SPECIAL PROVISIONS
SUPPLEMENTAL SPECIFICATIONS

Effective GDOT Shelf and Special Provisions NOT included in 2021 Edition of Standard Specifications for Construction of Transportation Systems, as Modified in the 2024 Edition

The following sections are applicable to this contract as GDOT Shelf and Special Provisions not included in the 2021 revision of GDOT's Standard Specifications and are specified as an attached:

Special Provision – Utility Conflicts *(dated 8/6/2012)*

Section 108.07 – Prosecution and Progress/Determination of Contract Time *(dated 5/7/2026)*

Section 108.08 – Prosecution and Progress/Failure or Delay in Completing Work on Time *(dated 5/7/2026)*

Section 150 - Traffic Control *(dated 8/22/2025)*

Section 150.3 - Traffic Control / Construction Requirements *(dated 5/7/2026)*

Section 201 – Clearing and Grubbing Right-Of-Way *(dated 7/21/2025*

Section 500 – Concrete Structures *(dated 3/23/2026)*

Section 653 – Thermoplastic Traffic Stripe

Section 716 – Erosion Control Mats (Slopes) *(dated 3/6/2024)*

Section 801 – Fine Aggregate *(dated 7/24/2025)*

Section 828 – Hot Mix Asphaltic Concrete Mixtures *(dated 4/13/2026)*

First Use Date: January 1, 2007
Revised: March 26, 2008
March 5, 2009
September 30, 2009
August 6, 2012

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Utility Conflicts

Utility companies having known facilities that conflict with the construction of this project will be directed by the Department to adjust or relocate their facilities and will be notified of the contract award.

Conform to all the requirements of the Specifications as they relate to cooperation with utility owners and the protection of utility installations that exist on the project. Refer to the requirements of Section 107, Legal Regulations and Responsibility to the Public, with particular attention to Subsection 107.21.

Coordinate The Work with any work to be performed by others in any right of way clearance and arrange a schedule of operations that will allow for completion of the Project within the specified contract time. Where stage construction is required, notify the utility owner when each stage of work is completed and the site is available for utility work to proceed.

Information concerning utility facilities known to exist within the project limits, including the list of owners, is available for reference.

Under Georgia Code Section 32-6-171, utilities are required to remove or relocate their facilities. The Department is required to give the utility at least 60 days written notice directing the removal, relocation, or adjustment and the utility owner is required to begin work within the time specified in the utility's work plan or revised work plan.

Upon request, copies of all approved Work Plans submitted by utility companies having facilities on this project will be made available for examination by the Contractor at the Department's District Office. Utility Adjustment Schedules, when submitted to the Department by the utilities, will be made available to the Contractor after the Notice to Contractors has been posted by the Office of Construction Bidding Administration. The Contractor is responsible for considering in its bid all existing and proposed utility locations and the removals, relocations, and adjustments specified in the Utility's Work Plan.

For this Project, Utility Owners that are required to remove, relocate, or adjust their facility to accommodate the construction of this Project may be liable to the Contractor for damages or delay costs resulting from the Utility Owner's failure to clear conflicts

within the time specified in the approved Utility Work Plan. If the Utility Owner is unable to submit and obtain Department approval of a revised Work Plan or fails to complete the removal, relocation, or adjustment of its facilities in accordance with the approved Work Plan, the Utility Owner may be liable to the Department, or the Contractor, for damages or delay costs.

In accordance with Subsection 105.06 of the Specifications, the Department is not liable for payment of any claims due to utility delays, inconvenience or damage sustained by the Contractor due to interference of any utilities or appurtenances, or the operation of moving them.

In any case in which the Contractor believes that it will be entitled to damages or delay costs from the Utility Owner in accordance with O.C.G.A. 32-6-171, the Contractor shall provide written notice to the Utility Owner and the Department within ten (10) days from the time of the dispute or potential dispute is identified. The Contractor shall follow the Procedures for Utility Damages or Delay Costs outlined in the latest edition of The Utility Accommodation Policy and Standards Manual. Failure to follow the above will result in waiver of the Contractor's claim against the Utility Owner for damages or delay costs.

In accordance with Subsection 107.21.G delays by utilities will continue to be considered by the Department in charging Contract Time. For purposes of applying provisions of this paragraph, railroads and the Metropolitan Atlanta Rapid Transit Authority (MARTA) are considered utilities.

May 7, 2026

DEPARTMENT OF TRANSPORTATION
COBB COUNTY GEORGIA

SPECIAL PROVISION

LOST MOUNTAIN ROAD AT AMBERTON DRIVE / HOPETON DRIVE
PROJECT NO: B2442

Section 108 – Prosecution and Progress

108.07 Determination of Contract Time

F. Extension of Contract Time

Retain subsection and add the following:

The Contract time includes due allowance for unsuitable weather days during which the work cannot be performed. For purposes of calculating Contract Time extension requests based on unsuitable weather sufficient to prevent performance of the work, the Contractor shall first refer to the unsuitable weather days contemplated under the Contract, in accordance with the schedule of monthly anticipated unsuitable weather delay days below. The Contractor shall not be entitled to any extension of Contract time for unsuitable weather unless Contractor encounters actual unsuitable weather in excess of those days set forth in the schedule below:

January – 10 days	February – 9 days	March – 7 days	April – 5 days
May – 5 days	June – 4 days	July – 4 days	August – 4 days
September – 4 days	October – 5 days	November – 6 days	December – 10 days

The schedule above represents a standard Monday through Friday (5 day) work week. No extension of Contract Time will be considered for unsuitable weather on Saturdays, Sundays, and Holidays.

In addition to any other project records required in this Contract, the Contractor shall provide a monthly record to the County summarizing any unsuitable weather in excess of those anticipated days indicated in the above schedule for which a request for a weather-related time extension will be made. The record shall state with particularity a description of the unsuitable weather as well as a description of the nature and extent of any delay caused by such weather. The Contractor shall submit the request for weather-related time extension within seven (7) days of the calendar month end, and such request shall be supported by documentation required by the County including, but not limited to, official weather reports. Days requested for weather-related time extensions will be offset against any days available from months with fewer unsuitable weather days than those provided for in the schedule. Weather-related Contract time extension requests will not be evaluated until the end of the project.

Weather-related Contract time extension requests will not be considered if Contractor has not actively pursued the work continuously since issuance of Notice to Proceed. Contractor's failure to utilize available days shall not warrant an extension of contract time due to unsuitable weather.

Any and all unsuitable weather-related delays shall be non-compensable, and the sole and exclusive remedy of the Contractor in the event of any such delay is an extension of Contract Time.

Should the Engineer find that the Contractor is due a Contract Time extension, the Director of the Cobb County Department of Transportation, or his designee, shall have the authority to execute change orders for the extension of Contract Time of behalf of the Department, provided no additional compensation is requested and all other terms of the Contract remain unchanged.

108.08 Failure or Delay in Completing Work on Time

Delete the Schedule of Deductions for Each Day of Overrun in Contract Time table shown in Section 108.08 and replace with the following:

An overall Completion Date of **Three Hundred Sixty-Five Days (365)** calendar days has been established for this Project.

Failure to complete the construction in accordance with the above will result in the assessment of Liquidated Damages at the rate of $2,000.00 per calendar day or portion thereof.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 150—Traffic Control

150.1 General Description

This section, as supplemented by the Plans, Specifications, and Manual on Uniform Traffic Control Devices (MUTCD) shall be considered the Temporary Traffic Control (TTC) Plan in accordance with Work Zone Safety and Mobility Policy. Activities shall consist of furnishing, installing, maintaining, and removing necessary traffic signs, pedestrian signs, barricades, lights, signals, cones, pavement markings and other traffic control devices and shall include flagging and other means for guidance and protection of vehicular and pedestrian traffic through the Work Zone. This Work shall include both maintaining existing devices and installing additional devices as necessary in construction work zones.

The Contractor shall be responsible for the maintenance of traffic signals and Advanced Traffic Management System (ATMs) devices from the time that the system is modified until final acceptance. The maintenance of traffic signals and ATMs devices that are not a part of the Work and that are not in conflict with any portion of the Work shall not be the responsibility of the Contractor. However, the Contractor is still responsible for damages to all devices that they or their subcontractors cause, in accordance with Section 107 and other Specifications.

When any provisions of this Specification or the Plans do not meet the minimum requirements of the MUTCD, the MUTCD shall control. The 2023 Edition of the MUTCD including revisions shall be in effect for the duration of the project.

All traffic control devices used during the construction of the project shall meet the standards utilized in the MUTCD, and shall comply with the requirements of these Specifications, Georgia Construction Standards and Details, Project Plans, Design Manuals, and Special Provisions.

The needs and control of all road users (motorists, bicyclists and pedestrians within the highway right-of-way and easements, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II,) through a Temporary Traffic Control (TTC) zone shall be an essential part of highway construction, utility work, maintenance operations and management of traffic incidents.

Utilities included in the Contract are bound by Special Provision 150 and shall follow its requirements. For utilities not included in the Contract but working within the project limits, they shall, at a minimum follow the MUTCD. Moreover, in accordance with Utility Accommodation Policy and Standards Manual dated 2016, the Engineer reserves the right to require additional certified flaggers, signs, warning lights, channelization devices, and other safety devices as may be necessary to properly protect, warn, and safeguard the traveling public. In addition, the Department reserves the right to place time restrictions or moratoriums on all utility work covered under a permit when, in the opinion of the Department, the continuance of the Work would seriously hinder traffic flow, be needlessly disruptive, or would unnecessarily inconvenience the traveling public. In case of emergencies, Utilities shall be provided access in accordance with Utility Accommodation Policy and Standards Manual.

150.1.01 Definitions

For Special Provision 150, the definitions for “shall”, “ should”, and “may” will be in accordance with MUTCD (1A.13) (1C.02).

Shall (Standard) - a statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device.

Should (Guidance) - a statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate.

May (Option) - a statement of practice that is a permissive condition and carries no requirement or recommendation.

150.1.02 Content

E. Barricades

1. Design
2. Application

F. Warning Lights

1. Design
2. Application

150.2.05 Flashing Beacon

150.2.06 Guardrail

150.2.07 Interim Signs

A. Posts
B. Sign Blanks and Panels

150.2.08 Pavement Markings

A. All Traffic Striping for Forty-Five (45) Days or Less (≤45 Days)
B. All Temporary Striping Beyond Forty-Five (45) days (>45 Days)
C. All Temporary Traffic Striping on Final Surface

150.2.09 Portable Changeable Message Signs

150.2.10 Portable Impact Attenuators

150.2.11 Portable Temporary Traffic Control Signals

150.2.12 Raised Pavement Markers

150.2.13 Rumble Strips

150.2.14 Temporary Barriers

A. Design
B. Application

150.2.15 Temporary Guardrail Anchorage- Type 12

150.2.16 Temporary Traffic Signal

150.3 Construction Requirements

150.3.01 General

A. Implementation Requirements
B. Maintenance of Traffic Control Devices
C. Traffic Interruption Restrictions
D. Work Zone Restrictions

1. Interstate
2. Non-Interstate Divided Highways
3. Non-Divided Highways

E. Work Zone Geometric Restrictions
F. Clear Zone
G. Milled Surface Restrictions
H. Construction Vehicle
I. Environmental Impacts
J. Existing Street Lights
K. Nighttime Work Lighting
L. Removal/Reinstallation of Miscellaneous Items

150.3.02 Personnel – Worker Safety Apparel

150.3.03 Signage – General

A. Signing Requirements of the Temporary Traffic Control (TTC) Plan
B. Conflicting or Non-Applicable Signs
C. Removal of Existing Signs and Supports
D. Interim Guide, Warning and Regulatory Signs
E. Existing Special Guide Signs

1. Special Guide Signs
2. Interim Special Guide Signs
3. Interim Overhead Guide Sign Structures
4. Permanent Special Guide Signs

F. Stop Sign Regulated Intersections

G. Low Shoulder Signage

1. Low Shoulder for Construction/Reconstruction/Resurfacing Projects
2. Shoulder Drop-Off for Construction/Reconstruction/Resurfacing Project

H. Bump Signage
I. Sign Visibility

150.3.04 Advance Warning Signs

A. Project Signs - All Type of Highways

1. State Routes
2. Interstate, Limited Access and Multilane Divided Highways
3. Ramp Work on Limited Access Highways

B. Highway Work Zone

1. No Reduction in the Existing Posted Speed Limit in Highway Work Zone
2. Reducing the Speed Limit in a Highway Work Zone
3. Variable Speed Limit Zones

C. Installation/Removal of Work Area Signage

150.3.05 Shoulder/Lane Closure

A. Approval/Restrictions

1. Closure Length
2. Duration

B. Shoulder Closure
C. Lane Closure

1. Advance Warning Signs
2. Transition Area – Taper
3. Activity Area
4. Termination Area

D. Removal of Lane Closures
E. Exit and Entrance Ramps

150.3.06 Traffic Pacing Method

A. Pacing of Traffic
B. Methods of Signing for Traffic Pacing

150.3.07 Flagging Operation

A. Flaggers
B. Flagger Certification
C. Flagger Appearance and Equipment
D. Flagger Warning Signs
E. Pilot Vehicle Requirements
F. Automated Flagger Assistance Devices
G. Portable Temporary Traffic Control Signals

150.3.08 Traffic Signals

A. Responsibility/Cost
B. Law Enforcement Officer Requirement

150.3.09 Mobile Operations

150.3.10 Pavement Markings

A. General

1. Resurfacing Projects
2. Widening and Reconstruction Projects
3. New Location Construction Projects

B. Installation and Removal of Pavement Markings

1. Installation
2. Removal
3. Intermediate Surface
4. Final Surface
5. Pay Factor Reduction for Asphaltic Concrete Final Surfaces
6. Preparation and Planning for Traffic ShiftsC. Raised Pavement Markers

1. Supplementing Lane Lines
2. Supplementing Ramp Gore Lines
3. Other Lines

D. Exceptions for Interim Markings

1. Two-Lane, Two-Way Roadway

2. Multi-Lane Highway - with No Paved Shoulder(s) or Paved Shoulder(s) Four Feet or Less (≤ 4')
3. Limited Access Roadways and Roadways with Paved Shoulder Greater than Four Feet (>4')
4. Ramps for Multi-lane Divided Highways
5. Miscellaneous Pavement Markings

150.3.11 Differences in Elevation between Travel Lanes and Shoulders

A. Differences in Elevations

1. Difference of Two Inches (≤ 2") or Less Between Adjacent Travel Lanes
2. Difference of Two Inches (≤ 2") or Less Between Adjacent Travel Lane and Paved Shoulder
3. Difference of Greater Than Two Inches (>2") is Permitted for Continuous Operations
4. Difference of Greater Than Two Inches (>2") Between Travel Lanes and/or Shoulders for Non-Continuous Operations

B. Healed Section
C. Emergency Situations
D. Plating
E. Asphaltic Concrete Resurfacing Projects

1. Shoulder Construction Included as a Part of the Contract
2 Shoulder Construction Not Included as a Part of the Contract

150.3.12 Work Zone Law Enforcement

150.4 Measurement

150.4.01 Traffic Control Items

A. Traffic Control
B. Changeable Message Sign, Portable
C. Flashing Beacon Assembly
D. Pavement Markings
E. Portable Impact Attenuators
F. Signs

1. Interim Ground Mounted or Interim Overhead Special Guide Signs
2. Remove and Reset Existing Special Guide Signs, Ground Mount or Overhead
3. Modify Special Guide Signs, Ground Mount or Overhead

G. Temporary Audible Information Device
H. Temporary Barrier
I. Temporary Curb Cut Wheelchair Ramps
J. Temporary Guardrail Anchorage, Type 12
K. Temporary Walkways with Detectable Edging
L. Traffic Signal Installation - Temporary
M. Work Zone Law Enforcement

150.5 Reserved

150.6 Special Conditions

150.7 Payment

150.7.01 Enforcement and Adjustments

150.1.03 Related References

A. Standard Specifications

Section 104 - Scope of Work

Section 105 - -Control of Work-Legal Regulations and Responsibility to the Public

Section 107 - Legal Regulations and Responsibility to the Public

Section 108 - Prosecution and Progress

Section 209 - Subgrade Construction

Section 400 - Hot Mix Asphaltic Concrete Construction

Section 441 - Miscellaneous Concrete

Section 429 - Rumble Strips

Section 620 - Temporary Barrier

Section 632 - Portable Changeable Message Signs

Section 641 - Guardrail

Section 647 - Traffic Signal Installation

Section 648 - Traffic Impact Attenuator

Section 652 - Painting Traffic Stripe

Section 653 - Thermoplastic Traffic Stripe

Section 654 - Raised Pavement Markers

Section 656 - Removal of Pavement Markings

Section 657 - Preformed Plastic Pavement Markings

Section 658 - Polyurea Traffic Strip

Section 659 - Hot Applied Preformed Plastic Pavement Markings

Section 911 - Sign Posts

Section 912 - Sign Blanks and Panels

Section 913 - Reflectorizing Materials

B. Referenced Documents

ASTM D4956-13 (Retro-reflectivity)

American Traffic Safety Services Association (ATSSA)

Construction Detail A-3 Curb Cut (Wheelchair) Ramps Concrete Sidewalk Details

Construction Detail A-4 Detectable Warning Surface Truncated Dome Size, Spacing and Alignment Requirements

Construction Detail T-3A (Type 7, 8, and 9 Square Tube Post Installation Detail)

GDOT Signing and Marking Design Guidelines

Georgia Standard 4000W "Lengths of Advancement, Clear Zone Distances, Fill Height Embankment"

Georgia Standard 4960 "Temporary Barrier (End Treatment Options)"

Georgia Standard 9102 "Traffic Control Detail for Lane Closure on Two-Lane Highway"

Georgia Standard 9106 "Traffic Control Detail for Lane Closure on Multi-Lane Divided Highway"

Georgia Standard 9107 "Traffic Control Detail for Lane Closure on Multi-Lane Undivided Highway"

Georgia Standard 9121 "Tapers, Signs, and Markings for Passing Lanes"

Manual for Assessing Safety Hardware (MASH)

Manual on Uniform Traffic Control Devices (MUTCD)

National Cooperative Highway Research Program (NCHRP) 350

National Safety Council

Qualified Product List #29 (QPL-29) Reflective Sheeting

Qualified Product List #34 (QPL-34) Work Zone Traffic Control Devices (Drums, Type III Barricades, Vertical Panels, and Portable Sign Systems)

Qualified Product List #35 (QPL-35) Drive Type Galvanized Steel Sign Posts

Qualified Product List #46 (QPL-46) Traffic Pavement Markings

Qualified Product List #64 (QPL-64) Attenuator Units (Compression Crash Cushion) and Guardrail End Treatments

Qualified Product List #76 (QPL-76) Raised Pavement Markers and Channel Markers

Qualified Product List #79 (QPL-79) Portable Arrow Boards

Qualified Product List #82 (QPL-82) "Portable Changeable Message Signs"

Utility Accommodation Policy and Standards Manual

Work Zone Safety and Mobility Policy

150.1.04 Submittals/Preconstruction

A. Worksite Traffic Control Supervisor

The Contractor shall designate a qualified individual as the Worksite Traffic Control Supervisor (WTCS). The WTCS shall be responsible for selecting, installing, and maintaining all traffic control devices in accordance with the Plans, Specifications, Special Provisions and the MUTCD. The WTCS shall be currently certified by the American Traffic Safety Services Association (ATSSA) Work Site Traffic Supervisor Certification program or the National Safety Council Certification program. On-line classes will not be accepted.

The WTCS shall be available on a twenty-four (24) hour basis to perform their duties. If the Work requires traffic control activities to be performed during the daylight and nighttime hours, it may be necessary for the Contractor

to designate an alternate WTCS. An alternate WTCS must meet the same requirements and qualifications as the primary WTCS and be accepted by the Engineer prior to beginning any traffic control duties. The Worksite Traffic Control Supervisor's traffic control responsibilities shall have priority over all other assigned duties.

As the representative of the Contractor, the WTCS shall have full authority to act on behalf of the Contractor in administering the TTC Plan. The WTCS shall have appropriate training in safe traffic control practices in accordance with Part 6 of the MUTCD. In addition to the WTCS, all other individuals making decisions regarding traffic control shall meet the training requirements of the Part 6 of the MUTCD.

The Worksite Traffic Control Supervisor (WTCS) shall have a copy of Part 6 of the MUTCD and the Contract on the job site. Copies of the current MUTCD may be obtained from the FHWA web page at http://mutcd.fhwa.dot.gov.

The WTCS shall supervise the initial installation of traffic control devices. The Engineer, prior to the beginning of construction, will review the initial installation. Modifications to traffic control devices as required by sequence of operations or staged construction shall be reviewed by the WTCS.

Any work performed on the interstate or limited access highway right-of-way that requires traffic control shall be supervised by a submitted/approved certified Worksite Traffic Control Supervisor. No work requiring traffic control shall be performed unless the certified WTCS is on the worksite. Failure to maintain a Certified Worksite Traffic Control Supervisor on the Work will be considered as non-performance under Subsection 150.7.01.

The WTCS or alternate WTCS shall be available on a full-time basis to maintain traffic control devices with access to all personnel, materials, and equipment necessary to respond effectively to an emergency situation within forty-five (45) minutes of notification of the emergency.

The WTCS shall perform inspections, at a minimum once a month, to ensure that traffic control is maintained. For all interstate and limited access highways, the WTCS shall perform, as a minimum, weekly traffic control inspections. The inspections will start with the installation of the advance warning signs and will stop when a maintenance acceptance is issued or when the corrective list is completed.

