in mixed grade fertilizer in lieu of inert material. The use of agricultural lime as filler material is to be shown on the fertilizer bag or invoice from the supplier. Do not deduct any amount of fertilizer when lime is used as filler.

2. Fertilizer Mixed Grade

Uniformly spread the fertilizer selected according to Subsection 700.2.D over the ground or by use of hydroseeding.

For bid purposes base estimated quantities on an initial application of 400 lb./acre of 19-19-19.

3. Mixing

Before proceeding, uniformly work the lime and fertilizer into the top 4 in. (100 mm) of soil using harrows, rotary tillers, or other equipment acceptable to the Engineer.

On cut slopes steeper than 3:1, other than serrated slopes, reduce the mixing depth to the maximum practical depth as determined by the Engineer.

Omit mixing on serrated slopes.

4. Native Restoration Areas, Multitropic Native Planting Areas, Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas

Omit the application of lime and fertilizer within riparian areas.

E. Seeding

Prepare seed and sow as follows:

1. Inoculation of Seed

Inoculate each kind of leguminous seed separately with the appropriate commercial culture according to the manufacturer's instructions for the culture.

When hydroseeding, double the inoculation rate.

Protect inoculated seed from the sun and plant it the same day it is inoculated.

2. Sowing

Weather permitting, sow seed within 24 hours after preparing the seed bed and applying the fertilizer and lime.

Sow seed uniformly at the rates specified in the seeding tables. Use approved mechanical seed drills, rotary hand seeders, hydroseeding equipment, or other equipment to uniformly apply the seed. Do not distribute by hand.

To distribute the seeds evenly sow seed types separately, except for similarly sized and weighted seeds. They may be mixed and sown together.

Do not sow during windy weather, when the prepared surface is crusted, or when the ground is frozen, wet, or otherwise non-tillable.

3. Overseeding

Temporary grass areas that were prepared in accordance with Subsection 700.3.05.A, may be overseeded using the no-till method. The no-till method is defined by planting permanent grass seeds using a drill-type seeder over existing temporary grass without plowing or tilling soil and in accordance with Subsection 700.3.05.C.

4. Riparian Seed Mix shall be used when specified in the plans. A mix of at least three (3) species from Seeding Table 3 (Native Grasses) and at least two (2) species from Seeding Table 4 (Approved Riparian Mitigation - Herbaceous Plants). The seed, shall be applied as Permanent Grassing within those areas designated on the plans. The kinds of seed, shall be used according to the appropriate Planting Dates given in the tables.

Section 700 — Grassing

F. Hydroseeding

Hydroseeding may be used on any grassing area. Under this method, spread the seed, fertilizer, and wood fiber mulch in the form of a slurry. Seeds of all sizes may be mixed together. Apply hydroseeding as follows:

1. Use wood fiber mulch as a metering agent and seed bed regardless of which mulching method is chosen. Apply wood fiber mulch at approximately 500 lbs./acre (560 kg/ha).
2. Prepare the ground for hydroseeding as for conventional seeding in Subsection 700.3.05.A.
3. Use specially designed equipment to mix and apply the slurry uniformly over the entire seeding area.
4. Agitate the slurry mixture during application.
5. Discharge slurry within one hour after being combined in the hydroseeder. Do not hydroseed when winds prevent an even application.
6. Closely follow the equipment manufacturer's directions unless the Engineer modifies the application methods.
7. Mulch the entire hydroseeded area according to Subsection 700.3.05.F.1, above, and Subsection 700.3.05.G, below. Native Restoration Areas, Multitropic Native Planting Areas, Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas may be hydroseeded. When hydroseeding in these areas only use water, seed and wood fiber mulch.

G. Mulching

Except as noted in Subsection 700.3.05.B and Subsection 700.3.05.C, apply mulch immediately after seeding areas as follows:

Areas with permanent grass seed and covered with slope mats or blankets will not require mulch.

Evenly apply straw or hay mulch between 3/4 in. and 1-1/2 in. (20 mm and 40 mm) deep, according to the texture and moisture content of the mulch material.

Mulch shall allow sunlight to penetrate and air to circulate as well as shade the ground, reduce erosion, and conserve soil moisture. If the type of mulch is not specified on the plans or in the Proposal, use any of the following as specified.

1. Mulch with Tackifier

Apply mulch with tackifier regardless of whether using ground or hydroseeding equipment for seeding.

- a. Mulch uniformly applied manually or with special blower equipment designed for the purpose. When using a blower, thoroughly loosen baled material before feeding it into the machine so that it is broken up.
- b. After distributing the mulch initially, redistribute it to bare or inadequately covered areas in clumps dense enough to prevent new grass from emerging (if required).
Do not apply mulch on windy days.
- c. Apply enough tackifier to the mulch to hold it in place. Immediately replace mulch that blows away.
If distributing the mulch by hand, immediately apply the tackifier uniformly over the mulched areas.
 - Tackifier: Use a tackifier listed in the Laboratory Qualified Products Manual and apply at the manufacturer's recommended rates.