An inspection shall include both daytime and nighttime reviews. The inspection shall be reported to the Engineer on a Traffic Control Inspection Report (TC-1) form provided by the Department. Unless modified by the special conditions or by the Engineer, routine deficiencies shall be corrected within a twenty-four (24) hour period. Failure to comply with these provisions shall be grounds for dismissal from the duties of WTCS and/or removal of the WTCS from the project. Failure of the WTCS to execute their duties shall be considered as non-performance under Subsection 150.7.01.

The Engineer will periodically review the Work for compliance with the requirements of the TTC plan.

On projects where traffic control duties will not require full time WTCS supervision, the Engineer may allow the Contractor's Project superintendent, foreman, subcontractor, or other designated personnel to serve as the WTCS as long as satisfactory results are obtained. Nevertheless, the individual shall meet the requirements and perform the duties of a WTCS.

B. Sequence of Operations

Any Sequence of Operations provided in this Contract in conjunction with any staging details which may be shown in the Plans, is a suggested sequence for performing the Work. It is intended as a general staging plan for the orderly execution of the Work while minimizing the impact on pedestrian facilities, mainline, cross-streets and side streets. The Contractor shall develop detailed staging and temporary traffic control plans for performing specific areas of the Work including but not limited to all traffic shifts, detours, bridge widenings, paces, or other activities that disrupt traffic or pedestrian flow. The Engineer may require detailed staging and TTC Plans for lane closures or disruption to pedestrian facilities. These Plans shall be submitted for approval at least two (2) weeks prior to the scheduled date of the activity. Activities that have not been approved at least seven (7) days prior to the scheduled date shall be rescheduled.

Where traffic is permitted through the work area under stage construction, the Contractor may choose to construct, at no additional expense to the Department, temporary on-site bypasses, or detours in order to expedite the Work. Plans for such temporary bypasses or detours shall be submitted to the Engineer for review and approval thirty (30) calendar days prior to the proposed construction. Such bypasses or detours shall be removed promptly when in

the opinion of the Engineer; they are no longer necessary for the satisfactory progress of the Work. Bypasses and detours shall meet the minimum requirements of Subsection 150.3.01.E.

As an option to the Sequence of Operations in the Contract, the Contractor may submit an alternative Sequence of Operations for review and approval. Alternate Sequence of Operations for pedestrian facilities shall be in compliance with the MUTCD and ADA. Pedestrian needs identified in the preconstruction phase shall be included in the proposed alternate plan.

The Department will not pay, or in any way, reimburse the Contractor for claims arising from the Contractor's inability to perform the Work in accordance with the Sequence of Operations provided in the Contract or from an approved Contractor alternate.

The Contractor shall secure the Engineer's approval of the Contractor's proposed plan of operation, sequence of work and methods of providing for the safe passage of vehicular and pedestrian traffic before it is placed in operation. The proposed plan of operation shall supplement the approved traffic control plan. Any major changes to the approved TTC plan, proposed by the Contractor, shall be submitted to the Department for approval.

Some additional traffic control details will be required prior to any major shifts or changes in traffic. The traffic control details shall include, but not be limited to, the following:

1. A detailed drawing showing traffic locations and lanes for each step of the change.

2. The location, size, and message of all signs required by the MUTCD, Plan, Special Provisions, and other signs as required to fit conditions. Any portable changeable message signs used shall be included in the details.

3. The method to be used in, and the limits of, the obliteration of conflicting lines and markings.

4. Type, location, and extent of new lines and markings.

5. Horizontal and vertical alignment and superelevation rates for detours, including cross-section and profile grades along each edge of existing pavement.

6. Drainage details for temporary and permanent alignments.

7. Location, length, and/or spacing of channelization and protective devices (temporary barrier, guardrail, barricades, etc.)

8. Starting time, duration, and date of planned change.

9. For each traffic shift, a paving plan, erection plan, or work site plan, as appropriate, detailing workforce, materials, and equipment necessary to accomplish the proposed Work. This will be the minimum resource allocation required in order to start the Work.

The above details shall be submitted to the Engineer for approval at least fourteen (14) days prior to the anticipated traffic shift. Submission should be made electronically in a portable document format (pdf). The Contractor shall have traffic control details for a traffic shift which has been approved by the Engineer prior to commencement of the physical shift. All preparatory work relative to the traffic shift, which does not interfere with traffic, shall be accomplished prior to the designated starting time. The Engineer and the Contractor's representative will verify that all conditions have been met prior to the Contractor obtaining materials for the actual traffic shift.

C. Pedestrian Considerations

All existing pedestrian facilities, including access to transit stops, shall be maintained. Where pedestrian routes are closed, alternate routes shall be provided. Closures of existing, interim, and final pedestrian facilities shall have the prior written approval of the Engineer. When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility. Pedestrian facilities are considered improvements and provisions made to accommodate or encourage walking. Whenever a sidewalk is to be closed, the Engineer shall notify the maintaining agency two (2) weeks prior to the closure. Prior to closure, detectable barriers (that are detectable by a person with a visual disability traveling with the aid of a long cane), as described by the MUTCD, shall be placed

across the full width of the closed sidewalk. Barriers and channelizing devices used along a temporary pedestrian route shall be in compliance with the MUTCD.

Temporary Traffic Control devices used to delineate a Temporary Traffic Control Zone Pedestrian Walkway shall be in compliance with Subsection 150.3.01.A. Appropriate signs as described in the MUTCD shall be maintained to allow safe passage of pedestrian traffic or to advise pedestrians of walkway closures (Refer to MUTCD Figures TA-28 and TA-29 for guidance). Advance closure signing should be placed at intersections rather than midblock locations so that pedestrians are not confronted with midblock work sites that will induce them to attempt skirting the work site or making a midblock crossing. Temporary Traffic Control devices and construction material shall not intrude into the usable width of the pedestrian walkway. Signs and other devices shall be placed such that they do not narrow or restrict any pedestrian passage to less than forty-eight inches (≥ 48").

1. Pedestrian Signage

A pedestrian walkway shall not be severed or relocated for non-construction activities, such as parking for construction vehicles and equipment. Movement by construction vehicles and equipment across designated pedestrian walkways should be minimized. When necessary, construction activities shall be controlled by flaggers. Pedestrian walkways shall be kept free of mud, loose gravel, or other debris.

When temporary covered walkways are used, they shall be lighted during nighttime hours. When temporary traffic barrier is used to separate pedestrian and vehicular traffic, the temporary barrier shall meet Manual for Assessing Safety Hardware (MASH) Test Level 3 and/or NCHRP-350 Test Level Three. The barrier ends shall be protected in accordance with Georgia Standard 4960. Curbing shall not be used as a substitute for temporary traffic barriers when temporary traffic barriers are required. Tape, rope, or plastic chain strung between temporary traffic control devices are not considered as detectable and shall not be used as a control for pedestrian movements.

The WTCS shall inspect the activity area daily to ensure that effective pedestrian TTC is being maintained. The inspection of TTC for pedestrian traffic shall be included as part of the TC-1 report.

2. Temporary Pedestrian Facilities

Temporary pedestrian facilities shall be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. The geometry, alignment and construction of the facility should meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)".

a. Temporary Walkways with Detectable Edging

A smooth, continuous hard surface (firm, stable and slip resistant) shall be provided throughout the entire length of the temporary pedestrian facility. Compacted soils, sand, crushed stone, or asphaltic pavement millings shall not be used as a surface course for walkways.

Temporary walkways shall include detectable edging as defined in the MUTCD. When temporary traffic barrier is included as a pay item in the Contract and where locations identified on the Plans for positive protection will also allow them to serve as pedestrian detectable edging, payment will be made for the temporary traffic barrier in accordance with Section 620. No payment will be made for temporary walkways with Detectable Edging where existing pavements or existing edging (that meets the requirements of MUTCD) are utilized as temporary walkways. Payment for temporary detectable edging, including approved barriers and channelizing devices, installed on existing pavements shall be included in Traffic Control-Lump Sum.

Regardless of the materials used, temporary walkways shall be constructed with sufficient thickness and durability to withstand the intended use for the duration of the construction project. If concrete or asphalt is used as the surface course for the walkway, it shall be a minimum of one and one-half inches (≥ 1-1/2") thick. Temporary walkways constructed across unimproved streets and drives shall be a minimum thickness of four inches (≥ 4") for concrete and three inches (≥ 3") for asphalt. Joints formed in concrete sidewalks shall be in accordance with Section 441 Concrete surfaces shall have a broom finish.

If plywood is used as a walkway, it must be a minimum of three quarters of an inch (≥ 3/4") thick, pressure treated and supported with pressure treated longitudinal joists spaced a maximum of sixteen inches (≤ 16") on center. The plywood shall be secured to the joist with galvanized nails or galvanized deck screws. Nails and screws shall be countersunk to prevent snagging or tripping the pedestrians. A slip resistant friction course shall be applied to any plywood surface that is used as a walkway. Any slip resistant material used shall have the prior written approval of the Engineer.

The Contractor may propose alternate types of Temporary Walkways provided that the Contractor can document that the proposed walkway meets the requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)". Alternate types of Temporary Walkways shall have the prior written approval of the Engineer.

Temporary walkways shall be constructed and maintained so there are no abrupt changes in grade or terrain that could cause a tripping hazard or could be a barrier to wheelchair use. The Contractor shall construct and maintain the walkway to ensure that joints in the walkway have a vertical difference in elevation of no more than one quarter (≤ 1/4") of an inch and that the horizontal joints have gaps no greater than one half (≤ 1/2") of an inch. The grade of the temporary walkway should parallel the grade of the existing walkway or roadway and the cross slope should be no greater than two percent (≤ 2%). A width of sixty inches (60"), if practical, should be provided throughout the entire length of any temporary walkway. The temporary walkway shall be a minimum width of forty eight (48") inches. When it is not possible to maintain a minimum width of sixty (60") inches throughout the entire length of temporary walkway, a sixty (60") inch by sixty (60") inch passing space should be provided at least every two hundred feet (200 ft.), to allow individuals in wheelchairs to pass.

Temporary walkways shall be constructed on firm subgrade. Compact the subgrade according to Section 209. Furnish and install any needed temporary pipes prior to constructing any walkway to ensure positive drainage away from or beneath the temporary walkway. Once the walkway is no longer required, remove any temporary materials, and restore the area to the original conditions or as shown in the Plans.

b. Temporary Curb Cut Wheelchair Ramps

Temporary curb cut wheelchair ramps shall be constructed in accordance with Section 441 and Construction Detail A-3 Curb Cut (Wheelchair) Ramps Concrete Sidewalk Details. Ramps shall also include a detectable warning surface in accordance with Construction Detail A-4 Detectable Warning Surface Truncated Dome Size, Spacing and Alignment Requirements. Other types of material for the construction of the temporary curb cut wheelchair ramps, including the detectable warning surface, may be used provided the Contractor can provide documentation that the material to be used meets the requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)". When a wheelchair ramp is no longer required, remove the temporary materials, and restore the area to existing conditions or as shown in the Plans. For the items required to restore the area to original conditions or as shown in the Plans, measures for payment shall be covered by Contract pay items. If pay items are not included in the Contract, then payment for these items shall be included in Traffic Control-Lump Sum.

c. Temporary Audible Information Device

Temporary audible information devices, when shown in the Plans, shall be installed in compliance with the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)". The devices shall be installed in accordance with the manufacturer's recommendations. Prior to installation, the Contractor shall provide the Engineer with a set of manufacturer's drawings detailing the proper installation procedures for each device. When no longer required, the devices shall remain the property of the Contractor.

150.2 Materials and Traffic Control Devices

150.2.01 Traffic Control Devices

A. NCHRP 350 and MASH

All devices shall be certified in accordance with the Manual for Assessing Safety Hardware (MASH) Test Level 3 and/or the National Cooperative Highway Research Program (NCHRP) 350 Test Level 3 as applicable unless modified by this Special Provision. In addition, temporary work zone devices, including portable barriers, manufactured after December 31, 2019, must have been successfully tested under 2016 edition of MASH requirements. Such devices manufactured on or before this date, and successfully tested under either NCHRP Report 350 or the 2009 edition of MASH, may continue to be used throughout their normal service lives.

B. Approval

All traffic control devices with applicable Qualified Products List (QPL) categories shall come from the appropriate QPL list. Products not on the QPL may be used with an approval letter from the Georgia Department of Transportation Office of Materials and Testing. If there is no applicable QPL, the Contractor shall provide proof of MASH/NCHRP 350 certification. The proof may be a letter or written statement from the manufacturer that the product is MASH/NCHRP 350 approved. Decal certifications are not proof of certification and are not required.

C. Quality Guidelines for All Temporary Traffic Devices

All traffic control devices found to be unacceptable in accordance with the current ATSSA, "Quality Guidelines for Temporary Traffic Devices and Features" regardless of total numbers shall be replaced within twenty-four (24) hours unless stated otherwise in the Specifications, in the Contract, or as directed by the Engineer.

150.2.02 Retroreflectivity Requirements

A. Signs

Reflective sheeting shall meet the requirements of Section 913 and QPL-29

All construction warning signs (black on fluorescent orange) shall meet the minimum reflectivity and color requirements of ASTM D4956 Type XI regardless of the mounting height. All other signs reflectorization shall be in accordance with the Plans, Contract, and "GDOT Signing and Marking Design Guidelines".

B. Channelization Devices

Reflective sheeting shall meet the requirements of Section 913 and QPL-29

All channelization devices (white/ fluorescent orange and white/red) shall meet the minimum retroreflectivity requirements of ASTM D4956 Type IV or Type VI.

150.2.03 Arrow Panels

Arrow panels shall meet the requirements for MUTCD (6L.06) and QPL-79.

Portable sequential arrow, sequential chevron, or flashing arrow panels shall be a minimum size of forty-eight inches (48") high by ninety-six inches (96") wide with not less than fifteen (15) lamps used for the arrow. The arrow shall occupy virtually the entire size of the arrow panel and shall have a minimum legibility distance of one (1) mile. The minimum legibility distance is the distance at which the arrow panel can be comprehended by an observer on a sunny day, or clear night. Arrow panels shall be equipped with automatic dimming features for use during hours of darkness. The arrow panels shall also meet the requirements for a Type C panel as shown in the MUTCD (6L.06). The sequential or flashing arrow panels shall not be used for lane closure on two-lane, two-way highways when traffic is restricted to one-lane operations in which case, appropriate signing, flaggers and when required, pilot vehicles will be deemed sufficient.

The arrow panels shall be placed on the shoulder at or near the point where the lane closing transition begins. The panels shall be mounted on a vehicle, trailer, or other suitable support. Vehicle mounted panels shall be provided with remote controls. Minimum mounting height shall be seven feet (7') above the roadway to the bottom of the panel, except on vehicle mounted panels which should be as high as practical.

For emergency situations, arrow display panels that meet the MUTCD requirements for Type A or Type B panels may be used until Type C panels can be located and placed at the site. The use of Type A and Type B panels shall be held to the minimum length of time possible before having the Type C panel(s) in operation. The Engineer shall determine when conditions and circumstances are considered to be emergencies. The Contractor shall notify the Engineer, in writing, when any non-specification arrow display panel(s) is being used in the Work.

150.2.04 Channelization Devices

A. General

Channelization shall clearly delineate the travel way through the work zone and alert drivers and pedestrians to conditions created by work activities in or near the travel way. Channelization shall be in accordance with the Plans, Specifications, MUTCD, QPL-34, and the following requirements.

B. Drums

1. Design

Drums shall meet the minimum requirement of the MUTCD (6K.06). Drums shall have six inch (6") wide stripes – white/fluorescent orange.

2. Application

Drums shall be used as the required channelizing device to delineate the full length of a lane closure, shift, or encroachment, except as modified by this Subsection.

3. Longitudinal Channelization

Drums shall be spaced as listed below for various roadside work conditions except as modified by Subsection 150.3.11. Spacing shall be used for situations meeting any of the conditions listed as follows:

a. FORTY FOOT (40') SPACING MAXIMUM
- For difference in elevation exceeding two inches (> 2").
- For healed sections no steeper than 4:1 as shown in Subsection 150.3.11, Detail 150-H.

b. EIGHTY FOOT (80') SPACING MAXIMUM
- For difference in elevation of two inches (≤ 2") or less.
- Flush areas where equipment or workers are within ten feet (≤ 10') of the travel lane.

c. 200 FOOT SPACING MAXIMUM: Where equipment or workers are more than ten feet (> 10') from travel lane. Lateral offset clearance to be four feet (4') from the travel lane.
- For paved areas, eight feet (> 8') or greater in width that are paved flush with a standard width travel lane.
- For disturbed shoulder areas not completed to typical section that are flush to the travel lane and considered a usable shoulder.

4. Removal of Drums

Drums may be removed after shoulders are completed to typical section and grassed. Guardrail and other safety devices shall be installed and appropriate signs advising of conditions such as soft or low shoulder shall be posted before the drums are removed.

C. Vertical Panels

1. Design

All vertical panels shall meet the minimum requirements of the MUTCD (6K.05). All vertical panels shall have a minimum of 270 square inches of retroreflective area facing the traffic and be a minimum of thirty-six inches (≥ 36") high. The vertical panels shall be in addition a minimum eight inches (≥ 8") wide with a stripe width of six inches (6") – white/fluorescent orange.

2. Application
Vertical panels with retroreflectivity less than Type VI can only be used when traffic drums reduce the travel lane to less than ten feet (≤ 10'); vertical panels shall be used to restore the travel lane to ten feet (≥ 10') or greater. No other application of vertical panels with retroreflectivity less than type VI will be permitted.

Vertical panels with a minimum type VI retroreflectivity and six (6") inch stripe may be used for longitudinal channelization in the activity zone where work takes place for short-term stationary lane closures and intermediate-term stationary lane closures. They can be used for lane closures lasting three (3) days and with Engineer approval up to seven (7) days. They shall not be used in the transition zone including the tapers and the tangent lengths between tapers.

D. Cones

1. Design:
All cones shall be a minimum of twenty-eight inches (≥ 28") in height regardless of application and shall meet the requirements of the MUTCD (6K-1). Retroreflectivity may be deleted from all cones.

2. Application
On interstates, cones shall be prohibited. On all other routes, cones may only be used for longitudinal channelization in the activity zone where work takes place for short-term stationary lane closures. They shall not be used in the transition zone including the tapers and the tangent lengths between tapers. The use of cones for nighttime work will not be permitted. Cones shall not be stored or allowed to be visible on the worksite during nighttime. Cones may be used for daytime flagging operations including tapers at flagging stations.

E. Barricades

1. Design

Type 3 barricades shall meet the minimum requirements of the MUTCD (6K.07). The Contractor has the option of choosing Type 3 barricades from the QPL-34 or the Contractor may utilize generic barricades that are approved by the Federal Highway Administration (FHWA). When barricades have been specifically crash tested with signs attached, the Contractor has the responsibility to attach the signs as per the manufacturer's recommendations to ensure crashworthiness. If the barricades were not tested with the signs, crashworthy compliance may require that rigid signs be mounted separate from the Type 3 barricade.

The use of Type 1 and Type 2 barricades will not be permitted.

2. Application
Type 3 barricades shall be placed as required by the Plans, the Standards, and as directed by the Engineer. When a barricade is placed so that it is subject to side impact from a vehicle, a drum shall be placed at the side of the barricade to add target value to the barricade.

F. Warning Lights

1. Design
All warning lights shall meet the requirements of the MUTCD (6L.07).

2. Application:
   a. Type A low-intensity flashing lights shall be used as shown in the Plans, the Standards, and as directed by the Engineer.

   b. Type C Steady-Burn lights shall be used as shown in the Plans, the Standards, and as directed by the Engineer.

150.2.05 Flashing Beacon

The flashing beacon assembly, when specified, shall be used in conjunction with construction warning signs, regulatory, or guide signs to inform traffic of special road conditions which require additional driver attention. The flashing beacon assembly shall be installed in accordance with the requirements of Section 647.

150.2.06 Guardrail

Guardrail shall comply with Section 641 Guardrail and the guardrail standards.

When the removal and installation of guardrail is required, as a part of the Work, the following time restrictions shall apply unless modified by the special conditions:

From the time that the existing guardrail or temporary positive barrier protection is removed, the Contractor has fourteen (14) days to install the new guardrail and anchors. During the interim, the location without guardrail shall be protected with drums spaced at a maximum spacing of twenty feet (20'). The guardrail blunt end is to be treated as a fixed object and shall be protected. The maximum length of rail that can be removed at any time without being replaced with positive barrier protection is a total of 2000 linear feet of existing rail or the total length of one run of existing rail, whichever is less. Based on existing field conditions, the Engineer may review the Work and require that the guardrail be installed earlier than the maximum time allowed.

The Contractor shall install new guardrail, such that traffic exposure to fixed objects is minimized. Within the same workday, temporary attenuators, as defined in Subsection 150.2.10, should be installed on the approach to fixed objects that can't be protected with guardrail. Truck or trailer mounted attenuators may be used to shield exposed fixed objects for periods not to exceed fourteen (14) days. No separate payment will be made for truck or trailer mounted attenuators, attenuators, or other methods unless provided for in the Contract.

When the roadway is open to traffic, guardrail panels shall be lapped to comply with the directional flow of traffic. Should the staging of the Work require that the lap of the guardrail be changed, this Work shall be completed before the roadway is opened to traffic. The Work to change the lap of any guardrail shall be included in Traffic Control-Lump Sum.

The laps on anchors shall be in accordance with the manufacturer's recommendations and installation instructions. As a result, a trailing anchor may be lapped opposing the flow of traffic.

Failure to comply with the above time and quantity restrictions shall be considered as non-compliance under Subsection 150.7.01.

150.2.07 Interim Signs

A. Sign Blanks and Panels

All TTC sign blanks and panels should conform to Section 912 of the Specifications. Alternative sign blank materials (composites, polycarbonates, fiberglass reinforced plastics, recycled plastics, etc.) shall have a letter of approval from the Office of Materials and Testing for use as interim construction signs before these materials are allowed to be incorporated into the Work, unless these rigid sign blanks are currently approved as a crashworthy sign blank material under QPL- 34.
Unless specified elsewhere in the Contract, Specifications, Plans, and/or directed by the Engineer, sign sizes are according to the following:

1. All construction signs sizes shall follow the dimensions provided in the MUTCD Table 6G-1, GH-1, and 6I-1 "Temporary Traffic Control Zone Sign and Plaque Sizes" under the column for "Freeway or Expressway".

2. For all other signs used just for staging, the sign sizes shall follow the dimensions provided in the MUTCD Table 2B-1 "Regulatory Sign and Plaque Sizes" for the largest size.

3. Permanent signs used for staging shall be according to Plans.

Plywood blanks or panels will not be permitted.

The use of flexible signs will not be permitted.

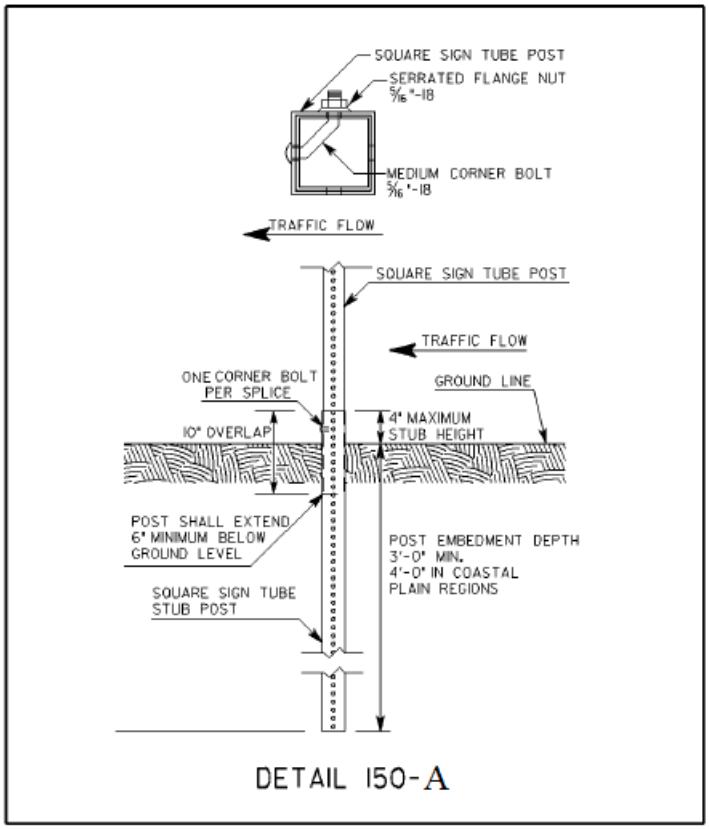
For utility work not included in the Contract, the utility Contractor may use flexible signs within the project limits.

B. Posts

Permanent mounting height to the bottom of sign shall be seven (7) feet to eight (8) feet measured vertically from the bottom of the sign to the elevation of the near edge of the pavement or from the walkway. Posts for all interim signs

should be square tubular post meeting the requirements of Section 911, QPL-35, and Construction Detail T-3A (Type 7, 8, and 9 Square Tube Post Installation Detail). Ground mounted sign(s) that are greater than 48" wide shall be mounted on two posts. For barrier mounted sign, single post mount is allowed. The post(s) shall not extend beyond the top of the sign(s). The sign(s) shall be substantially plumbed and leveled.

Unprotected interim posts shall be spliced as shown in Detail 150-A, unless full length unspliced posts are used. Unprotected post splices will not be permitted any higher than four inches above the ground line to lessen the possibility of affecting the undercarriage of a vehicle. Installation of posts may require establishment of openings in existing pavements, islands, shoulders, etc.



150.2.08 Pavement Markings

All temporary traffic striping shall conform to the applicable requirements of Section 652, Section 653, Section 657, Section 658, Section 659, and QPL-46.

A. All Traffic Striping for 45 Days or Less (≤45 Days)

All traffic striping that will be in place for 45 days or less shall be 4 inches or greater in width.

B. All Temporary Striping Beyond 45 days (>45 Days)

All traffic striping applied on intermediate surfaces shall be a minimum 5 inches in width or as shown on the Plans. On final surfaces when temporary striping will be overlaid or eradicated, the temporary striping shall be a minimum 5 inches in width.

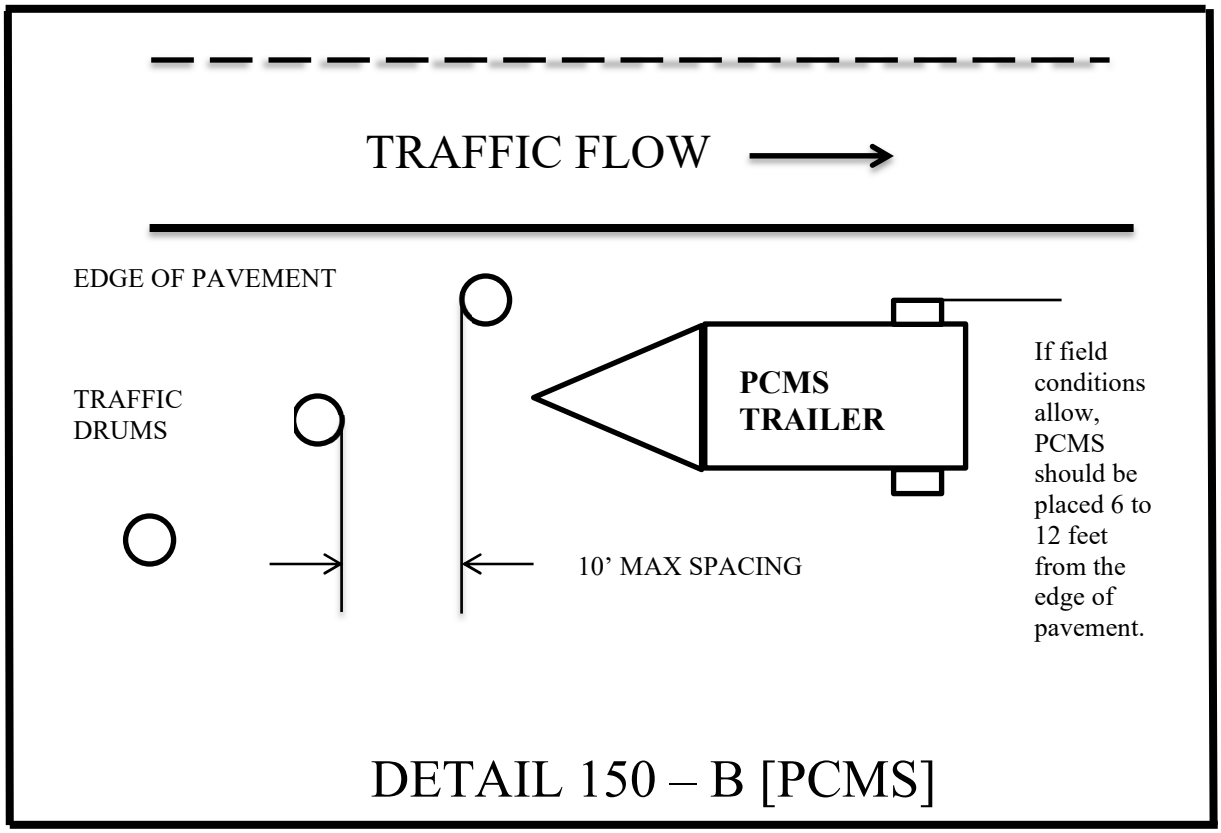
C. All Temporary Traffic Striping on Final Surface

All temporary traffic striping applied to final surfaces which will not be overlaid or grinded may be 4 inches in width or as shown on the Plans.

150.2.09 Portable Changeable Message Signs

When specified, a portable changeable message sign (PCMS) shall meet the minimum requirements of Section 632, MUTCD (6L.05) and be on QPL-82. The maximum amount of messages allowed to be flashed on one PCMS is two phases (flashes). The language and the timing of the messages shall comply with the MUTCD and Section 632. When used as an advanced device, the PCMS should typically be placed ahead of the construction activities. If the PCMS is used as a substitute for another device, then the requirements for the other device apply.

Any PCMS in use, which is not protected by positive barrier protection, shall be delineated by a minimum of three drums that meet the requirement of Subsection 150.2.04.B. The drum spacing shall not exceed a maximum of ten (10') feet as shown in Detail 150-B. When the PCMS is within twenty (20') feet of the opposing traffic flow, the trailing end of the PCMS shall be delineated with a minimum of three drums spaced in the same manner as the approach side of the PCMS.



DETAIL 150 – B [PCMS]

When not in use, the PCMS shall be removed from the roadway, unless protected by positive barrier protection. If the PCMS is protected by positive barrier protection, the sign panel shall be turned away from traffic when not in use.

150.2.10 Portable Impact Attenuators

This work consists of the furnishing (including spare parts), installation, maintenance, relocation, reuse as required, and removal of Portable Impact Attenuator Units/Arrays.

Portable Impact Attenuator Unit/Arrays installation shall conform to the requirements of Section 648, Manufacturer's recommendations and "(Georgia Standard 4960 "Temporary Barrier (End Treatment Options)" and shall be installed at locations designated by the Engineer, and/or as shown on the Plans. When gating attenuators are used, the Contractor shall maintain the appropriate recovery area in accordance with the manufacturers' recommendations.

Generic sand/water loaded modules are prohibited. Manufacturers' sand/water loaded modules with specific arrays that have been NCHRP 350/MASH approved can be used in appropriate locations.

The test level of protection provided shall equal or exceed the speed limit. Test level 3 shall be used for forty-five (45) mph or above.

150.2.11 Portable Temporary Traffic Control Signals

The use of Portable Temporary Traffic Control Signals shall meet the following minimum requirements:

Only two-lane, two-way roadways will be allowed to utilize Portable Temporary Traffic Control Signals.

All portable traffic control signals shall meet the physical display and operational requirements of conventional traffic signals described in the MUTCD.

Each signal face shall have at least three lenses. The lenses shall be red, yellow, and green in color and shall give a circular type of indication. All lenses shall be twelve (12") inches nominal in diameter. A minimum of two signal faces shall face each direction of traffic. A minimum of one signal head shall be suspended over the roadway travel lane in a manner that will allow the bottom of the signal head housing to be not less than seventeen (17') feet above and not more than nineteen (19') feet above the pavement grade at the center of the travel lane. The second signal head may be located over the travel lane with the same height requirements or the second signal head may be located on the shoulder. When the signal head is located on the shoulder, the bottom of the signal head housing shall be at least eight (8') feet but not more than (15') feet above the pavement grade at the center of highway.

Advance warning signage and appropriate pavement markings shall be installed as part of the spliceal operation.

The signals shall be operated in a manner consistent with traffic requirements. The signals may be operated in timed-mode or in a vehicle-actuated mode. The signals shall be interconnected in a manner to ensure that conflicting movements cannot occur. To ensure that the appropriate operating pattern, including timing is displayed to the traveling public, regular inspections, including the use of accurate timing devices shall be made by the WTCS. If, at any time, any part of the system fails to operate within these requirements then the use of the signal shall be suspended, and the appropriate flagging operation shall begin immediately.

The (WTCS) shall continuously monitor the portable traffic control signal to ensure compliance with the requirements for maintenance under the MUTCD. The signal shall be maintained in a manner consistent with the intention of the MUTCD, with emphasis on cleaning of the optical system. Timing changes shall be made only by the WTCS. The WTCS shall keep a written record of all timing changes.

The portable temporary traffic signal shall have two power sources and shall be capable of running for seven calendar days continuously.

The Contractor shall have an alternate temporary traffic control plan in the event of failure of the signal.

150.2.12 Raised Pavement Markers

Raised pavement markers (RPMs) shall meet the requirements of Section 654 and QPL-76 .

150.2.13 Rumble Strips

Rumble strips incorporated into the Work shall meet the requirements of Section 429 and the MUTCD. Existing rumble strips that are positioned in the traveled way to warn traffic of a stop condition shall be reinstalled prior to opening to traffic. Based on the following requirements:

Intermediate surfaces that will be in use for more than forty-five (45) calendar days shall have rumble strips reinstalled on the traveled way in the area of a stop condition. Non-refundable deductions in accordance with Subsection 150.7.01 will be assessed for any intermediate surface in place for greater than 45 days without rumble strips.

Rumble strips shall be installed on the final surface within fourteen (14) calendar days of the placement of the final surface in the area of the stop condition. Failure to install within fourteen (14) calendar days will result in assessment of non-refundable deductions in accordance with Subsection150.7.01.

Prior to the removal of any rumble strips located in the travel lane, stop ahead (W3-1) warning signs shall be double indicated ahead of the stop condition. These warning signs shall be a minimum of 48 inches by 48 inches. These warning signs shall remain in place until the rumble strips have been reinstalled on the traveled way. Any existing warning signs for the stop ahead condition shall be removed or covered while the 48" X 48" (W3-1) signs are in place. When the rumble strips have been reinstalled, these warning signs should be promptly removed, and any existing signage placed back in service.

150.2.14 Temporary Barriers

A. Design:

Temporary barriers shall meet the requirements of Sections 620. The lengths of advancement should be in accordance with Georgia Standard 4000W "Lengths of Advancement, Clear Zone Distances, and Fill Height Embankment". The approach end of the taper should have 10:1 or flatter ground slope. Temporary barriers shall not be used as a channelization device. Their use is in accordance with MUTCD (6K.09).

B. Application:

Temporary barriers shall be placed as required by the Plans, Standards, and as directed by the Engineer. When Temporary barrier is located twenty feet (≤ 20') or less from a travel lane, yellow reflectors shall be fixed to the top of the barrier at intervals not greater than forty feet (≤ 40') in the longitudinal section and twenty feet (20') in the taper section and shall be mounted approximately two inches (2") above the barrier. If both lanes of a two-lane two-way roadway are within twenty feet (≤ 20') or less of the barrier then the reflectors shall be installed for both directions of traffic.

The reflectors shall be one hundred (100) square inches (ASTM Type VII or VIII/ Type XI) reflective sheeting mounted on flat-sheet blanks. The reflectors shall be mounted approximately two inches above the top of the barrier. The reflectors shall be attached to the barrier with adhesive or by a drilled-in anchor type device. The reflectors shall not be attached to a post or board that is placed between the gaps in the barrier sections.

Approach end of Temporary barrier shall be protected according to Georgia Standard 4960 "Temporary Barrier (End Treatment Options)" or by a portable impact attenuator.

On interstates or other controlled access highways where lane shifts or crossovers cause opposing traffic to be separated by less than forty feet (<40'), portable barrier should be used as a separator.

150.2.15 Temporary Guardrail Anchorage- Type 12

This work consists of the furnishing, installation, maintenance, and removal of Temporary Guardrail Anchorage- Type 12 used for Portable Barrier or temporary guardrail end treatment. Materials used in the Temporary Guardrail Anchorage- Type 12 shall meet the requirements of Section 641 of the Specifications and current Georgia Standards and may be new or used. Materials salvaged from the Project, which meet the requirements of Standards, may be utilized if available. The use of any salvaged materials will require prior approval of the Engineer.

Installation of the Temporary Guardrail Anchorage- Type 12 shall conform to the requirements of the Plans, current Georgia Standards and Section 641 of the Specifications. Installation shall also include sufficient additional guardrail and appurtenances to effect the transition and connection to Temporary Concrete Barrier as required by the details in Georgia Standard 4960 "Temporary Barrier (End Treatment Options)".

150.2.16 Temporary Traffic Signals

Temporary traffic signals shall meet the requirements of Section 647 and the MUTCD.

150.3 Construction Requirements

150.3.01 General

A. Implementation Requirements

No work shall be started on any project phase until the appropriate traffic control devices have been placed in accordance with the Project requirements. Changes to traffic flow shall not commence unless all labor, materials, and equipment necessary to make the changes are available on the Project.

When any shift or change is made to the location of traffic or to the flow patterns of traffic, including pedestrian traffic, the permanent safety features shall be installed and fully operational before making the change. If staging or site conditions prevent the installation of permanent features, then the equivalent interim devices shall be utilized. This work shall also include any necessary removal and reinstallation of guardrail panels to achieve the required panel lap to accommodate the appropriate shift and traffic flow including the final traffic flow configuration. The cost of performing this work shall be included in Traffic Control-Lump Sum.

Any section of the Work that is on a new location shall have all permanent safety features installed and fully operational before the Work is opened to traffic. Safety features shall include, but are not limited to the following items:

Guardrails including anchors and delineation with properly lapped panels

1) Cable Barrier
2) Impact attenuators
3) Traffic signals
4) Warning devices
5) Pavement markings including, but not limited to, words, symbols, stop bars, arrows, hatching and crosswalks
6) Roadway signs including regulatory, warning, and guide

Outdoor lighting shall be considered as a safety feature for welcome centers, rest areas, and weigh station projects. For typical roadway type projects, new street lighting is not considered a safety feature, unless specifically noted in the Plans or in the special conditions.

B. Maintenance of Traffic Control Devices

Traffic control devices shall be in acceptable condition when first erected on the Project and shall be maintained in accordance with Section 104 throughout the construction period. All unacceptable traffic control devices shall be replaced within twenty-four (24) hours. When not in use, all traffic control devices shall be removed, placed or covered so as not to be visible to traffic.

C. Traffic Interruption Restrictions

The Department reserves the right to restrict construction operations when, in the opinion of the Engineer, the continuance of the Work would seriously hinder traffic flow, be needlessly disruptive or unnecessarily inconvenience the traveling public. The Contractor shall suspend and/or reschedule any work when the Engineer deems that conditions are unfavorable for continuing the Work.

Advanced notification requirements to the Contractor to suspend work will be according to the events and the time restrictions outlined below:

Incident management - No advanced notice required

Threatening/Inclement weather - twenty-four (24) hours

Holiday, sporting events, unfavorable conditions - Three (3) calendar days

If the Work is suspended, the Contractor may submit a request for additional Contract time as allowed under Section 108. The Department will review the request and may grant additional Contract time as justified by the impact to the Contractor's schedule. Compensation for loss of productivity, rescheduling of crews, rental of equipment or delays to the Contractor's schedule will not be considered for payment. Additional Contract time will be the only consideration granted to the Contractor.

D. Work Zone Restrictions

1. Interstate

The Contractor should not simultaneously perform work on both the inside shoulder and outside shoulder on either direction of traffic flow when the Work is within 12 feet of the travel-way. Shoulders can be alternated if areas are separated by at least one-half mile of distance.

2. Non-Interstate Divided Highways

The Contractor should not simultaneously perform work on both the inside shoulder and outside shoulder on either direction of traffic flow when the Work is within 12 feet of the travel-way. Shoulders can be alternated if areas are separated by at least one-half mile distance in rural areas or at least 500 feet of distance in urban areas.

3. Non-Divided Highways

a. The Contractor should not simultaneously perform work on opposite sides of the roadway when the Work is within 12 feet of the travel-way. Shoulders can be alternated if areas are separated by at least one-half mile of distance in rural areas or at least 500 feet of distance in urban areas.

b. On two-lane projects where full width sections of the existing subgrade, base or surfacing are to be removed, and new base, subgrade, or surfacing are to be constructed, the Contractor should maintain one-lane of traffic through the construction area by removing and replacing the undesirable material for half the width of the existing roadway at a time. Replacement should be made such that paving is completed to the level of the existing pavement in the adjacent lane by the end of the workday or before opening all the roadway to traffic.

E. Work Zone Geometric Restrictions

There should be no reduction in the total number of available traffic lanes including turning lanes that existed prior to construction, except as specifically allowed by the Contract and as approved by the Engineer.

Travel lane Clearances: All portions of the Work should maintain the following minimum requirements:

Horizontal: The combined dimensions of the paved shoulder and the roadway surface remaining outside the Work Zone should be no less than sixteen feet (≥ 16') in width at any location.

Vertical: The overhead clearance should not be reduced to less than fifteen feet (≥ 15') at any location.

The restrictions above apply to all shifts, lane closures, on-site detours and off-site detours whether shown in the Contract or proposed by the Contractor. It shall be the responsibility of the Contractor to verify that these minimum requirements have been met before proceeding with any phase of the Work. Two-lane, two-way roadways may have temporary horizontal restrictions of less than sixteen feet (≥ 16') during flagging operations. The minimum horizontal clearance should be restored before the flagging operation is removed.

F. Clear Zone

At the end of the workday, all equipment, materials, and TTC devices not in use should be moved out of the clear zone or behind positive protection. The clear zone is defined by Georgia Standard 4000W "Lengths of Advancement, Clear Zone Distances, Fill Height Embankment". For urban roadway with curb, the minimum set back is six (6') feet from the curb face. If stored behind positive protection, proper lengths of advancement should be maintained. If stored behind guardrail the items shall be a minimum five feet (≥ 5') from the face of the guardrail and not in the recovery zone of the anchor.

The WTCS shall monitor the Work to ensure that all the rocks, boulders, construction debris, stockpiled materials, equipment, tools, and other potential hazards are kept clear of the travel lane.

G. Milled Surface Restrictions

1. Non – Resurfacing Projects

Unless modified by the special conditions, a milled surface on any non-resurfacing project shall not be allowed to remain open for a period of time that exceeds thirty (**30)** calendar days.

2. Resurfacing Projects

   A. Unless modified by the special conditions, a milled surface (excluding micro-mill) on an interstate or limited access highway resurfacing project shall be covered prior to opening to traffic.