2. Walked-in-Mulch

Apply walked-in-mulch on slopes ranging in steepness from 5:1 to 2:1 and treat as follows:

- a. Immediately walk it into the soil with a cleated track dozer. Make dozer passes vertically up and down the slope.
 - b. Where walked-in-mulch is used, do not roll or cover the seeds as specified in Subsection 700.3.05.E.3.
3. Apply only wheat straw mulch on Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas after they have been seeded. The wheat straw mulch is to be applied with a maximum thickness of 1 in.

Section 700 — Grassing

H. Sod

Furnish and install sod in all areas shown on the plans or designated by the Engineer.

1. Kinds of Sod

Use only Common Bermudagrass (*Cynodon dactylon*) or one of the following Bermudagrass varieties:

Tifway 419

Tifway II

Tift 94

Tifton 10

Midlawn

Midiron

GN-1

Vamont

No dwarf Bermuda types shall be used. Sod shall be nursery-grown and be accompanied with a Georgia Department of Agriculture Live Plant License Certificate or Stamp. Sod shall consist of live, dense, well-rooted material free of weeds and insects as described by the Georgia Live Plant Act.

2. Type and Size Of Sod:

Furnish either big roll or block sod. Ensure that big roll sod is a minimum of 21 in. wide by 52 ft. long. Minimum dimensions for block sod are 12 in. wide by 22 in. long. Ensure all sod consists of a uniform soil thickness of not less than 1 in.

3. Ground Preparation

Excavate the ground deep enough and prepare it according to Subsection 700.3.05.A to allow placing of sod. Spread soil, meeting the requirements of Subsection 893.2.01, on prepared area to a depth of 4 in.

4. Application of Lime and Fertilizer

Apply lime and fertilizer according to Subsection 700.3.05.D within 24 hours prior to installing sod.

5. Weather Limitation

Do not place sod on frozen ground or where snow may hinder establishment.

6. Install Sod

Install Sod as follows:

- Place sod by hand or by mechanical means so that joints are tightly abutted with no overlaps or gaps. Use soil to fill cracks between sod pieces, but do not smother the grass.
- Stake sod placed in ditches or slopes steeper than 2:1 or any other areas where sod slipping can occur.
- Use wood stakes that are at least 8 in (200 mm) in length and not more than 1 in. (25 mm) wide.
- Drive the stakes flush with the top of the sod. Use a minimum of 8 stakes per square yard (meter) to hold sod in place.
- Once sod is placed and staked as necessary, tamp or roll it using adequate equipment to provide good contact with soil.
- Use caution to prevent tearing or displacement of sod during this process. Leave the finished surface of sodded areas smooth and uniform.

7. Watering Sod

After the sod has been placed and rolled or tamped, water it to promote satisfactory growth. Additional watering will be needed in the absence of rainfall and during the hot dry summer months. Water may be applied by Hydro Seeder, Water Truck or by other means approved by the Engineer.

8. Dormant Sod

Dormant Bermuda grass sod can be installed. However, assume responsibility for all sod through establishment and until final acceptance.

9. Establishment

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I. Application of Nitrogen

Apply nitrogen at approximately 50 lbs./acre (56 kg/ha) when specified by the Engineer after plants have grown to 2 in. (50 mm) in height.

One application is mandatory and must be applied before Final Acceptance.

Apply nitrogen with mechanical hand spreaders or other approved spreaders capable of uniformly covering the grassed areas. Do not apply nitrogen on windy days or when foliage is damp.

Do not apply nitrogen between October 15 and March 15 except in Zone 4.

1. Native Restoration Areas, Multitropic Native Planting Areas, Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas

Do not apply nitrogen to these areas.

J. Application of Polyacrylamide (PAM)

1. Prepare soil according to project plans and specifications prior to applying PAM.
2. Apply PAM according to manufacturer's recommendations and the requirements listed herein.
3. Apply Polyacrylamide (PAM) to all areas that receive permanent grassing.
4. Apply PAM (powder) before grassing or PAM (emulsion) to the hydroseeding operation.
5. Use only anionic PAM.
6. Ensure that the application method provides uniform coverage to the target and avoids drift to non-target areas including waters of the state.
7. Achieve > 80% reduction in soil loss as measured by a rainfall simulator test performed by a certified laboratory (1-hour storm duration, 3 in. (75 mm) rainfall per hour).
8. Ensure uniform coverage to the target area and minimize drift to non-target areas. Apply anionic PAM to all cut and fill slopes, permanently grassed or temporarily grassed, either prior to grassing or in conjunction with hydroseeding operations. Mulch will not be eliminated.
9. Use application rates in accordance with manufacturer's instructions.
10. Do not exceed 200 lbs./acre/year (224 kg/ha/year).
11. Do not include polyacrylamide when planting in Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas

700.3.06 Quality Acceptance

The Engineer may require replanting of an area that shows unsatisfactory growth for any reason at any time.