   B. Unless modified by the special conditions, a milled surface on any other resurfacing project not specified above shall not be allowed to remain open for a period of time that exceeds three **(3)** calendar days.

Failure to cover milled areas as specified above will result in liquidated damages to be assessed in accordance with Special Provision Section 150.7.01 Enforcement and Adjustments.

H. Construction Vehicles

The Contractor's vehicles shall travel in the direction of normal roadway traffic and shall not reverse direction except at intersections, interchanges, or approved temporary crossings. The Contractor may submit a plan requesting that construction traffic be allowed to travel in the opposite direction of normal traffic when it would be desirable to modify traffic patterns to accommodate specific construction activities.

Prior approval of the Engineer shall be obtained before any construction traffic is allowed to travel in a reverse direction. If the Contractor's submittal is approved, the construction traffic shall be separated from normal traffic by appropriate traffic control devices.

The parking of Contractor's and/or workers' personal vehicles within the work area or adjacent to traffic is prohibited. It shall be the responsibility of the WTCS to ensure that any vehicle present at the worksite is necessary for the completion of the Work.

I. Environmental Impacts

The Contractor shall ensure that dust, mud, and other debris from construction activities do not interfere with normal traffic operations or adjacent properties.

J. Existing Street Lights

Existing street lighting shall remain lighted as long as practical and until removal is approved by the Engineer.

K. Nighttime Work Lighting

Adequate temporary lighting shall be provided at all nighttime work sites where workers will be immediately adjacent to traffic.

L. Removal/Reinstallation of Miscellaneous Items

In the prosecution of the Work, if it becomes necessary to remove any existing signs, markers, guardrail, etc. not covered by specific pay item, they shall be removed, stored and reinstalled, when directed by the Engineer, to line and grade, and in the same condition as when removed.

150.3.02 Personnel – Worker Safety Apparel

In accordance with MUTCD (6D.03) (6C.04) all workers, within the right-of-way who are exposed either to traffic or to work vehicles and construction equipment within the TTC zone, shall wear high-visibility safety apparel that meets the Performance Class 2 or better.

150.3.03 Signage - General

A. Signing Requirements of the Temporary Traffic Control (TTC) Plan

When existing regulatory, warning or guide signs are required for proper traffic and pedestrian control, the Contractor shall maintain these signs in accordance with the TTC plan. The Contractor shall review the status of all existing signs, interim signs added to the Work, and permanent sign installations that are part of the work to eliminate any conflicting or non-applicable signage in the TTC Plan. The Contractor's review of all signs in the TTC Plan shall establish compliance with the requirements of the MUTCD and Section 150. Any conflicts shall be reported to the Engineer immediately and the WTCS shall take the necessary measures to eliminate the conflict.

The Contractor shall make every effort to eliminate the use of interim signs as soon as the Work allows for the installation of permanent signs.

All existing illuminated signs shall remain lighted and be maintained by the Contractor.

Existing street name signs shall be maintained at street intersections.

Refer to section 150.2.05.B. Sign Blanks and Panels for size and material requirements**.**

B. Conflicting or Non-Applicable Signs

Any sign(s) or portions of a sign(s) that are not applicable to the TTC plan shall be covered so as not to be visible to traffic or shall be removed from the roadway when not in use. The WTCS shall review all traffic shifts and changes in the traffic patterns to ensure that all conflicting signs have been removed. The review shall confirm that the highest priority signs have been installed and that signs of lesser significance are not interfering with the visibility of the high priority signs. High priority signs include signs for road closures, shifts, detours, lane closures and curves. Any signs, such as speed zones and speed limits, passing zones, littering fines and litter pick up, that reference activities that are not applicable due to the presence of the Work shall be removed, stored and reinstalled when the Work is completed.

Failure to promptly eliminate conflicting or non-applicable signs shall be considered as non-performance under Subsection 150.7.01.

C. Removal of Existing Signs and Supports

The Contractor shall not remove any existing signs and supports without prior approval from the Engineer. All existing signs and supports which are to be removed shall be stored and protected if this material will be required later in the Work as part of the TTC plan. If the signs are not to be utilized in the Work, then the signs will become the property of the Contractor unless otherwise specified in the Contract documents.

D. Interim Guide, Warning and Regulatory Signs

Interim guide, warning, or regulatory signs required to direct traffic and pedestrians shall be furnished, installed, reused, and maintained by the Contractor in accordance with the MUTCD, the Plans, Special Provisions, Special Conditions, or as directed by the Engineer. These signs shall remain the property of the Contractor. When the signs are used for long-term stationary operations as defined MUTCD (6G.02), the bottom of all interim signs shall be mounted seven feet (7') to eight feet (8') above the level of the pavement edge or sidewalk. The signs offset should be six feet (6') to twelve feet (12') from the pavement edge or two feet (≥ 2') minimum for sidewalks according to MUTCD (6F-1) (6G-1, 6H-1, and 6I-1). Special Conditions under Subsection 150.6 may modify this requirement.

Portable signs may be used when the duration of the Work is less than three (3) days or as allowed by the special conditions in Subsection 150.6. Portable interim signs shall be mounted a minimum of one foot (≤ 1') above the level of the pavement edge for directional traffic of two (2) lanes or less and at seven feet (7') for directional traffic

of three (3) or more lanes according to MUTCD (6F-2). Signs shall be mounted at the height recommended by the manufacturer's crashworthy testing requirements.

All sign blanks shall be rigid whether the sign is mounted as a portable sign, on a Type III barricade or as a permanent mount height sign. Utilities and their subcontractors working in the project limits, and not included in the project Contract, may use non-rigid signs.

E. Existing Special Guide Signs

Existing special guide signs on the Project shall be maintained until conditions require a change in location or legend content. When change is required, existing signs shall be modified and continued in use if the required modification can be made within existing sign borders using design requirements (legend, letter size, spacing, border, etc.) equal to that of the existing signs, or of Subsection 150.3.E.2. Differing legend designs shall not be mixed in the same sign.

1. Special Guide Signs

   Special guide signs are those expressway or freeway guide signs that are designed with message content (legend) that applies to a particular roadway location. When an existing special guide sign is in conflict with work to be performed, the Contractor shall remove the conflicting sign and reset it in a new, non-conflicting location which has been approved by the Engineer.

2. Interim Special Guide Signs

   When it is not possible to utilize existing signs, either in place or relocated, the Contractor shall furnish, erect, maintain, modify, relocate, and remove new interim special guide signs in accordance with the Plans or as directed by the Engineer. Interim special guide signs that may be required in addition to, or a replacement for, existing expressway and freeway (interstate) signs shall be designed and fabricated in compliance with the minimum requirements for guide signing contained in Chapter 2E "Guide Signs – Freeway and Expressway" of the MUTCD. All interstate shields on these signs shall be 48 inches and 60 inches for two-numeral and three-numeral routes, respectively.

   The road name of the exit or route shield shall be placed on the exit gore sign.

3. Interim Overhead Guide Sign Structures

   Interim overhead special guide sign structures are not required to be lighted unless specifically required by the Plans. If lighting is required, the sign shall be lighted as soon as erected and shall remain lighted, during the hours of darkness, until the interim sign is no longer required. The Contractor shall notify the Power Company at least thirty (30) days prior to desire connection to the power source.

4. Permanent Special Guide Signs

   The installation of new permanent special guide signs and the permanent modification or resetting of existing special guide signs, when included in the Contract, shall be accomplished as soon as practical to minimize the use of interim special guide signs. If lighting is required by the Plans, all new permanent overhead special guide signs shall be lighted as soon as erected.

F. Stop Sign Regulated Intersections

For intersections that utilize stop sign(s) to control the flow of traffic and to restrict the movement of vehicles, the stop sign(s) shall be maintained for the duration of the Work or until such time that the stop condition is eliminated or until an interim or permanent traffic signal can be installed to provide proper traffic control. The traffic signal shall be installed and properly functioning before the removal of the existing stop sign(s) is permitted. If the existing intersection is enhanced traffic control features, such as stop lines, double indicated stop signs, oversized signs, advanced warning stop ahead signs, rumble strips on the approaches or flashing beacons located overhead or on the shoulders then these features shall be maintained for the duration of the project or until the permanent traffic control plan has been implemented.

Whenever the staging of the Work requires that the traveled way be relocated or realigned the Contractor shall reinstall all enhanced traffic control features noted above on the newly constructed sections of the Work. The cost of relocating the stop lines, stop signs, advanced warning signs, the rumble strips and the flashing beacons shall be included in the price bid for Traffic Control - Lump Sum unless individual pay items are included in the Contract for rumble strips and/or flashing beacons. When pay items are included in the Contract for rumble strips or flashing beacons then these items will be paid per each.

When staging requires the relocation or realignment of an existing stop condition, it may be necessary to consider the addition of enhanced traffic control features even though none existed at the original location. Horizontal and vertical alignment changes at a new location may have decreased or restricted sight distance or the stop condition may occur sooner than in the previous alignment. If these conditions occur, then the Engineer and/or the WTCS should consider additional measures to enhance the motorist's awareness of the changes even though the staging plans may not address enhanced features. Stop signs should be a minimum of thirty-six (36") inches for interim situations. The use of forty-eight (48") inch stop signs may be warranted under project specific conditions. Flags may be used on interim/permanent stop signs that are mounted at seven (7') feet in height for a short duration in order to direct additional attention to a new or relocated stop sign(s). Flags should not be used for durations exceeding two weeks unless unusual or site-specific conditions warrant a longer period of time. The use of Type "A" flashing red light(s) attached to the stop sign(s) may be appropriate during the same period that the flags are in use to increase attention.

The use of rumble strips and/or PCMS may be considered. The use of new rumble strips, where none previously existed, shall have the prior approval of District Traffic Operations before being included as part of the temporary traffic control plan. The message(s) displayed on any PCMS shall have the prior approval of the Engineer and the message(s) shall be included as part of the TTC plan for the interim staging.

The placement of any additional interim ground mounted signs and posts or stop lines shall be considered as incidental to the price bid for Traffic Control - Lump Sum. The installation of rumble strips, flashing beacons or the use of Portable Changeable Message Signs (PCMS) shall be considered as Extra Work unless pay items are included in the Contract.

G. Low Shoulder Signage

1. Low Shoulder for Construction/Reconstruction/Resurfacing Projects

"Low Shoulder" (W8-9) signs shall be erected when a difference in elevation less than four (< 4') feet from the traveled way, exceeds one inch (> 1") but does not exceed three inches (≤3") between the travel lane and any type of shoulder. "Low Shoulder" (W8-9) signs shall be a minimum dimension of forty-eight inches by forty-eight inches (48"x48")

The spacing of the signs shall not exceed one (1) mile and the signs shall be placed immediately past each crossroad intersection. The "Low Shoulder" signs shall remain in place until the difference in elevation is eliminated and the shoulder has been dressed and permanently grassed for a minimum of thirty (30) calendar days. These signs shall be furnished, installed, maintained, and removed by the Contractor as part of Traffic Control-Lump Sum. These signs shall be fluorescent orange with black borders.

2. Shoulder Drop-Off for Construction/Reconstruction/Resurfacing Project

"Shoulder Drop-Off" (W8-17) signs shall be used when a difference in elevation, less than four feet (< 4') from the traveled way, exceeds three inches (> 3") and is not protected by positive barrier protection. These warning signs shall be placed in advance of the drop-off. "Shoulder Drop-Off" (W8-17) shall be a minimum dimension of forty-eight inches by forty-eight inches (48"x48")

The spacing of the signs shall not exceed one (1) mile and the signs shall be placed immediately past each crossroad intersection. The "Shoulder Drop-Off" signs shall remain in place until the difference in elevation is eliminated and the shoulder has been dressed and permanently grassed for a minimum of thirty (30) calendar days. These signs shall be furnished, installed, maintained, and removed by the Contractor as part of Traffic Control-Lump Sum. These signs shall be black borders on fluorescent orange background.

H. Bump Signage

A bump sign (W8-1) shall be utilized when a transverse joint in the pavement structure has a vertical difference in elevation of three quarters (≥ 3/4") of an inch or greater in depth with no horizontal taper to ramp the traffic from one elevation to the other. This condition typically occurs at approach slabs during pavement milling operations and at transverse joints in asphaltic pavement lifts. Other conditions include utility and storm drainage repairs that require concrete placement for patching and/or steel plating. "Bump" sign (W8-1) shall be a minimum dimension of forty-eight inches by forty-eight inches (48"x48")

The W8-1 sign shall be placed sufficiently in advance to warn the motorist of the condition.

I. Sign Visibility

All existing, interim, and new permanent signs shall be installed to be completely visible and legible for an advance distance in compliance with the MUTCD. Any clearing required for maintaining the line of sight to existing, interim or permanent signs shall be done as part of the requirements of the TTC plan. The clearing shall include any advance warning signs, both interim and permanent, that are installed as a part of the Work including advance warning signs that are installed outside the limits of the project. Limbs, brush, construction equipment and materials shall be kept clear of the driver's line of sight to all signs that are part of the TTC plan.

150.3.04 Advance Warning Signs

A. Project Signs - All Type of Highways

Advance warning signs shall be placed ahead of the work area in accordance with Part 6 of the MUTCD and unless noted below shall include a series of at least three advance road work (W20-1) signs placed at the termini of the project. The series shall have the legend ROAD WORK (1500 FEET, 1000 FEET, AND 500 FEET).

At grade intersecting roadways and on-ramps shall be signed with a minimum of one ROAD WORK AHEAD sign.

When work terminates at a "T" intersection, a minimum of one "ROAD WORK AHEAD" sign shall be placed in advance of the intersection and one "END ROAD WORK" sign shall be placed at the termination end of the intersection. Field conditions may require the use of additional warning signage.

1. State Routes

Advanced Warning Signs on State Routes shall be a minimum dimension of forty-eight inches by forty-eight inches (48" x 48"). When a State Route intersects a project which consists of adding travel lanes, reconstructing an existing roadway or new location work, the State Route approaches shall have a minimum of three (W20-1) advanced warning signs (1500 ft., 1000 ft., 500 ft.). The termination end of an intersecting State Route shall have END ROAD WORK signage.

The W20-1 signs shall be placed at the termini of the project or sufficiently in advance of the termini to allow for lane shifts, lane closures and other activities which may also require advanced warning signs. The advanced warning signs for the project should not overlap with the advanced warning signs for lane shifts, lane closures, etc.

The length of a work zone should be held to the minimum length required to accomplish the Work. If a project has multiple individual worksites within the overall limits of the project, each site should be signed individually if the advance warning signs for each site can be installed without overlapping an adjacent worksite. As soon as the work is completed at any individual site, the warning signs shall be removed from that site. Clean-up work shall be performed with portable signage.

Project mileage indicated on the G20-1 sign shall be the actual project mileage rounded up to the nearest whole mile. Projects less than two (< 2) miles in length or individual worksites that are part of a multiple worksite project may delete this sign. The G20-1 sign shall be forty-eight inches by twenty-four inches (48" x 24") and the G20-2 sign shall be forty-eight inches by twenty-four inches (48" x 24").

2. Interstate, Limited Access and Multilane Divided Highways

In addition to the W20-1 signs required at 500 ft., 1000 ft. and 1500 ft., multi-lane divided highways shall also have additional advanced warning signs installed with the legend "ROAD WORK (2 MILES, 1 MILE and 1/2 MILE). All construction warning signs on divided highways shall be double indicated (i.e., on the left and right sides of the roadway.) If the use of the half (½) mile, one (1) mile and two (2) mile advanced warning signs cause an overlap with other work or do not benefit field conditions then the Engineer may review the use of these signs and eliminate their installation. When the posted speed limit is fifty (≤ 50) mph or less, the one-half (½) mile, one (1) mile and two (2) mile signs should be eliminated especially in urban areas.

The W20-1 advance warning signs for ROAD WORK 500 FEET; 1000 FEET; and 1500 FEET shall be temporarily covered when work involving the advanced warning signs for lane shifts and lane closures overlap these signs. The ROAD WORK ½ MILE, ROAD WORK 1 MILE, and ROAD WORK 2 MILES shall be in place when the 500, 1000 and 1500 feet signs are temporarily covered.

When the Temporary Traffic Control zone already has advanced warning (W20-1) signs installed the W20-1 signs required for lane closures under Standard 9106 should be eliminated.

3. Ramp Work on Limited Access Highways

The work zone shall not be signed for the entire length of the mainline of a limited access highway when only short individual worksites, interchange or ramp work is being performed.

When work is restricted to ramp reconstruction or widening activities, the advance warning signs on the mainline section of the limited access highway shall be limited to the use of portable advance warning signs. These portable advance warning signs shall only be utilized when work activity is within the gore point of the ramp and the mainline traveled way or work is active in the acceleration/deceleration lane adjacent to the mainline traveled way. Portable advance warning signs (W20-1: 1500 ft. /1000 ft. /500 ft.) shall be installed on the traveled way of the limited access highway when the above conditions are present. The advance warning signs shall be installed only in one direction where work is active. All portable signs shall be double indicated. When work is not active, the ramp work shall be advanced warned by the use of a single forty-eight inches by forty-eight inches (48" x 48") "ROAD WORK AHEAD" (W20-1) with an "ON RAMP" plaque (W13-4p) sign along the right shoulder of the mainline traveled way prior to the beginning of the taper for the deceleration lane. Differences in elevation shall be in compliance with the requirements of Subsection 150.3.11 prior to the removal of the portable (W20-1) advanced warning signs from the mainline.

B. Highway Work Zone

In accordance with Georgia Code, O.C.G.A. § 40-6-188, all sections or segments of the roadway under construction or reconstruction shall be signed as a Highway Work Zone except non-state highway two-lane two-way resurfacing projects. Two conditions can be applied to a Highway Work Zone. Condition 1 is when no reduction in the existing speed limit is required. Condition 2 is when worksite conditions require a reduction of the speed limit through the designated Work Zone. Properly marking a Highway Work Zone shall include the following minimum requirements:

1. No Reduction in the Existing Posted Speed Limit in Highway Work Zone

a. Signage shall be posted at the beginning point of the Highway Work Zone warning the traveling public that increased penalties for speeding violations are in effect. The beginning point of Highway Work Zone is at the project limits, start of work zone, or at the start of the first taper. The HWZ-2 sign shall be placed a minimum of 600 feet in advance of the Highway Work Zone and shall not be placed more than 1000 feet in advance of the Work Zone. If no speed reduction is required, it is recommended that the HWZ-2 be placed at 750 feet from the work area between the ROAD WORK 500 FT. and the ROAD WORK 1000 FT. signs.

HWZ-2 signs shall be placed at intervals not to exceed one mile for the length of the project. HWZ-2 signs should be placed on the mainline after all major intersections except State Routes. State Routes shall be signed as per the requirements for intersecting roadways below.

b. The existing speed limit shall be posted at the beginning of the Work Zone. Existing Speed Limit signs (R2-1) shall be maintained.

c. Intersecting state routes shall be signed in advance of each intersection with the Work Zone with an HWZ-2 sign to warn motorists that increased fines are in effect. All other intersecting roadways that enter into a designated Highway Work Zone may be signed in advance of each intersection with the Work Zone. When construction equipment and personnel are present in the intersection on the mainline of a multi-lane roadway, the intersecting side roads shall be signed in advance with HWZ-2 signs. As soon as the work operation clears the intersection, the signage may be removed.

d. Sign HWZ-3 shall be posted at the end of the Highway Work Zone indicating the end of the zone and indicating that increased penalties for speeding violations are no longer in effect.

e. When a designated Highway Work Zone is no longer necessary, all signs shall be removed immediately.

2. Reducing the Speed Limit in a Highway Work Zone

Highway Work Zone signs shall be posted as required in Condition 1 above and in accordance with Detail 150-C.

A "Reduced Speed Ahead" sign shall be posted 600 feet prior to the reduced speed limit.

Then a "Speed Limit" signage (R2-1) for the reduced speed limit shall be erected at the beginning of the Work Zone. Additional signs shall be placed at whichever is least:

a. on non-interstate roads after every junction with a numbered (state or U.S.) route.

b. on interstates entrance ramp 1,500 feet from the end of the entrance taper. Detail 150-D

c. on non-interstate and interstate, a maximum spacing of no greater than one (1) mile apart.

On interstates and multi-lane divided highways, the speed limit signs shall be double indicated when the reduced speed is in use.

Additional signs may be necessary to adjust for actual field conditions.

For limited access (interstate) highways and controlled access multi-lane divided highways, the posted speed limit shall be reduced as required below.

When any one or more of the following conditions exist and the existing speed limit is sixty-five (65) mph or seventy (70) mph, the speed limit shall be reduced by ten (10) mph. If the existing speed limit is sixty (60) mph, the speed limit should be reduced by five (5) mph. If the existing speed limit is fifty-five (≤ 55) mph or less, the Contractor can only reduce the speed limit with the prior approval of the Engineer. The reduction in the speed limit shall be no greater than ten (10) mph:

a) Lane closure(s) of any type and any duration.
b) The difference in elevation exceeds two inches (> 2") adjacent to a travel lane as shown in Subsection 150.3.11, Detail 150-E, Detail 150-F.
c) Any areas where equipment or workers are within ten feet (10') of a travel lane.
d) Temporary portable concrete barriers located less than two feet (2') from the traveled way.
e) As directed by the Engineer for conditions distinctive to this project.

When the above conditions are not present, the speed limit shall be immediately returned to the existing posted speed limit. A speed reduction shall not be put in place for the entire length of the project unless conditions warranting the speed reduction are present for the entire project length. All existing speed limit signs within the temporary speed reduction zone shall be covered or removed while the temporary reduction in the speed limit is in effect. All signs shall be erected to comply with the minimum requirements of the MUTCD.

At a minimum, the following records shall be kept by the WTCS:

a) Identify the need for the reduction.
b) Record the time of the installation and removal of the temporary reduction.
c) Fully describe the location and limits of the reduced speed zone.
d) Document any accident that occurs during the time of the reduction.

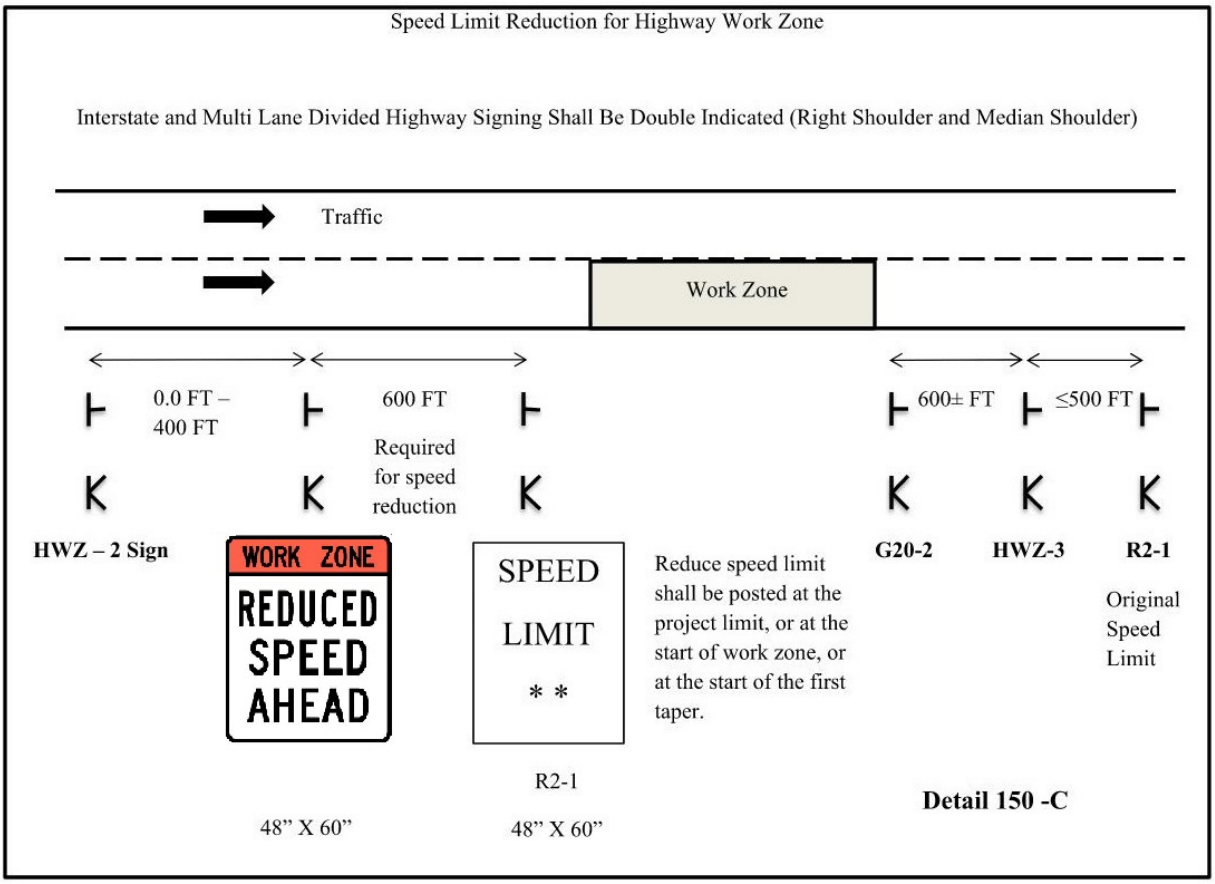
A copy of the weekly records for reduced speed zones shall be submitted to the Engineer.

When a pilot vehicle is used on a two-lane two-way roadway, the speed limit should not be reduced. For special conditions specific to the Work, on two-lane two-way roadways or multi-lane highways, the Contractor may reduce the posted speed limit with the prior approval of the Engineer.

3. Variable Speed Limit Zones

Projects that are within or extends into variable speed limit zones shall be posted according to condition 1 with HWZ-1, HWZ-2, and HWZ-3 signs. No additional "speed limit" signs, (R2-1), shall be posted. Any reduction or increase in speed limits will be controlled by the normal operation of the variable speed limit system.

Upon request, a maximum speed limit of fifty-five (55) mph may be set for the project limits.



HWZ-2;

3" Radius, 1" Border, 1" Indent, Black on Fluorescent orange;
"WORK ZONE", C 2K specified length;

3" Radius, 1" Border, 1" Indent, Black on White;
"SPEEDING", C 2K specified length; "FINES", C 2K specified length;
"INCREASED", C 2K specified length;

3" Radius, 1" Border, 1" Indent, Black on White;
"MINIMUM", D 2K specified length; "FINE $100", D 2K specified length;

HWZ-2

1. All HWZ-2 sign panels shall be rigid.
2. The size of the HWZ-2 sign shall not be reduced for use on two-lane roadways.

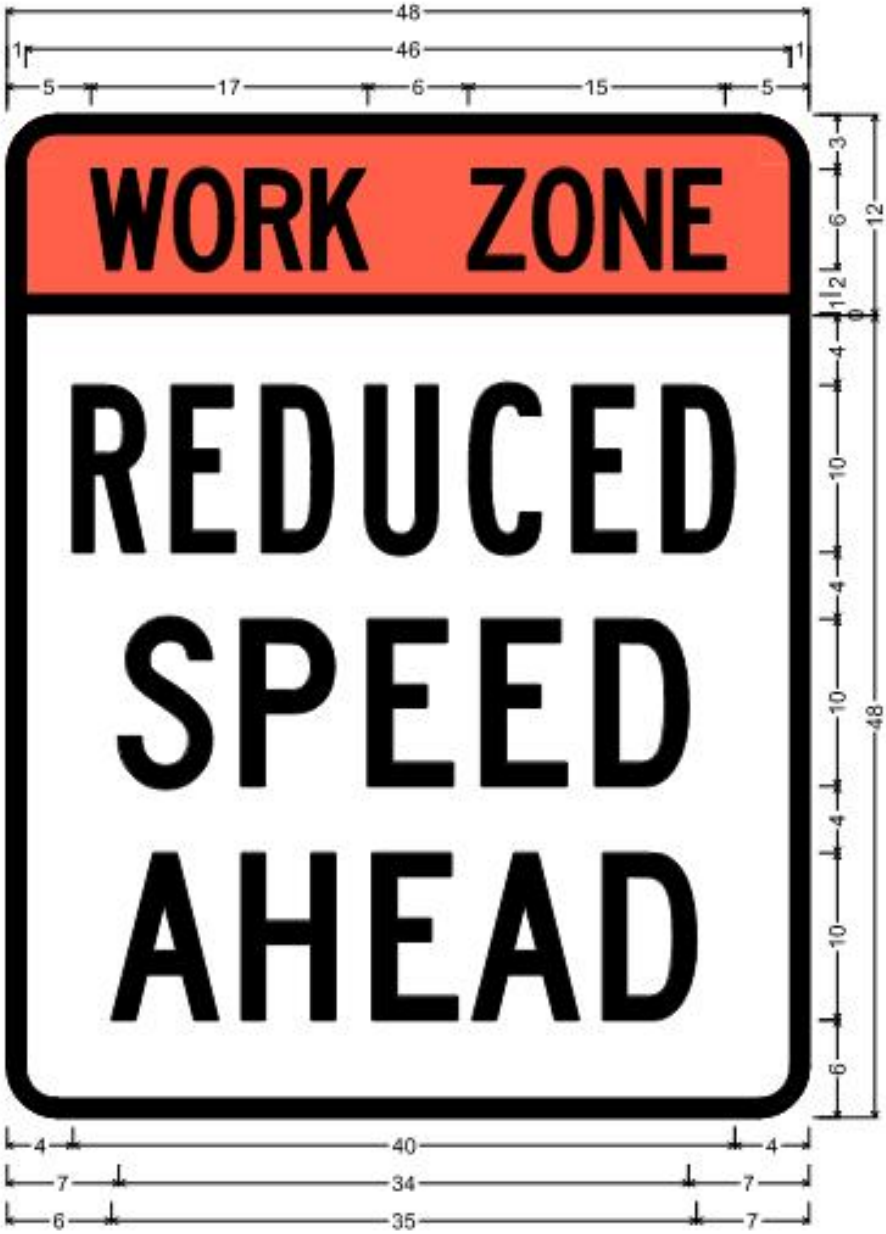
HWZ-3;

3" Radius, 1" Border, 1" Indent, Black on Fluorescent orange;
"WORK ZONE", C 2K specified length;

3" Radius, 1" Border, 1" Indent, Black on White;
"END", C 2K specified length; "INCREASED", C 2K specified length;
"SPEEDING", C 2K specified length; "FINES", C 2K specified length;

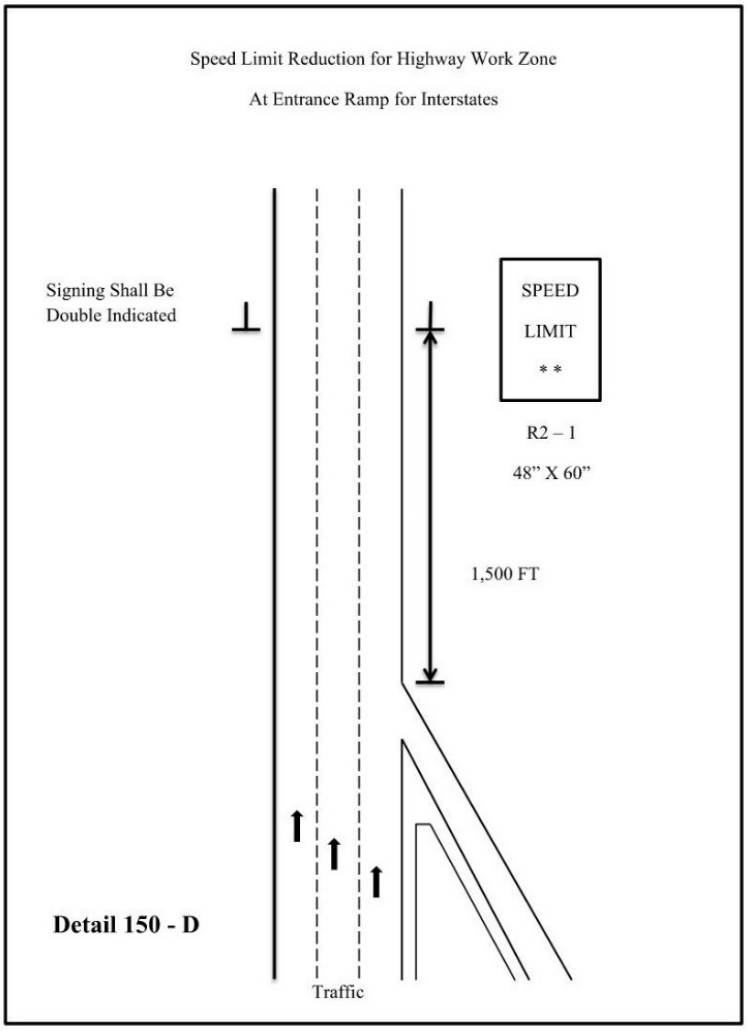
HWZ-3

1. All HWZ-3 sign panels shall be rigid.
2. The size of the HWZ-3 sign shall not be reduced for use on two-lane roadways.



3" Radius, 1" Border, Black on Fluorescent orange;
"WORK", C 2K 60% spacing; "ZONE", C 2K 60% spacing;

3" Radius, 1" Border, Black on White;
"REDUCED", B 2K; "SPEED", C 2K; "AHEAD", C 2K;



C. Installation/Removal of Work Area Signage

No payment will be made for Traffic Control-Lump Sum until the Work has actually started on the Project. The installation of traffic control signage does not qualify as the start of work. Advanced warning signs shall not be installed until the actual beginning of work activities. Any permanent mount height signs installed as the work is preparing to start shall be covered until all signs are installed unless all signs are installed within seven (≤ 7) calendar days after beginning installation.

All temporary traffic control devices shall be removed as soon as practical when these devices are no longer needed. When work is suspended for short periods of time, temporary traffic control devices that are no longer appropriate, shall be removed or covered.

All construction warning signs shall be removed within seven (≤ 7) calendar days after time charges are stopped or pay items are complete. If traffic control devices are left in place for more than ten (> 10) calendar days after completion of the Work, the Department shall have the right to remove such devices, claim possession thereof, and deduct the cost of such removal from any monies due, or which may become due, the Contractor.

CORRECTIVE LIST WORK: Portable signs shall be utilized to accomplish the completion of all corrective list items, if the corrective list is the only work being performed. The portable signs shall be removed daily. All permanent mount height signs shall be removed prior to the beginning of the corrective list only work, except "Low/Soft Shoulder" signs and any signs that have the prior written approval of the Engineer to remain in place while the corrective list work is in progress.

Failure to promptly remove the construction warning signs within the seven (7) calendar days after the completion of the Work or failure to remove or cover signs when work is suspended for short periods of time shall be considered as non-performance under Subsection 150.7.01.

150.3.05 Shoulder/Lane Closures

A. Approval/Restrictions

All shoulder closures and lane closures of any type or duration shall have the prior approval of the Engineer.

1. Closure Length

The length of a shoulder closure and a lane closure shall not exceed two (2) miles in length excluding the length of the tapers unless the prior approval of the Engineer has been obtained. The Engineer may extend the length of the closure based upon field conditions; however, the length of a work zone should be held to the minimum length required to accomplish the Work. Shoulder closure and Lane Closures shall not be spaced closer than one mile. The advanced warning signs for the Project should not overlap with the advanced warning signs for lane shifts, lane closures, etc.

2. Duration

The first (7) calendar days in an Urban area and the first three (3) calendar days in a Rural area of any lane closure shall be signed and marked as per Georgia Standard 9106 "Traffic Control Detail for Lane Closure on Multi-Lane Divided Highway" or Georgia Standard 9107 "Traffic Control Detail for Lane Closure on Multi-Lane Undivided Highway". However, lane closures that exist for a duration longer than three (> 3) calendar days may be signed and marked as per the details in Georgia Standard 9121 "Tapers, Signs, and Markings for Passing Lanes", provided the prior approval of the Engineer is obtained. The approved lane drop shall utilize a PCMS and only the signs and markings shown for the termination end of the lane drop in Georgia Standard 9121. All warning signs in the lane drop sequence shall be used. Drums may be substituted for the Type I Crystal Delineators at the same spacing.

B. Shoulder Closures

In accordance with MUTCD (6N.06), when paved shoulders, having a width of eight feet (≥ 8') or more are closed, at least one (1) advance warning sign shall be used. The sign(s) should read SHOULDER CLOSED (W21-5a). The signs are only posted on the side with the shoulder closure. Where the downstream end of the shoulder closure extends beyond the distance that can be perceived by road users, a supplementary plaque bearing the message NEXT XX FEET(W16-4P) or MILES (W7-3aP) should be placed below the SHOULDER CLOSED (W21-5a) sign. These signs shall be placed 500 feet prior to the shoulder closure. For multi-shoulder closures, the Shoulder Closed sign shall be repeated after two (2) miles at 500 feet prior to the next shoulder closure.

A shoulder closure will require a shoulder taper of (1/3) L (L=merging taper length). Traffic drums shall be used for the taper. Arrow boards are not required.

If positive barriers are used to close the shoulder, the taper and drums shall be in accordance with Standard 4960, Temporary Barrier (End Treatment Options). The approach end of the barrier taper should be 10:1 or flatter slope.

C. Lane Closure

1. Advance Warning Signs

The Advance Warning signs shall be in accordance with MUTCD and Georgia Standard 9106 "Traffic Control Detail for Lane Closure on Multi-Lane Divided Highway" and Georgia Standard 9107 "Traffic Control Detail for Lane Closure on Multi-Lane Undivided Highway".

When the Temporary Traffic Control zone already has advanced warning (W20-1) signs installed the W20-1 signs required for lane closures under Standard 9106 and 9107 should be eliminated.

For Interstate, Limited Access and Multi-lane Divided Highways, an additional PCMS shall be placed one (1) mile in advance of a lane closure with a message denoting the appropriate lane closure one (1) mile ahead. No other message shall be displayed on this PCMS. The PCMS shall be placed on the outside shoulder in accordance with Detail 150-B [PCMS]. This is in addition to the other traffic control devices required by Standard 9106.

At the discretion of the Engineer, the Contractor may start placing advance warning signs a half-hour (1/2 hr.) prior to the lane closure.

2. Transition Area – Taper

Drums shall be used on all transition tapers. If traffic drums with retroreflectivity of less than type VI are used for a merge taper that exists into the night, all drums located in the taper shall have, for the length of the taper only, a six inch (6") fluorescent orange (ASTM Type VI, VII, VIII, IX or X) reflectorized top stripe on each drum. The top six inch (6") stripe may be temporarily attached to the drum while in use in a taper. The Engineer may allow the fluorescent orange reflectorized six inch (6") top stripe on each drum in a merging taper to remain in place during daylight hours provided there is a lane closure(s) with a continuous operation that begins during one nighttime period and ends during another nighttime period. All drums that have the six inch (6") top stripe permanently attached shall not be used for any other conditions.

In accordance with MUTCD (6B.08), the minimum length for a merging taper for a lane closure on the travel way shall be as shown in Table 150-1:

TABLE 150-1

Posted Speed Limit, MPH	Lane Width 9 Feet	Lane Width 10 Feet	Lane Width 11 Feet	Lane Width 12 Feet	Maximum Drum Spacing in Tapers, (Feet)
	Minimum Taper Length (L) in Feet				
20	60	70	75	80	20
25	95	105	115	125	25
30	135	150	165	180	30
35	185	205	225	245	35
40	240	270	295	320	40
45	405	450	495	540	45
50	450	500	550	600	50
55	495	550	605	660	55
60	540	600	660	720	60
65	585	650	715	780	65
70	630	700	770	840	70
75	675	750	825	900	75

If site conditions require a longer taper, then the taper shall be lengthened to fit particular individual situations.

The length of shifting tapers should be at least one-half (1/2) L.

Multiple Lane Closures:

a. A maximum of one (1) lane at a time shall be closed with each merging taper.

b. A minimum tangent length of two (≥ 2) L shall be installed between each individual lane closure taper. The tangent length is part of the transition area. Therefore, only traffic drums can be used in the tangent.

3. Activity Area

The activity area consists of a buffer and the work space. Georgia Standard 9106 "Traffic Control Detail for Lane Closure on Multi-Lane Divided Highway" states "Buffer zones of 300' minimum, 500' desirable are required for tangent sections and shall be increased for horizontal or vertical curves due to sight distance considerations"

Georgia Standard 9107 "Traffic Control Detail for Lane Closure on Multi-Lane Undivided Highway" requires a fifty feet (50') buffer. The buffer shall be increased for horizontal or vertical curves due to sight distance considerations"

The channelization devices are spaced at a maximum of eighty feet (80').

4. Termination Area

Georgia Standard 9106 "Traffic Control Detail for Lane Closure on Multi-Lane Divided Highway" requires a 150 feet buffer and a minimum 200 feet downstream taper.

Georgia Standard 9107 "Traffic Control Detail for Lane Closure on Multi-Lane Undivided Highway" requires 150 feet downstream taper.

D. Removal of Lane Closures

To provide the greatest possible convenience to the public in accordance with Section 107, the Contractor shall remove all signs, lane closure markings, and devices immediately when lane closure work is completed or temporarily suspended for any length of time or as directed by the Engineer. All portable signs and portable sign mounting devices shall be removed from the roadway to an area which will not allow the sign to be visible and will not allow the sign or sign mounting device to be impacted by traffic. All devices shall be stored beyond the clear zone or behind positive protection.

E. Exit and Entrance Ramps

On multi-lane highways, where traffic has been shifted to the inside lanes, the exit and entrance ramps shall have drums placed on both sides of the ramp. This requirement will apply to any situation where traffic is shifted to contra flows or inside staging lanes to facilitate reconstruction work in the vicinity of exit and entrance ramps. The temporary ramp taper length should be greater than, or equal to, the existing taper length. Interim EXIT gore signs shall be placed at the ramp divergence. The "EXIT OPEN" sign shown in Figure TA-42 of the MUTCD shall be utilized. For exit ramps, drums spacing shall be decreased to ten feet (10') for 200 feet in advance of the temporary gore and be decreased to ten feet (10') for the first 100 feet of the temporary gore, and throughout the exit ramp. For on-ramps, drums should be used 200 feet prior to the ramp and end 100 feet past the merge taper. The drum spacing for the on ramp may be decreased but should not obstruct the view of the drivers i.e. for the ramp vehicles.

150.3.06 Traffic Pacing Method

A. Pacing of Traffic

With prior approval from the Engineer, traffic may be paced allowing the Contractor up to twenty (20) minutes maximum to work in or above all lanes of traffic for the following purposes:

1. Placing bridge members or other bridge work.

2. Placing overhead sign structures.

3. Other work items requiring interruption of traffic.

The Contractor shall provide a uniformed law enforcement officer with patrol vehicle and blue flashing light for each direction of pacing. The law enforcement officer, Engineer, and flaggers at ramps shall be provided with a radio which will provide continuous contact with the Contractor.

When ready to start the work activity, the law enforcement vehicle will act as a pilot vehicle slowing the traffic, thereby providing a gap in traffic allowing the Contractor to perform the Work. Any on-ramps between the pace and the work area shall be blocked during pacing of traffic, with a flagger properly dressed and equipped with a Stop/Slow paddle. Each ramp should be opened after the law enforcement vehicle has passed.