Except as otherwise specified or permitted by the Engineer, prepare replanting areas according to the specifications as if they were the initial planting areas. Use a soil test or the Engineer's guidance to determine the fertilizer type and application rate, then furnish and apply the fertilizer.

700.3.07 Contractor Warranty and Maintenance

A. Plant Establishment

Before Final Acceptance, provide plant establishment of the specified vegetation as follows:

1. Plant Establishment
Preserve, protect, water, reseed or replant, and perform other work as necessary to keep the grassed areas in satisfactory condition.
2. Watering
Water the areas during this period as necessary to promote maximum growth.
3. Mowing
Mow seeded areas of medians, shoulders, and front slopes at least every 6 months. Avoid damaging desirable vegetation.

Section 700 — Grassing

In addition, mow as necessary to prevent tall grass from obstructing signs, delineation, traffic movements, sight distance, or otherwise becoming a hazard to motorists.

Do not mow lespedezas or tall fescue until after the plants have gone to seed.

4. Do not mow riparian areas, stream restoration areas, or wetland and stream mitigation areas after planting.

B. Additional Fertilizer Mixed Grade

Apply fertilizer based on the initial soil test report at half the recommended rate each spring after initial plant establishment. For bid purposes apply 200 lbs./acre of 19-19-19. Continue annual applications until Final Acceptance. This additional fertilizer will be measured and paid for at the Contract Unit Price for fertilizer mixed grade.

Do not apply additional fertilizer to Native Restoration Areas, Multitropic Native Planting Areas, Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas.

C. Growth and Coverage

Provide satisfactory growth and coverage, ensuring that vegetation growth is satisfactory with no bare spots larger than 1 ft.² (0.1 m²). Bare spots shall comprise no more than 1 percent of any given area. An exception is given for seed not expected to have germinated and shown growth at that time.

D. Permissible Modifications

When all Items of the work are ready for Final Acceptance except for newly planted repaired areas or other areas with insufficient grass, the Contractor may fill the eroded areas or treat bare areas with sod obtained, placed, and handled according to Subsection 700.3.05.H.

Carefully maintain the line and grade established for shoulders, front slopes, medians, and other critical areas.

Sod as described above will not be paid for separately but will be an acceptable substitute for the satisfactory growth and coverage required under this specification. These areas treated with sod are measured for payment under the Item for which the sod is substituted.

700.4 Measurement

A. Permanent Grassing

Permanent Grassing will be measured for payment by the acre (hectare).

B. Mulches

Straw or hay mulch applied to permanent grassing areas will be measured by the ton (megagram). Wood fiber mulch furnished by the Contractor for permanent grassing is not measured for separate payment.

C. Quantity of Sod

Sod is measured for payment by the number of square yards (meters) , surface measure, completed and accepted.

D. Water

Water furnished and applied to promote a satisfactory growth is not measured for payment.

E. Quantity of Lime and Fertilizer Mixed Grade

Lime and fertilizer are measured by the ton (megagram). Lime used as a filler in fertilizer is measured by the ton (megagram).

F. Quantity of Nitrogen Used for Permanent Grassing

Nitrogen is measured in pounds (kilograms) based on the weight of fertilizer used and its nitrogen content.

G. Replanting and Plant Establishments

No measurement for payment is made for any materials or work required under Subsection 700.3.06 and Subsection 700.3.07.

Section 700 — Grassing

H. Temporary Grass

Temporary grass is measured for payment by the acre (hectare) according to Section 163.

I. Seeded Native Restoration Areas, Multitropic Native Planting Areas, Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas

Seeded Native Restoration Areas, Multitropic Native Planting Areas, Riparian areas, Stream Restoration area, and Wetland and Stream Mitigation areas will be measured by the acre (hectare) and included under the pay item *Native Restoration and Riparian Seeding*.

700.4.01 Limits

General Provisions 101 through 150.

700.5 Payment

As grassing and planting progress, the Contractor will receive full measurement and payment on regular monthly estimates provided the work complies with the specifications.

A. Permanent Grassing

Permanent grassing will be paid for at the Contract Price per acre (hectare), complete and in place. Payment is full compensation for preparing the ground, seeding, wood fiber mulch, polyacrylamide, and providing plant establishment, soil tests and other incidentals.

B. Straw or Hay Mulch

Straw or hay mulch required for Permanent Grassing will be paid for according to Section 163.