Pilot vehicles shall travel at a safe pace speed. The Contractor shall provide a vehicle to proceed in front of the law enforcement vehicle and behind the other traffic in order to inform the Contractor's work force when all vehicles have cleared the area.

Traffic should not be permitted to stop during pacing unless approved by the Engineer.

B. Methods of Signing for Traffic Pacing

At a point not less than 1,000 feet in advance of the beginning point of the pace, the Contractor shall place a PCMS sign with the message "TRAFFIC SLOWED AHEAD EXPECT SHORT DELAY".

150.3.07 Flagging Operations

A. Flaggers

Flaggers shall be provided as required to handle traffic, as specified in the Plans or Special Provisions, and as required by the Engineer.

B. Flagger Certification

All flaggers shall meet the requirements of the MUTCD and shall have received training and a certificate upon completion of the training from one of the following organizations:

National Safety Council
American Traffic Safety Services Association (ATSSA)

On-line classes are not accepted.

Failure to provide certified flaggers as required above shall be reason for the Engineer suspending work involving the flagger(s) until the Contractor provides the certified flagger(s). Flaggers shall have proof of certification and valid identification (photo I.D.) available any time they are performing flagger duties.

C. Flagger Appearance and Equipment

Flaggers shall wear Performance Class 2 or better for daytime activities. Flaggers shall wear Performance Class 3 or better high-visibility clothing for nighttime activities. Flagger stations shall be illuminated at night according to MUTCD (6M.08). They shall use a Stop/Slow paddle meeting the requirements of the MUTCD (6D.02) for controlling traffic. The Stop/Slow paddles shall have a shaft length of seven feet (≥ 7') minimum. The Stop/Slow paddle shall be retroreflectorized for both day and night usage. In addition to the Stop/Slow paddle, a flagger may use a flag as an additional device to attract attention. This flag shall meet the minimum requirements of the MUTCD (6D.02). The flag shall, as a minimum, be twenty-four inches (≥ 24") square and red or red/orange in color.

D. Flagger Warning Signs

Signs for flagger traffic control shall be placed in advance of the flagging operation, in accordance with the MUTCD and Georgia Standard 9102 "Traffic Control Detail for Lane Closure on Two-Lane Highway". In addition, signs at regular intervals, warning of the presence of the flagger shall be placed beyond the point where traffic can reasonably be expected to stop under the most severe conditions for that day's work.

E. Pilot Vehicle Requirements

Pilot vehicles should be required during placement of bituminous surface treatment or asphaltic concrete on two-lane roadways unless otherwise specified. Pilot vehicles shall meet the requirements of the MUTCD (6E.04).

F. Automated Flagger Assistance Devices

The Contractor may request, in writing, the use of Automated Flagger Assistance Devices (AFAD). The equipment shall meet the requirements of MUTCD (6L.02). As a part of this request, the Contractor shall also submit an alternate temporary traffic TTC plan in the event of a failure of the AFAD. Any alternate plan that requires the use of flaggers shall include the use of certified flaggers. The Contractor shall obtain the approval of the Engineer before the use of any AFAD will be permitted.

G. Portable Temporary Traffic Control Signals

The Contractor may request, in writing, the substitution of portable temporary traffic control signals for flaggers on two-lane two-way roadways provided the temporary signals meets the requirements of the MUTCD, Section 647, and subsection 150.2.11. As a part of this request, the Contractor shall also submit an alternate TTC plan in the event of a failure of the signals. Any alternate plan that requires the use of flaggers shall include the use of certified flaggers. The Contractor shall obtain the approval of the Engineer before the use of any portable temporary traffic control signals will be permitted.

150.3.08 Traffic Signals

A. Responsibility/Cost

If the sequence of operations, staging, or the TTC plan requires the relocation or shifting of any components of an existing traffic signal system then any work on these traffic signals will be considered as part of Traffic Control – Lump Sum.

B. Law Enforcement Officer Requirement

In accordance with Georgia law § 40-6-20, law enforcement officers shall be used to regulate and maintain traffic control at functioning signalized intersections when lane closures or traffic shifts block or restrict movements causing interference with road user flows and will not allow the activated traffic signal to guide the traffic through the signal site.

150.3.09 Mobile Operations

A mobile operation is defined by a minimum speed of three (3) mph. When pavement markings (centerlines, lane lines, and edge lines) are applied in a continuous operation by moving vehicles and equipment, the following minimum equipment and warning devices shall be required. These devices and equipment are in addition to the minimum requirements of the MUTCD.

All vehicles shall be equipped with the official slow moving vehicle symbol sign. All vehicles shall have a minimum of two (2) flashing or rotating beacons visible in all directions. All protection vehicles shall have an arrow panel mounted on the rear. All vehicles requiring an arrow panel shall have, as a minimum, a Type B panel. All vehicle mounted signs shall be mounted with the bottom of the sign a minimum height of forty-eight inches (48”) above the pavement. All sign legends shall be covered or removed from view when work is not in progress.

The lead vehicle may be a separate vehicle or the work vehicle applying the pavement markings may be used as the lead vehicle. The lead vehicle shall have an arrow panel mounted so that the panel is easily visible to oncoming (approaching) traffic. The arrow panel should operate in the caution mode.

The work vehicle(s) applying markings shall have an arrow panel mounted on the rear. The arrow panel should typically operate in the caution mode. The work vehicle placing cones shall follow directly behind the work vehicle applying the markings.

A protection vehicle shall follow the last work vehicle at all times and shall be equipped with a truck or trailer mounted attenuator that shall be certified for impacts not less than sixty-two (62) mph in accordance with MASH/NCHRP350 Test Level Three (3).

150.3.10 Pavement Markings

A. General

Full pattern pavement markings in conformance with Chapter 3A and 3B, except 3B.0 3, of the MUTCD are required on all courses before the roadway is opened to traffic, unless noted in this section. No passing zones shall be marked to conform to Subsection 150.3.10.D.1.b.. During construction and maintenance activities on all highways open to traffic, both existing markings and markings applied under this Section shall be fully maintained until Final Acceptance. If the pavement markings are, or become, unsatisfactory in the judgment of the Engineer due to wear, weathering, or construction activities, they shall be restored immediately.

Markings on the final surface course, which must be removed, shall be a removable type. The Contractor will be permitted to use paint, thermoplastic, or tape on pavement which is to be overlaid as part of the Project, unless otherwise directed by the Engineer. Partial (skip) reflectorization (i.e. reflectorizing only a portion of a stripe) will not be allowed.

1. Resurfacing Projects

   Pavement markings shall be provided on all surfaces that are placed over existing markings. Interim and final markings shall conform in type and location to the markings that existed prior to resurfacing unless changes or additions are noted in the Contract. The replacement of parking spaces will not be required unless a specific item or note has been included in the Contract. Any work to make additions to the markings that existed prior to resurfacing is to be considered as extra work.

2. Widening and Reconstruction Projects

   If the lane configuration is altered from the preconstruction layout then pavement markings will be as required by the Plans or the Engineer.

3. New Location Construction Projects

   Pavement marking plans will be provided.

B. Installation and Removal of Pavement Markings

1. Installation

   All pavement markings, both interim and permanent, shall be applied to a clean surface. The Contractor shall furnish the layout and preline the roadway surface for the placement of pavement markings applied as part of the TTC plan. All interim marking tape and RPM's on the final surface shall be removed prior to the placement of the final markings.

   The Contractor shall sequence the Work in such a manner as to allow the installation of markings in the final lane configuration at the earliest possible stage of the Work.

2. Removal

   Markings no longer applicable shall be removed in accordance with Section 656.
   The elimination of conflicting pavement markings by overpainting with unapproved paint or any type of liquid asphalt is not acceptable.

3. Intermediate Surface

   Interim markings shall be removed by methods that will cause minimal damage to the pavement surface, while also ensuring that traveling public will not be confused or misdirected by any residual markings remaining on the intermediate surface. The use of approved black-out tape and black-out paint (manufactured for the sole purpose of covering existing pavement markings) may be permitted on some interim surfaces, provided the results are satisfactory to the Engineer.

4. Final Surface

   No interim paint or thermoplastic markings will be permitted on any final surface unless the interim markings are in alignment with the location of the permanent markings and the interim marking will not interfere or

adversely affect placement of the permanent markings. The proposed method of removal for layout errors that require markings to be removed from the final surface shall have the prior approval of the Engineer. Any damage to the final pavement surface caused by the pavement marking removal process shall be repaired at the Contractor's expense by methods acceptable and approved by the Engineer. Section 400 shall apply when corrective measures are required. The use of black-out tape or black-out paint will not be permitted under any circumstance to correct layout errors on any final surface.

Traffic shifts that are done on the final surface shall be accomplished using interim traffic marking tape that can be removed without any blemishing of the final surface. Interim traffic marking tape shall be used on any of the following final surfaces: asphaltic concrete, Portland cement concrete, and bridge deck surfaces. The Contractor may propose alternate traffic markings and removal methods on the final surface. Submitted proposals shall include the type of material, method of removal and a cost comparison to the traffic marking tape method. Prior to any approval, the Contractor shall field demonstrate to the satisfaction of the Engineer that the proposed traffic markings can be removed without any blemishing of the final surface. If the proposal is determined to be acceptable, a supplemental agreement will be executed prior to the installation of the proposed alternate traffic markings. The supplemental agreement shall denote the type of traffic marking materials, method of removal and any cost and/or time savings to the Department. The Department will not consider or participate in any cost increase that may result from implementing the proposed alternate method.

5. Pay Factor Reduction for Asphaltic Concrete Final Surfaces

When the correction of an error in the layout of the final pavement markings requires the final surface to be grounded, blemished, scarred, or polished the pay factor shall be reduced to 0.95 for the entire surface area of the final topping that has a blemish, polished or a scarred surface. The reduced pay factor shall not be confined to only the width and length of the stripe or the dimensions of the blemished areas, the whole roadway surface shall have the reduced pay factor applied. The area of the reduced pay factor shall be determined by the total length and the total width of the roadway affected. If the affected area is not corrected, the reduction in pay shall be deducted from the final payment for the topping layer of asphaltic concrete. The Engineer shall make the final determination whether correction or a reduced pay factor is acceptable.

The eradication of pavement markings on intermediate and final concrete surfaces shall be accomplished by a method that does not grind, polish, or blemish the surface of the concrete. The method used for the removal of the interim markings shall not spall chip the joints in the concrete and shall not damage the sealant in the joints. Any joint or sealant repairs shall be included in the bid price for Traffic Control-Lump Sum. The proposed method of removal shall have the prior approval of the Engineer.

Failure to promptly remove conflicting or non-applicable pavement markings shall be considered as non-performance under Subsection 150.7.01.

6. Preparation and Planning for Traffic Shifts

When shifting of traffic necessitates removal of centerline, lane lines, or edge lines, all such lines shall be removed prior to, during, or immediately after any change to present the least interference with traffic. Interim traffic marking tape shall be used as a temporary substitute for the traffic markings being removed.

Before any change in traffic lane(s) alignment, marking removal equipment shall be present on the project for immediate use. If marking removal equipment failures occur, the equipment shall be repaired or replaced (including leasing equipment if necessary), so that the removal can be accomplished without delay.

Except for the final surface, markings on asphaltic concrete may be obliterated by an overlay course, when approved by the Engineer. When an asphaltic concrete overlay is placed for the sole purpose of eliminating conflicting markings and the in place asphaltic concrete section will allow, said overlay will be eligible for payment only if designated in the Plans. Overlays to obliterate lines will be paid for only once and further traffic shifts in the same area shall be accomplished with removable markings. Only the minimum asphaltic concrete thickness required to cover lines will be allowed. Excessive build-up will not be permitted. When an overlay for the sole purpose of eliminating conflicting markings is not allowed, the markings no longer applicable shall be removed in accordance with Section 656.

C. Raised Pavement Markers

Retroreflective raised pavement markers (RPMs) shall be placed as listed below for all asphaltic concrete pavements before the roadway is open to traffic, unless noted this section. On the final surface, RPMs shall be placed according to the timeframes specified in Subsection 150.3.10.D for full pattern pavement markings. When Portland Cement Concrete is an intermediate or final surface and is open to traffic, one (1) calendar day is allowed for cleaning and drying before the installation of RPMs is required.

Raised pavement markers are not allowed on the right edge lines under any situation.

Retroreflective raised pavement markers (RPMs) shall be placed and/or maintained on intermediate pavements surfaces on all highways that the final ride surface is not completed within 45 calendar days which is open to traffic. This includes all resurfacing projects along with widening and reconstruction projects. The RPMs shall be placed as follows:

1. Supplementing Lane Lines:
   - **a.** Eighty foot (80') center on skip lines with curvature less than three degrees. (Includes tangents)
   - **b.** Forty foot (40') centers on solid lines and all lines with curvature between three degrees and six degrees.
   - **c.** Twenty foot (20') centers on curves over six degrees.
   - **d.** Twenty foot (20') centers on lane transitions or shifts.
2. Supplementing Ramp Gore Lines:
   - **a.** Twenty foot (20') centers, two each, placed side by side.
3. Other Lines:
   - **a.** As shown on the Plans or directed by the Engineer.

D. Exceptions for Interim Markings

Some exceptions to the time of placement and pattern of markings are permitted as noted below; however, full pattern pavement markings are required for the completed project.

1. Two-Lane, Two-Way Roadways
   - **a.** Skip Lines

     If used, interim temporary tape or paint skip (broken) stripe may only be used for a maximum of three (3) calendar days. The stripes shall be at least two feet (> 2') long with a maximum gap of thirty-eight feet (≤ 38'). On curves greater than six degrees (>6º), a one foot (1') stripe with a maximum gap of nineteen feet (≤ 19') shall be used. In lane shift areas, solid lines will be required.

     Interim raised pavement markers may be substituted for the interim skip (broken) stripes. If raised pavement markers are substituted for the two foot (2') interim skip stripe, three (3) markers spaced at equal intervals over a two feet (2') distance will be required. No separate payment will be made if the interim raised pavement markers are substituted for interim skip lines.

     Interim raised pavement markers shall be retro-reflective, shall be the same color as the pavement markers for which they are substituted, and shall be visible during daytime.

     The type of interim marker and method of attachment to the pavement shall be approved by the Office of Materials and Testing but in no case will the markers be attached by the use of nails. Flexible reflective markers, Type 14 or Type 15, may be used for a maximum of three (3) calendar days as an interim marker. Any flexible reflective markers in use shall be from the QPL-76.

The interim raised pavement markers shall be maintained until the full pattern pavement markings are applied. At the time full pattern markings are applied the interim raised markers shall be removed in a manner that will not interfere with application of the full pattern pavement markings.

b. No Passing Zones Two-Lane, Two-Way Roadways

Passing zones shall be re-established in the locations existing prior to resurfacing unless otherwise noted in the Contract. No changes to the location of passing zones shall be done without the written approval of the Engineer. For periods not to exceed three (3) calendar days where interim skip centerlines are in place, no-passing zones shall be identified by using post or portable mounted DO NOT PASS regulatory signs (R4-1) twenty-four inches by thirty inches (24" x 30") at the beginning and at intervals not to exceed one-half (≤½) mile within each no-passing zone. A post or portable mounted PASS WITH CARE regulatory sign (R4-2) twenty-four inches by thirty inches (24" x 30") shall be placed at the end of each no-passing zone. Post mounted signs shall be placed in accordance with the MUTCD. Portable signs shall be secured in such a manner to prevent misalignment and minimize the possibility of being blown over by weather conditions or traffic.

On new location projects and on projects where either horizontal or vertical alignments has been modified; the location of No-Passing Zones will be identified by the Engineer.

c. Edge lines

- Bituminous Surface Treatment Paving
  Edge lines will not be required on intermediate surfaces (including asphaltic concrete leveling for bituminous surface treatment paving) that are in use for a period of less than sixty (<60) calendar days except at bridge approaches, on lane transitions, lane shifts, and in such other areas as determined by the Engineer. On the final surface, edge lines shall be placed within thirty (≤30) calendar days of the time that the final surface was placed.

- All Other Types of Pavement
  Edge lines will not be required on intermediate surfaces that are in use for a period of less than thirty (<30) calendar days except at bridge approaches, on lane transitions, lane shifts, and in such other areas as determined by the Engineer. On the final surface, edge lines shall be placed within fourteen (≤ 14) calendar days of the time that the surface was placed.

2. Multi-Lane Highways – With No Paved Shoulder(s) or Paved Shoulder(s) Four Feet or Less (≤ 4')

a. Undivided Highways (Includes Paved Center Turn Lane)

- Centerlines and No-Passing Barrier-Full Pattern centerlines and no-passing barriers shall be restored before opening to traffic.

- Lane lines- Interim skip (broken) stripe as described in Subsection 150.3.10.D.1.a. may be used for periods not to exceed three (≤ 3) calendar days. Skip lines are not permitted in lane shift areas. Solid lines shall be used.

- Edge lines- Edge lines shall be placed on intermediate and final surfaces within three (3) calendar days of obliteration.

b. Divided Highways (Grass or Raised Median)

- Lane lines- Full pattern skip stripe shall be restored before opening to traffic. Skip lines are not permitted in lane shift areas. Solid lines shall be required.

- Centerline/Edge line- Solid lines shall be placed on intermediate and final surfaces within three calendar days of obliteration.

3. Limited Access Roadways and Roadways with Paved Shoulders Greater Than Four Feet (> 4')

   a. Same as Subsection 150.3.10.D.2 except as noted in (b) below.

   b. Edge lines-

      - Asphaltic Concrete Pavement- Edge lines shall be placed on intermediate and final surfaces prior to opening to traffic.

      - Portland Cement Concrete Pavement- Edge lines shall be placed on any surface open to traffic no later than one calendar day after work is completed on a section of roadway. All water and residue shall be removed prior to daily striping.

4. Ramps for Multi-Lane Divided Highways

   A minimum of one solid line edge stripe shall be placed on any intermediate surface of a ramp prior to opening the ramp to traffic. The other edge stripe may be omitted for a maximum period of three (3) calendar days on an intermediate surface. Appropriate channelization devices shall be spaced at a maximum of twenty-five feet (25') intervals until the other stripe has been installed.

   The final surface shall have both stripes placed prior to opening the ramp to traffic.

5. Miscellaneous Pavement Markings

   a. Final Surface

      School zones, railroads, symbols, words, arrows, and other similar markings shall be placed on final surfaces conforming to Section 652 within fourteen (14) calendar days of completion of the final surface. Final markings shall conform to the type of pay item in the Plans. When no pay item exists in the Plans the final markings shall conform to Section 652 for painted markings.

   b. Intermediate Surface

      Intermediate surfaces that will be in use for more than forty-five (45) calendar days shall have the miscellaneous pavement markings installed to conform to the requirement of Section 652. Under Subsection 150.6, Special Conditions, or as directed by the Engineer these markings may be eliminated.

   c. Stop Line

      All stop signs and traffic signals shall have temporary twelve inch (12") stop lines placed in accordance with MUTCD (3B. 19) on all surfaces prior to opening to traffic. Temporary tape may be used.

150.3.11 Differences in Elevations Between Travel Lanes and Shoulders

All time frames and requirements may be changed with the Engineer's approval.

A. Differences in Elevations

Difference in elevations due to construction between travel lanes and/or shoulders within the clear zone should be limited to the following:

1. Difference of two inches (≤ 2") or less between adjacent travel lanes should remain for a maximum period of fourteen (14) calendar days.

2. Difference of two inches (≤ 2") or less between adjacent travel lane and paved shoulder should remain for a maximum of thirty (30) calendar days. Traffic control devices shall be in accordance with Detail 150-G.

3. Difference of greater than two inches (> 2") is permitted for continuous operations. Traffic control devices shall be in accordance with Detail 150-E.

4. Difference of greater than two inches (> 2") between travel lanes and/or shoulders for non-continuous operations will not be allowed for more than a twenty-four (24) hour period. For the first twenty-four (24) hours, traffic control shall be in accordance with Detail 150-E. After twenty-four (24) hours the section should be healed according to Detail 150 – H. This condition can exist for a maximum sixty (60) calendar days.

   a. A single length of area that does not exceed 1000 feet total length may be left open as a startup area for periods not to exceed forty-eight (48) hours provided the Contractor can demonstrate the ability to complete the Work in a proficient manner. Prior approval of the Engineer shall be obtained before any startup area may be allowed.

   b. For cement stabilized base, work adjacent to the travel lane and/or shoulders shall be healed as per Detail 150-H within forty-eight (48) hours after the seven (7) calendar day curing period is complete for each section placed. During the placement and curing period, traffic control shall be in accordance Detail 150 E.

Failure to meet these requirements shall be considered as non-performance of Work under Subsection 150.7.01.

B. Healed Section

Healed section and traffic control devices should be placed in accordance with Detail 150-H. If crushed stone materials are used to provide a healed section no separate payment will be made for the material used to heal any section. The Contractor may submit a plan to utilize existing pay items for crushed stone provided the plan clearly demonstrates that the materials used to heal an area will be incorporated into the Work with minimal waste. Handling and hauling of any crushed stone used to heal shall be kept to a minimum. The Engineer shall determine if the crushed stone used to heal meets the Specifications for gradation and quality when the material is placed in the final location.

C. Emergency Situations

Inclement weather, traffic accidents, and other events beyond the control of the Contractor may prevent the Work from being completed as required above. The Contractor shall notify the Engineer in writing stating the conditions and reasons that have prevented the Contractor from complying with the time limitations. The Contractor shall also outline a plan detailing immediate steps to complete the Work. Failure to correct these conditions on the first calendar day that conditions will allow corrective work shall be considered as non-performance of Work under Subsection 150.7.01.

D. Plating

Plating for drainage structures, utility facilities, etc. is prohibited on the interstates. Plating on State Routes and secondary roads will require the prior approval of the project Engineer. Steel plates shall not be used on highways with a posted speed greater than forty-five (45) mph. The plate shall completely cover the pavement cut or excavation. The plate shall be adequately secured and shall provide a safe and reasonable transition to the adjoining roadway surface. An asphalt wedge can be used to provide a smooth transition over the plate(s). Temporary traffic control warning signs W8-24 shall be posted in advance warning motorist about plates in roadway in accordance with the MUTCD. Plating should not remain in place for more than four (4) calendar days.

E. Asphaltic Concrete Resurfacing Projects

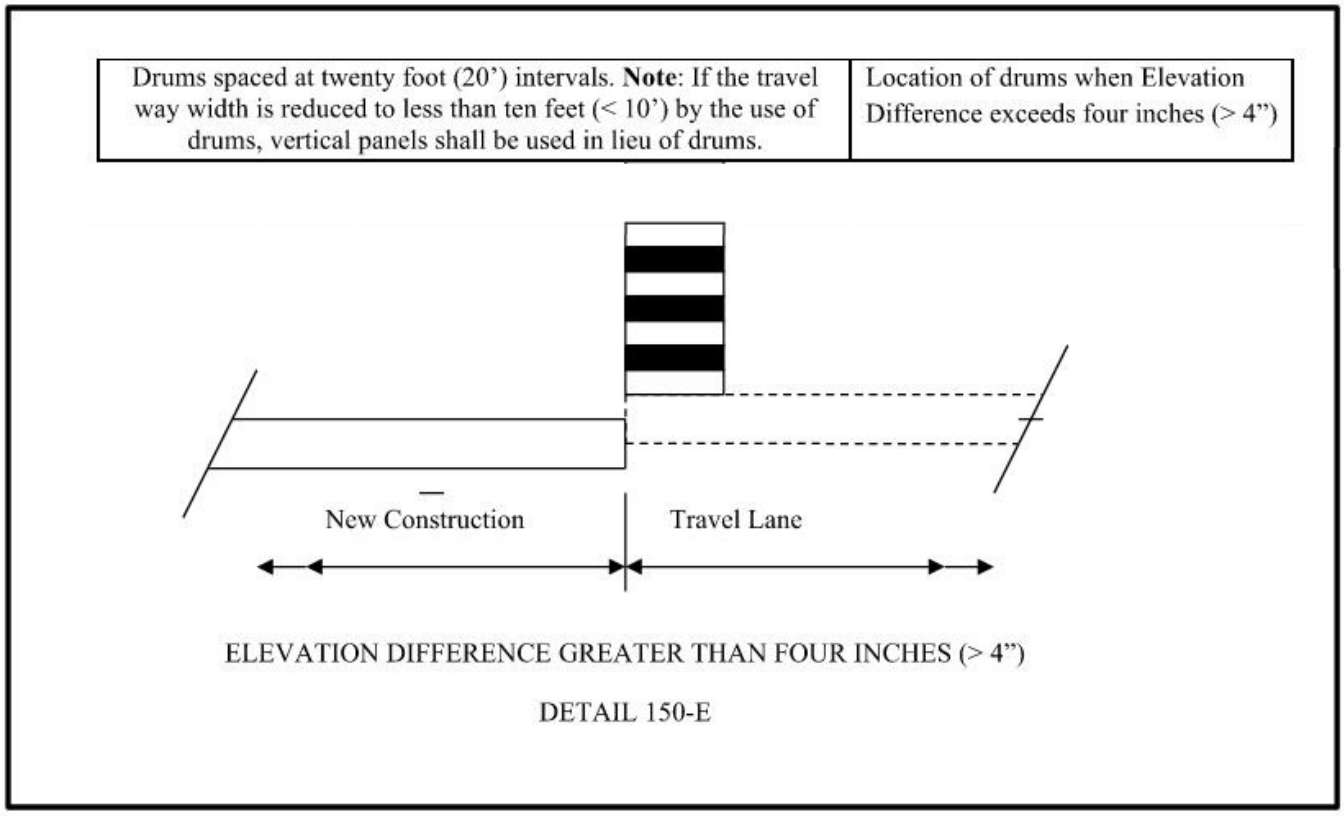
1. Shoulder Construction Included as a Part of the Contract

When the placement of asphaltic concrete materials creates a difference in elevation greater than two inches (> 2") between the earth shoulder (grassed or un-grassed) and the edge of travel lane or between the earth shoulder and a paved shoulder that is less than four feet (< 4') in width, the Contractor shall place and maintain drums in accordance with the requirements of Subsection 150.2.04.B.3. When the edge of the paved surface is tapered with a safety edge, drums may be spaced at two (2) times the speed limit in MPH. Drums shall remain in place

and be maintained until the difference in elevation has been eliminated by the placement of the appropriate shoulder materials.

2. Shoulder Construction Not Included as a Part of the Contract

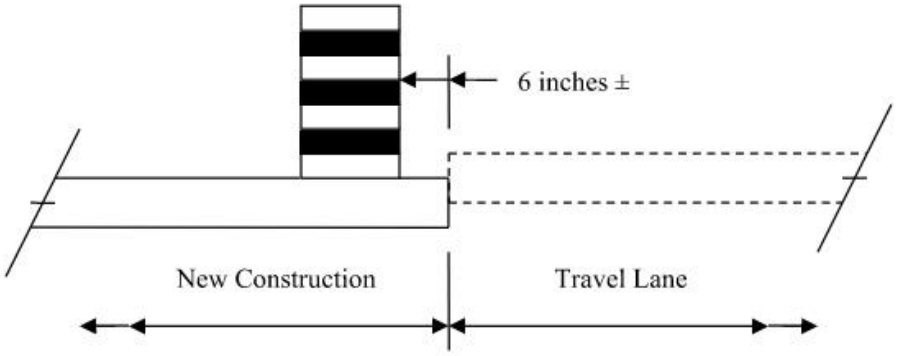
When the placement of asphaltic concrete materials creates a difference in elevation greater than two inches (> 2”) between the earth shoulder (grassed or un-grassed) and the edge of travel lane or between the earth shoulder and a paved shoulder that is less than four feet (< 4’) in width, the Contractor shall notify the Engineer, in writing, when the resurfacing work including all corrective list items has been completed.



ELEVATION DIFFERENCE GREATER THAN FOUR INCHES (> 4”)

DETAIL 150-E

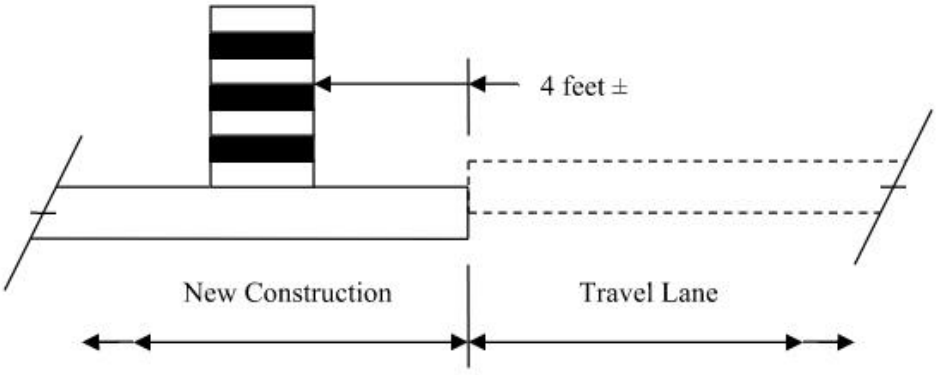
Drums spaced at forty foot (40') intervals.	Location of drums when Elevation Difference is greater than two inches (> 2") to four inches (4")



ELEVATION DIFFERENCE GREATER THAN TWO INCHES (> 2") TO FOUR INCHES (4")

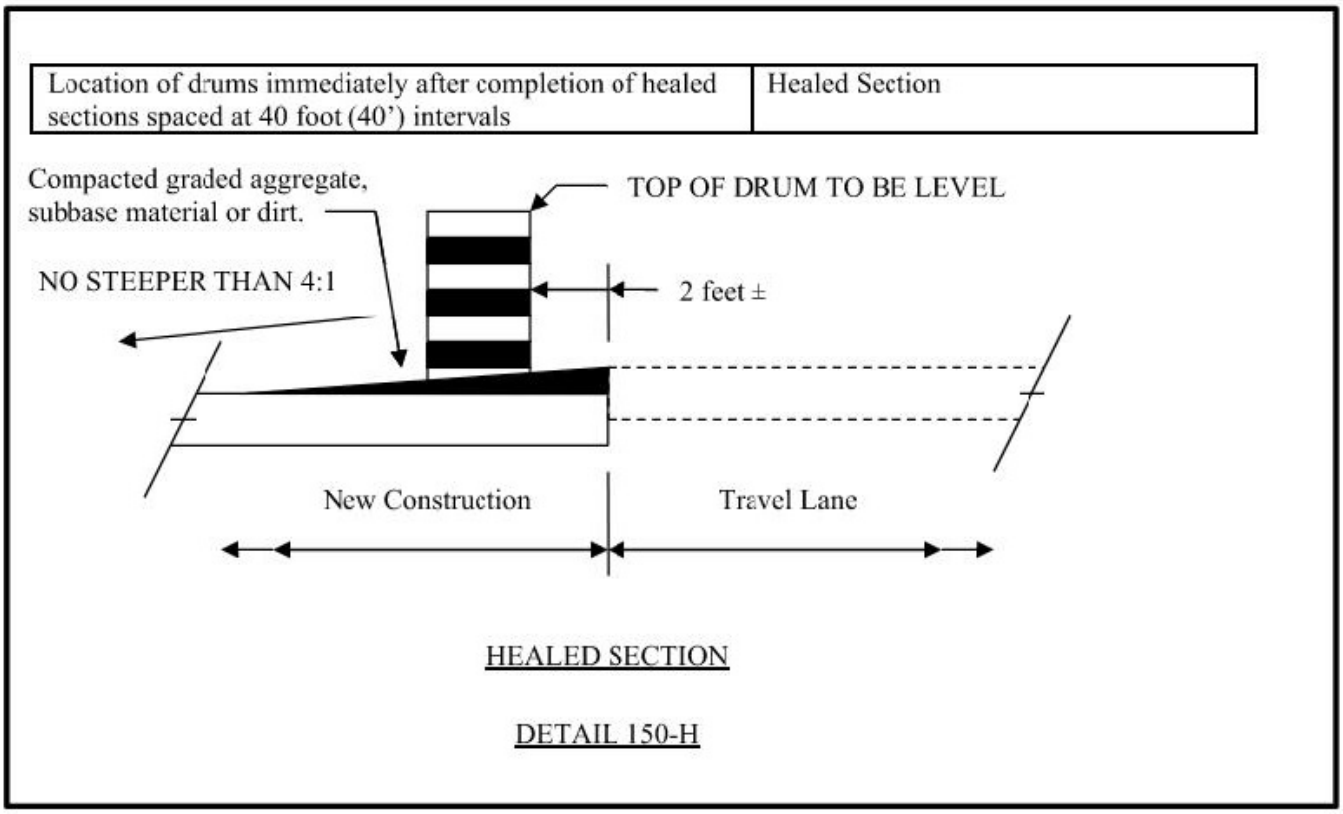
DETAIL 150-F

Drums spaced at eighty foot (80') intervals.	Location of drums when Elevation Difference is two inches (≤ 2") or less.



ELEVATION DIFFERENCE OF TWO INCHES (≤ 2") OR LESS

DETAIL 150-G



150.3.12 Work Zone Law Enforcement

Work zone law enforcement consists of utilizing a uniformed law enforcement officer equipped with patrol vehicle and blue flashing lights to enforce traffic laws in construction work zones and the administration of this service. Payment for work zone law enforcement will be made only for the utilization in work zones during lane closures, traffic pacing, or other activities that occur within travel lanes. The Contractor will be responsible for negotiating a rate of reimbursement and making reimbursement to that law enforcement agency.

The Contractor will be responsible for coordinating and scheduling the utilization of the work zone law enforcement. The Engineer may require the use of work zone law enforcement at specific times and locations.

Work zone law enforcement will be required in all work zones during lane closures, traffic pacing, or other activities that occur within travel lanes on the interstate.

150.4 Measurement

150.4.01 Traffic Control Items

A. Traffic Control

When listed as a pay item in the Proposal, payment will be made at the lump sum price bid, which will include all traffic control not paid for separately, and will be paid as follows:

When the first Construction Report is submitted, a payment of twenty-five percent (25%) of the lump sum price will be made. For each progress payment thereafter, the total of the Project percent complete shown on the last pay statement plus twenty-five percent (25%) will be paid (less previous payments), not to exceed one hundred percent (100%).

When no payment item for Traffic Control-Lump Sum is shown in the Proposal, all of the requirements of Section 150 and the Temporary Traffic Control Plan shall be in full force and effect. The cost of complying with these requirements will not be paid for separately but shall be included in the overall bid submittal.

B. Changeable Message Sign, Portable

Portable changeable message sign will be measured as specified in Section 632.

C. Flashing Beacon Assembly

Flashing beacon assemblies will be measured as specified in Section 647.

D. Pavement Markings

Pavement markings will be measured as specified in Section 150.

E. Portable Impact Attenuators

Each portable impact attenuator will be measured by the unit/array which shall include all material components, hardware, incidentals, labor, site preparation, and maintenance, including spare parts recommended by the manufacturer for repairing accident damage. Each unit will be measured only once regardless of the number of locations installed, moves required, or number of repairs necessary because of traffic damage. Upon completion of the project, the units shall be removed and retained by the Contractor.

F. Signs

When shown as a pay item in the Contract, interim special guide signs will be paid for as listed below. All other regulatory, warning, and guide signs, as required by the Contract, will be paid for under Traffic Control Lump Sum or included in the overall bid submitted.

1. Interim ground mounted or interim overhead special guide signs will be measured for payment by the square foot. This payment shall be full compensation for furnishing the signs, including supports as required, erecting, illuminating overhead signs, maintaining, removing, re-erecting, and final removal from the Project. Payment will be made only one time regardless of the number of moves required.

2. Remove and reset existing special guide signs, ground mount or overhead, complete, in place, will be measured for payment per each. Payment will be made only one time regardless of the number of moves required.

3. Modify special guide signs, ground mount or overhead, will be measured for payment by the square foot. The area measured shall include only that portion of the sign modified. Payment shall include materials, removal from posts or supports when necessary, and remounting as required.

G. Temporary Audible Information Device

Temporary audible information devices are measured as the actual number furnished and installed in accordance with the manufacturer's recommendations, which shall include all necessary materials, equipment, labor, site preparation, maintenance, and removal. Each temporary audible information device will be paid for only one time regardless of the number of times it's reused during the duration of the Work. These devices shall remain the property of the Contractor.

H. Temporary Barrier

Temporary barrier shall be measured as specified in Sections 620.

I. Temporary Curb Cut Wheelchair Ramps

Temporary curb cut wheelchair ramps are measured as the actual number formed and poured, complete and accepted, which shall include all necessary materials, equipment, labor, site preparation, maintenance, and removal.

No additional payment will be made for sawing existing sidewalk and removal and disposal of removed material for temporary wheelchair ramp construction. No additional payment will be made for constructing the detectable warning surface.

J. Temporary Guardrail Anchorage, Type 12

Temporary guardrail anchorage- Type 12 will be measured by each assembly, complete in place and accepted according to the details shown in the Plans, which shall also include the additional guardrail and appurtenances necessary for transition and connection to temporary concrete barrier. Payment shall include all necessary materials, equipment, labor, site preparation, maintenance, and removal.

K. Temporary Walkways with Detectable Edging

Temporary walkways with detectable edging will be measured in linear feet (meters), complete in place and accepted, which shall include all necessary materials, equipment, labor, site preparation, temporary pipes, passing spaces, maintenance, and removal. Excavation and backfill are not measured separately for payment. No payment will be made for temporary walkways where existing pavements or existing edging (that meets the requirements of MUTCD) are utilized for the temporary walkway. Payment for temporary detectable edging, including approved barriers and channelizing devices, installed on existing pavement shall be included in Traffic Control-Lump Sum.

L. Traffic Signal Installation- Temporary

Temporary traffic signal installation will be measured as specified in Section 647.

M. Work Zone Law Enforcement

When work zone law enforcement is shown as a pay item, work zone law enforcement will be measured for payment by the hour. The Contractor shall provide a daily work record containing the actual number of hours charged by the law enforcement officer. The daily work record shall be complied on a form provided by the Department, signed by the law enforcement officer, signed by the Contractor's Worksite Traffic Control Supervisor attesting that the law enforcement was utilized during the time recorded, and then submitted to the Engineer.

Work zone law enforcement will be measured for payment by the hour up to the maximum number of hours included in the Contract. The Engineer may at their discretion increase the maximum number of hours.

Payment shall be full compensation for reimbursing the law enforcement agency and for all cost incurred by the Contractor in coordinating, scheduling, and administering the item work zone law enforcement.

If no work zone law enforcement pay item is included in the Contract, then all work zone law enforcement cost shall be included in Traffic Control – Lump Sum.

150.5 Reserved

150.6 Special Conditions

Special Conditions, if used, will be included elsewhere in the Contract.

150.7 Payment

When shown in the Schedule of Items in the Proposal, the following items will be paid for separately. Payment will be made under:

Item No. 150	Traffic control -	Lump Sum
Item No. 150	Traffic control, solid traffic stripe __ inch, (color)	Per linear mile
Item No. 150	Traffic control, skip traffic stripe __ Inch, (color)	Per linear mile
Item No. 150	Traffic control, solid traffic stripe, thermoplastic 24 inch, color	Per linear mile
Item No. 150	Traffic control, raised pavement markers –all types	Per each
Item No. 150	Remove and reset, existing special guide signs, overhead, complete-in-place	Per each
Item No. 150	Temporary walkways with detectable edging	Per linear foot
Item No. 150	Temporary curb cut wheelchair ramps	Per each
Item No. 150	Temporary audible information device	Per each
Item No. 150	Work Zone Law Enforcement	Per hour

150.7.01 Enforcement and Adjustments

The safe passage of pedestrians and traffic through and around the temporary traffic control zone, while minimizing confusion and disruption to traffic flow, shall have priority over all other Contractor activities. Continued failure of the Contractor to comply with the requirements of Section 150 - Traffic Control will result in non-refundable deductions of monies from the Contract as shown in this Subsection for non-performance of Work.

Failure of the Contractor to comply with this Specification shall be reason for the Engineer suspending all other work on the Project except erosion control and traffic control, taking corrective action as specified in Section 105, and/or withholding payment of monies due to the Contractor for any work on the Project until traffic control deficiencies are corrected. These other actions shall be in addition to the deductions for non-performance of traffic control.

SCHEDULE OF DEDUCTIONS FOR EACH CALENDAR DAY OF DEFICIENCIES OF TRAFFIC CONTROL INSTALLATION AND/OR MAINTENANCE		
ORIGINAL TOTAL CONTRACT AMOUNT		
From More Than	To and Including	Daily Charge
$0	$100,000	$250
$100,000	$1,000,000	$650
$1,000,000	$5,000,000	$1,300
$5,000,000	$20,000,000	$2,000
$20,000,000	$40,000,000	$2,600
$40,000,000	$----------	$4,000

May 7, 2026

DEPARTMENT OF TRANSPORTATION
COBB COUNTY GEORGIA

SPECIAL PROVISION

LOST MOUNTAIN ROAD AT
AMBERTON DRIVE AND HOPETON DRIVE
PROJECT NO: B2442

SECTION 150 – TRAFFIC CONTROL

ADD the following:

150.3 CONSTRUCTION REQUIREMENTS

150.3.01 GENERAL

C. Traffic Interruption Restrictions

Delete in its entirety and add:

The Department reserves the right to restrict construction operations when, in the opinion of the Engineer, the continuance of the Work would seriously hinder traffic flow, be needlessly disruptive or unnecessarily inconvenience the traveling public. The Contractor shall suspend and/or reschedule any work when the Engineer deems that conditions are unfavorable for continuing the Work.

If the Work is suspended, the Contractor may submit a request for additional Contract time as allowed under Section 108. The Department will review the request and may grant additional Contract time as justified by the impact to the Contractor's schedule. Compensation for loss of productivity, rescheduling of crews, rental of equipment or delays to the Contractor's schedule will not be considered for payment. Additional contract time will be the only consideration granted to the Contractor.

The Contractor shall not install lane closures, pace traffic or move equipment or materials between the hours of 6:00 a.m. and 9:00 a.m. and 4:00 p.m. to 7:00 p.m. Monday through Friday and 6:00 a.m. to 1:00 p.m. Sunday.

Failure to adhere to these restrictions will result in non-refundable deductions as specified in Section 150.7.01 Enforcement and Adjustments.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

Section 201—Clearing and Grubbing Right-of-Way

201.1 General Description

This work includes clearing, grubbing, removing and disposing of vegetation, buildings and debris within the entire Right-of-Way and easement areas adjacent to the Right-of-Way or as designated by the Engineer. Except, do not remove objects designated to remain or removed according to other sections of these specifications. This work also includes preserving (from injury and defacement) vegetation and objects designated to remain in place.

201.1.01 Definitions

Clearing: Removing and disposing trees, brush, stumps, logs, grass, weeds, roots, decayed vegetable matter, poles, stubs, rubbish, refuse dumps, sawdust piles, and loose boulders of 1 yd^3 (1 m^3) or less existing outside of the construction limits, debris resting on or protruding through the ground surface, or appearing on the Right-of-Way before final acceptance of the work.

Clearing also includes removing and disposing of obstructions, such as fences, bridges, buildings, and other incidental structures within the Right-of-Way unless the work or a portion of the work is:

- Removed as excavation
- Shown in the Proposal as a separate Pay Item
- Performed by others

Grubbing: Removal from the Right-of-Way and proper disposal of all objectionable matter defined above under clearing, which is embedded in the underlying soil.