C. Fertilizer Mixed Grade

Fertilizer mixed grade will be paid for at the Contract Price per ton (megagram). Payment is full compensation for furnishing and applying the material.

D. Lime

Lime will be paid for at the Contract Price per ton (megagram). Lime used as filler in fertilizer will be paid for per ton (megagram). Payment is full compensation for furnishing and applying the material.

E. Nitrogen

Nitrogen will be paid for at the Contract Price per pound (kilogram) of nitrogen content. Payment is full compensation for furnishing and applying the material.

F. Sod

1. Sod will be paid by the square yard (meter) in accordance with the following schedule of payments. Payment is full compensation for ground preparation, including addition of topsoil, furnishing and installing live sod, and for Plant Establishment.
2. 70 percent of the Contract Price per square yard will be paid at the satisfactory completion of the installation.
3. 20 percent of the Contract Price will be paid upon satisfactory review of sod which is healthy, weed free and viable at the inspection made at the end of the first spring after installation.
4. 10 percent of the contract price will be paid upon satisfactory review of sod that is healthy, weed free and viable at the Final Acceptance.

G. Temporary Grass

Temporary Grass will be paid for under Section 163.

Section 700 — Grassing

H. Seeded Native Restoration Areas, Multitropic Native Planting Areas, Riparian Areas, Stream Restoration Areas, and Wetland and Stream Mitigation Areas

Seeded Native Restoration Areas, Multitropic Native Planting Areas, Riparian areas, Stream Restoration area, and Wetland and Stream Mitigation areas will be paid for at the Contract Price per acre (hectare), complete and in place. Payment is full compensation for preparing the ground, seeding, and providing plant establishment and other incidentals. and included under the pay item “Native Restoration and Riparian Seeding”.

Payment will be made under:

Item No. 700	Permanent grassing	Per acre (hectare)
Item No. 700	Agricultural lime	Per ton (megagram)
Item No. 700	Fertilizer mixed grade	Per ton (megagram)
Item No. 700	Fertilizer nitrogen content	Per pound (kilogram)
Item No. 700	Sod	Per square yard (meter)
Item No. 700	Native Restoration and Riparian Seeding	Per acre (hectare)

700.5.01 Adjustments

General Provisions 101 through 150.

Section 716—Erosion Control Mats (Slopes)

716.1 General Description

This work includes furnishing and placing erosion control mats (blankets) made of fiberglass, excelsior, jute mesh, bituminous treated roving, and straw, synthetic, or coconut over grass areas prepared according to Section 700 for permanent grass. Place according to the plans or as directed by the Engineer. This specification is not applicable for waterways.

716.1.01 Definitions

General Provisions 101 through 150.

716.1.02 Related References

A. Standard Specifications

Section 712—Fiberglass Blanket

Section 713—Organic and Synthetic Material Fiber Blanket

Section 714—Jute Mesh Erosion Control

B. Referenced Documents

General Provisions 101 through 150.

716.1.03 Submittals

General Provisions 101 through 150.

716.2 Materials

General Provisions 101 through 150.

716.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

716.3 Construction Requirements

716.3.01 Personnel

General Provisions 101 through 150.

716.3.02 Equipment

General Provisions 101 through 150.

716.3.03 Preparation

General Provisions 101 through 150.

716.3.04 Fabrication

General Provisions 101 through 150.

716.3.05 Construction

The contractor may elect to use either Section 712 – Fiberglass Blanket, Section 713 – Organic and Synthetic Material Fiber Blanket (except do not use Type II Wood Fiber Blanket), or Section 714 – Jute Mesh Erosion Control on slopes. All of the materials, construction and measurement portions of the noted sections apply to the type mat (blanket) selected for use.

Section 716 — Erosion Control Mats (Slopes)

Place blankets or mats vertically on the slopes beginning at the top of the slope and extending to the bottom of the slope. Horizontal installation of the blankets or mats is not permitted.

The application of mulch is not required for permanent grassing when one of the above noted mats or blankets is placed on the previously prepared and grassed slopes with 24 hours.

716.3.06 Quality Acceptance

General Provisions 101 through 150.

716.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

716.4 Measurement

Erosion control mats (Slopes) are measured according to the specification sections referenced in Subsection 716.3.05.

716.4.01 Limits

General Provisions 101 through 150.

716.5 Payment

Erosion control mats (Slopes), measured as specified in Section 712, Section 713, or Section 714 will be paid for at the Contract Unit Price per square yard (meter).

This payment is full compensation for constructing the mat (blanket) and providing materials, equipment, tools, labor, and incidentals needed to maintain mats (blankets) for the life of the Contract or until a stand of grass has developed enough to prevent erosion.

Payment will be made under:

Item No. 716	Erosion control mats (slopes)	Per square yard (meter)
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716.5.01 Adjustments

General Provisions 101 through 150.