Grubbing also includes removing and properly disposing of parking lots, abandoned pavements, sidewalks, driveways, catch basins, drop inlets, pipes, manholes, curbing, retaining walls, utilities, foundations, paved floors, underground tanks (for removal of underground tanks see Section 217), and other structures within the Right-of-Way unless the work or portions of the work are:

- Obstructions removed as one of the excavation items
- Shown in the Proposal as separate Pay Items
- Removed by others
- To be incorporated in the project.

Objectionable Roots: Any of the following types of roots:

- Matted trees and brush roots (regardless of the size of the roots)
- Individual roots more than 0.75 in. (20 mm) diameter
- Individual roots more than 3 ft. (1 m) long regardless of size
- Large quantities of smaller roots present in the top 1 ft. (300 mm) of the finished subgrade or road surface when detrimental to the work as determined by the Engineer.

Stumps: The butt of a tree with a diameter of 4 in. (100 mm) or more.

Drift material: Organic debris, primarily large tree limbs, that are carried by a stream and accumulate at the upstream side of bridges and culverts, impeding navigation and threatening the integrity of the drainage structure.

201.1.02 Related References

A. Standard Specifications

Section 107—Legal Regulations and Responsibility to the Public

Section 109—Measurement and Payment

Section 160—Reclamation of Material Pits and Waste Areas

Section 161—Control of Soil Erosion and Sedimentation

Section 208—Embankments

Section 215 – Removal of Solid Waste

Section 217—Removal of Underground Storage Tanks

B. Referenced Documents

General Provisions 101 through 150.

201.1.03 Submittals

General Provisions 101 through 150.

201.2 Materials

General Provisions 101 through 150.

201.2.01 Delivery, Storage, and Handling

General Provisions 101 through 150.

201.3 Construction Requirements

201.3.01 Personnel

General Provisions 101 through 150.

201.3.02 Equipment

General Provisions 101 through 150.

201.3.03 Preparation

General Provisions 101 through 150.

201.3.04 Fabrication

General Provisions 101 through 150.

201.3.05 Construction

A. General

Establish Right-of-Way and construction lines. The Engineer will designate which trees, shrubs, and plants will remain in the ground. Preserve things designated to remain.

Apply the requirements of Subsection 107.22, Subsection 107.23, and Section 161 to clearing and grubbing operations.

Ensure Subsection 161.3.05.H is reviewed and implemented before beginning any land disturbing activity.

Strip grass immediately ahead of grading.

To prevent the spread of *Introduced Invasive Pest Species*, do the following:

1. Adhere to the restrictions of Section 155.3.05.A for moving soil, mulch, sod or plants, stump wood or timber with soil attached.
2. Adhere to the requirements of Section 155.3.05.B for cleaning of equipment, except that the USDA inspection will not be required for vegetative matter.
3. Dispose of vegetative parts of plants that may reproduce (roots and aboveground parts that bear fruit) by burning on site (where permitted) or bury with a minimum cover of 3 ft. (1 meter) at an approved site. Obtain the Engineer's approval for any other methods of disposal.

B. Clearing

Clear objects within the Right-of-Way and easement areas as follows:

1. Choose a method of clearing that prevents damage to property, trees, or retained shrubbery in or outside of the Right-of-Way.
2. Remove stumps that are part of the clearing operations as specified under Subsection 201.3.05.C, *Grubbing*
3. Cut the stumps not grubbed as specified in this section.
4. Dispose of cleared materials as specified in Subsection 201.3.05.E.

C. Grubbing

Grubbing consists of removing and disposing objectionable matter embedded in the underlying soil (defined in Subsection 201.3.05.B, *Clearing*) from the Right-of-Way and easement areas.

1. Grubbing Operations

   When grubbing, remove abandoned obstructions referenced in Subsection 201.1.01 *Definitions* to the following depths:

   a. Under Pavements: Remove to a depth of at least 3 ft. (1 m) below the finished subgrade.
   b. Underneath Other Structures: Remove to at least 3 ft. (1 m) below the foundations of any proposed structure, including installations such as guard rail posts and utility poles.
   c. Elsewhere in the Right-of-Way and easement areas: Remove as follows:
      1) Remove to at least 3 ft. (1 m) below the finished surface of slopes and shoulders and 1 ft. (300 mm) below natural ground outside construction lines.
      2) Thoroughly crack or break abandoned structures that may impound water. These structures include concrete floors, basements, and catch basins within 10 ft. (3 m) of finished grade.
      3) Break floors so that no section greater than 10 ft.^{2} (1 m^2) remains intact.

2. Except as modified under Subsection 201.3.05.D, use the following procedure to perform grubbing:
   a. Remove stumps and other matter that cannot be removed by a root rake. Remove stumps to a minimum depth of 2 ft. (600 mm) below the ground line.
   b. Rake areas containing objectionable roots to a depth of at least 6 in. (150 mm) below the surface.
   c. Remove remaining objectionable matter by hand or other suitable means. When necessary, remove small roots (see Subsection 201.1.01 *Objectionable Roots*) detrimental to the work.
   d. Backfill stump holes and compact backfill to the approximate density of the surrounding soil.
   e. Harrow the area with a heavy-duty disc harrow that penetrates and turns the ground to at least 6 in. (150 m) deep.
   f. Remove objectionable matter exposed by the harrowing.
   g. Level the harrowed areas with blading equipment. Leave the grubbed areas smooth enough for a power mower.

D. Modifications of Clearing and Grubbing

Modify clearing and grubbing as follows:

1. In Excavation Areas

   Modify clearing and grubbing in excavation areas as follows:

   a. Harrowing and leveling may be omitted.

   b. Do not fill stump holes except when the bottom of any stump hole extends below the elevation of the finished subgrade. In this case, fill the portion of each hole below subgrade elevation with suitable material compacted to at least the density of the surrounding soil.

2. In Embankment Areas

   Modify clearing and grubbing in embankment areas as follows:

   a. Under 4.5 ft. (1.4 m)

      Clear and grub areas without modification where the original ground and finished grade differ in elevation 4.5 ft. (1.4 m) or less.

   b. Over 4.5 ft. (1.4 m)

      Clear, but do not grub areas covered by embankments exceeding the 4.5 ft. (1.4 m) elevation difference specified in step (a) above. Except the removal of unsound or decayed stumps.

      Remove and backfill stumps according to Subsection 201.3.05.C.2. When leaving sound stumps in place, cut them off to no more than 6 in. (150 mm) above the original ground line.

   c. Embankment Areas Over Old Roads

      Clear and grub without modification ditches and slopes of old roads to a depth that removes all objectionable matter to provide a firm foundation.

3. Areas Outside of Roadway

   Except as specified in this section, clear and grub the entire Right-of-Way and easement areas outside construction limits and leave it smooth and free from loose boulders and debris that would interfere with power mowers. Exceptions to the above requirements are as follows:

   a. Selective Clearing

      When the Engineer directs to preserve certain trees and plants, protect them from injury. Trees to be removed shall be felled to prevent injury to standing trees, plants, and improvements to be preserved.

      Cut off tree branches overhanging the roadway within 20 ft. (6 m) of the finished grade close to the boles. Also, remove other branches to create a balanced appearance. Grub areas adjacent to selected trees and shrubs without damage to living roots of the selected trees or shrubs.

   b. Special Treatment Areas

      Clear special treatment areas according to the plan notes.

   c. Steep Slopes

      Clear or selectively clear slopes that are too steep for power mowers (slopes steeper than 3 horizontal to 1 vertical) and clear or selectively clear slopes that are subject to excessive erosion. Do not grub in these areas.

   d. Grassed Areas

      Do not grub (if the Engineer approves) reasonably large areas outside construction limits covered with grasses and smooth enough for power mowers. Remove stumps, trees, loose rocks, and other objectionable matter.

4. Bridge Sites

   Modify clearing and grubbing at bridge sites as follows:

   a. Stream Bridges

      Clear the Right-of-Way for stream bridges for the full length of the proposed structure and existing structures. Cut stumps and brush flush with the ground line.

      The Engineer will require a second cutting if high water prevents cutting stumps flush with the ground. If the Engineer requires more than two cuttings, see Subsection 201.5 for payment.

Remove drift and stumps where necessary to permit installation of rip rap, piling, piers, abutments, wing walls, bents, removal of existing structures, and other parts of the Work. Properly backfill the holes.

Preserve stump and brush root systems at river and stream banks when they have been cut flush with the ground line.

b. Other Bridges

Clear and grub bridges (other than stream bridges) as specified within this specification for roadway areas and areas outside of the roadway.

E. Removal and Disposal of Materials

1. Merchantable Timber and Buildings

The Department may dispose of merchantable timber and buildings or may allow a property owner to remove them from the land granted for Right-of-Way before the Contractor begins operation. Therefore, the Department does not guarantee that merchantable timber or buildings will be on the Right-of-Way when the work begins.

Material salvaged from removing timber or buildings becomes the property of the Contractor.

Demolish, remove, and dispose of all building structures within the right of way and easement areas including concrete slabs, footings, foundations, etc. except building structures designated to remain in place. Grade to drain all disturbed ground to a reasonably smooth and pleasing appearance, free from loose boulders and other debris that would interfere with the use of power mowers. Grass all disturbed areas.

Prior to demolition or removal:

a. Inspect all building structures for the presence of asbestos. The inspection shall be done by an EPA Asbestos Hazard Emergency Response Act (AHERA) accredited inspector whose certification is current.

b. Provide a copy of all inspection reports including the inspector's credentials to the Engineer.

c. Provide written notice of intent to demolish to the Georgia Environmental Protection Division (EPD) of the Georgia Department of Natural Resources in accordance with EPD regulations with a copy to the engineer. This notice is required even if there is no asbestos present.

If there is asbestos present, its removal shall be done by a contractor licensed with the EPD in accordance with the Rules of Georgia Department of Natural Resource Environmental Protection Division chapter 391-3-14-04. All asbestos removal and disposal shall be done in accordance with EPD regulations. All asbestos removal shall be considered as Extra Work and payment will be made in accordance with Subsection 109.05.

2. Combustible Material

Abide by Federal, State, and local codes when the Right-of-Way (or any portion of the Right-of-Way) lies within an area where burning is restricted. All combustible material except sawdust piles may be burned on the Right-of-Way except where prohibited by Federal, State, or local air pollution control regulations.

a. Prevent fire from spreading to adjacent areas and damaging living trees and shrubs designated to remain on the Right-of-Way and easement areas.

b. Prevent damage to public and private installations either within or adjacent to the Right-of-Way and prevent damage to traveling public.

c. Obtain suitable areas for burning the combustible material when necessary (at the Contractor's expense). Burning area are subject to the approval of the Engineer.

d. Dispose of unburned combustible material according to Subsection 201.3.05.E.3. If the disposal area is located on private property, present written authority to the Engineer (signed by the property owner) granting the Contractor and the Department permission to use the area for the purpose intended. Reclaim the disposal area according to Section 160 except that the reclamation is at the Contractor's expense.

e. Completely remove sawdust within the construction limits. Haul the sawdust to approved disposal areas, or deposit it on the Right-of-Way in a layer less than 3 in (75 mm) deep. Immediately mix the sawdust with the underlying soil by dicing and harrowing. Leave the harrowed surface smooth.

3. Solid Waste Material

a. Nonregulated Material

(1) Common fill is defined as soil, rock, brick, concrete without reinforcement, concrete with reinforcement where the reinforcement has been removed flush with the surface of the concrete and cured asphalt, provided that such material does not contain hazardous waste constituents above background levels and the material results from Department funded construction contracts. Such fill is not subject to the Georgia Comprehensive Solid Waste Management Act of 1990 and the Solid Waste Management Rules when used as fill material on Department funded construction contracts or Department property or when used as fill material on property not owned by the Department when all requirements of this specification are fully met. Common fill meeting this definition may be placed as follows:

(a) At a permitted municipal, construction and demolition materials or inert landfill fully meeting all requirements of the Solid Waste Rules and Act and any other applicable laws or ordinances.

(b) At an off-site engineered fill location in accordance with the following requirements;

- Place the material in uniform layers 3 ft. thick or less and distributed to avoid the formation of large voids or pockets.
- Fill voids with finer material.
- Cover the last layer of fill with at least 2 ft. of soil.
- Construct the fill according to Section 208, except compact it to at least 90 percent of the maximum laboratory dry density.
- A Georgia registered professional engineer shall document, certify and submit the following information on behalf of the Contractor to the Department; compaction rates, waste description including average particle size, and the depth of clean earthen fill lying above the engineered fill.

(c) On site as compacted fill if prior written approval has been granted by the Engineer and in accordance with the following requirements:

- As compacted fill incorporated into embankment only. No area shall be excavated for the sole purpose of disposing of common fill.
- Place the material in uniform layers 3 ft. thick or less and distributed to avoid the formation of large voids or pockets.
- Fill voids with finer material.
- Cover the last layer of fill with at least 2 ft. of soil.
- Construct the fill according to Section 208, except compact it to at least 90 percent of the maximum laboratory dry density.
- Records of the exact location by station and offsets, amount disposed per location in cubic yards, waste description including average particle size, compaction rates and depth of clean earthen fill lying above the composite materials shall be kept by the Engineer.

(d) Materials that may be recycled or reused such as asphaltic concrete, Portland cement concrete, plastic, metal and materials that qualify under EPD regulations for sale or use may be reclaimed by the Contractor.

b. Regulated Material

(1) Inert waste is defined as organic debris such as stumps, limbs and leaves, and any of the aforementioned common fill items that do not meet the compaction requirements when placed in an excess materials pit. An inert waste landfill permit shall be obtained in accordance with GDNR/EPD Rules to properly record the disposal of inert waste when compaction requirements are not met at an excess materials pit. If disposed of at a landfill, inert waste may only be disposed

at a permitted municipal, construction and demolition materials or inert landfill fully meeting all requirements of the Solid Waste Rules and Act and any other applicable laws or ordinances.

(2) Construction and demolition waste is defined as construction forms, barrels, scrap metal, and other such by-products of construction not specifically listed above as either common fill or inert waste. Construction and or demolition waste must be disposed of at a permitted municipal, construction and demolition materials, or inert landfill fully meeting all requirements of the Solid Waste Rules and Act and any other applicable laws or ordinances.

(3) Dispose of oils, solvents, fuels, untreated lead paint residue, and other solid hazardous waste through a properly licensed hazardous waste disposal facility.

(4) Remove municipal solid waste discovered during construction or shown on the plans according to Section 215.

c. Solid Waste Handling and Disposal Documentation Requirements:

(1) Waste disposed at a permitted municipal or construction and demolition landfill – all tipping receipts generated by the receiving landfill shall be provided to the Engineer.

(2) Waste disposed at inert landfill – a copy of the landfill's Permit by Rule notification, and for landfills exceeding one acre, a copy of the landfill's NPDES General Storm water Permit Notice of Intent (NOI) and any local jurisdiction Land Disturbing Activity Permit, if applicable, shall be provided to the Engineer.

(3) Any necessary documentation regarding a disposal site's permit status must be obtained by the Contractor and verified by the Department before any common fill, inert waste, or other solid waste is allowed to leave the site.

(4) The documentation listed herein shall be maintained on-site in the project files and at any other location the Department deems necessary until a valid NPDES Notice of Termination is filed.

d. Recyclable materials must be separated from all waste materials and shall be properly stored in containers.

e. Excluding the above allowances, all types of waste shall be handled in full compliance with the following:

- The Georgia Solid Waste Management Rules, as amended (391-3-4)
- Georgia Comprehensive Solid Waste Management Act of 1990, as amended (O.C.G.A. 12-8-20)
- The Georgia Erosion & Sedimentation Act as amended (O.C.G.A. 12-7-1) and any applicable Local and State requirements as well as the General Permits of the Georgia Water Quality Control Act
- Any other applicable Federal, State, or Local rules or laws

F. Removal of Drift Material from Drainage Structures

When removal of drift material is required on the project, the following conditions are intended as a minimum to protect aquatic resources during drift removal activities executed by GDOT personnel or contractors.

1. All Project personnel shall be advised of the potential presence of federally and state protected species. These species are protected under the Endangered Species Act of 1973, the Georgia Endangered Wildlife Act of 1973 and the Georgia Wildflower Preservation Act of 1973. There are civil and criminal penalties for harming, harassing, or killing these species.
2. Drift removal shall be accomplished by attaching lift cables or ropes to the drift and hoisting the materials out of the stream from the top of the bridge deck or road surface. Any modifications to this method or any other methods for removal shall be submitted to, and will require prior written approval from, the State Environmental

Administrator within the GDOT Office of Environmental Services (Ecology_submittals@dot.ga.gov). Accumulated drift material shall not be dragged across the streambed.

3. Mechanized equipment shall not be allowed to rest upon or contact the streambed. Boats shall be allowed into the stream for the purpose of accessing accumulated drift, provided that water depth is adequate to ensure the watercraft would not contact the streambed.
4. If vegetation clearing is required to accomplish drift removal (e.g. to provide access for boats), mechanized clearing shall not be used within 200 feet of stream banks. Vegetation clearing by hand is permissible.
5. Drift material shall be disposed of outside the project right of way and placed in either a permitted solid waste facility or a permitted inert waste landfill. Refer to Subsection 201.3.05.E.3.b of the Standard Specification and Supplements thereto for additional information.
6. In the event any incident occurs that may cause, or has caused, harm to an aquatic species, the State Environmental Administrator shall immediately be notified by providing a description of the incident and photos of the harmed aquatic species to Ecology_submittals@dot.ga.gov. All activities on or near the structure shall cease, except traffic control and erosion control activities, pending consultation by the Department with the U. S. Fish and Wildlife Service, National Marine Fisheries Service, Georgia Department of Natural Resources, and, if applicable, the lead federal agency.

201.3.06 Quality Acceptance

General Provisions 101 through 150.

201.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

201.4 Measurement

The Department does not measure clearing and grubbing separately for payment. The area is considered the full Right-of-Way width for the length of the Project including slope and construction easement areas shown on the plans.

201.4.01 Limits

General Provisions 101 through 150.

201.5 Payment

Payment for this Item, completed and accepted, will be made at the lump sum price bid. The payment will be full compensation for all work specified in this Section including final cleanup as required.

If the Engineer requires more than two cuttings to clear the Right-of-Way for stream bridges (according to Subsection 201.3.05.D.4.a), the additional cuttings will be paid for as a Force Account according to Subsection 109.05.

No separate payment will be made for the disposal of solid waste materials.

Removal of Drift Material will only be paid for separately when shown in the plans for maintenance projects. Otherwise, Removal of Drift Material will be included in lumps sum Clearing and Grubbing. When Clearing and Grubbing is not shown as a payment item, the cost is included in the overall Contract Price.

Payment will be made under:

Item No. 201	Clearing and grubbing	Per lump sum
Item No. 201	Removal of Drift Material	Per lump sum

201.5.01 Adjustments

General Provisions 101 through 150.

March 23, 2026

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 500—Concrete Structures

500.1 General Description

This work consists of manufacturing and using Portland cement concrete to construct structures. See the Contract Plans for the specified color and locations for placing integrally colored concrete.

500.1.01 Definitions

General Provisions 101 through 150.

Self-Consolidating Concrete (SCC): a highly workable concrete that can flow through dense reinforcement under its own weight and adequately fill voids without segregation or excessive bleeding and without the need for vibration.

High Performance Self-Consolidating Concrete (HPC-SCC): a highly workable concrete, using High Performance cement, that can flow through dense reinforcement under its own weight and adequately fill voids without segregation or excessive bleeding and without the need for vibration.

500.1.02 Related References

A. Standard Specifications

Section 104—Scope of Work

Section 211—Bridge Excavation and Backfill

Section 431—Grind Concrete Pavement

Section 507—Prestressed Concrete Bridge Members

Section 511—Reinforcement Steel

Section 530—Waterproofing Fabrics

Section 531—Damp proofing

Section 621—Concrete Barrier

Section 800—Coarse Aggregate

Section 801—Fine Aggregate

Section 830—Portland Cement

Section 831 - Admixtures

Section 836—Special Surface Coating for Concrete

Section 838—Graffiti-Proof Coating for Concrete

Section 853—Reinforcement and Tensioning Steel

Section 865—Manufacture of Prestressed Concrete Bridge Members

B. Referenced Documents

ASTM A 653/653M

ASTM A 924/924M

ASTM C 138

ASTM C 231

ASTM C 1610

ASTM C 1611

ASTM C 1621

ASTM C 1712

ASTM C 1758

ASTM C 685

ASTM C 979

ASTM D 260, Type I or Type II

AASHTO C 309

AASHTO C 171

AASHTO M 85

AASHTO M 240

AASHTO M 194M/M 194

AASHTO R 39

AASHTO R 81

AASHTO T 23

AASHTO T 277

AASHTO T 358

AWS D 1.5

SOP 10

SOP 17

SOP 46

American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members

Federal Specification TT-P-641d, Type II

Georgia Standards 4941 Series and 4949 Series

QPL 10

QPL 17

QPL 100

GDT 134

DOT 525

500.1.03 Submittals

A. Concrete Mix Designs

The Contractor is responsible for all concrete mix designs. Ensure that concrete mixes contain enough cement to produce workability within the water-ratio specified in Table 1—Concrete Mix Table, below.

Design concrete mixes that meet the requirements of the Table 1—Concrete Mix Table, below. The Office of Materials and Testing will determine the concrete properties using the applicable method in Section 500 of the Sampling, Testing, and Inspection Manual.

Self-Consolidating Concrete Mix Designs contained in Table 1A shall only be used in Prestress/Precast Concrete Plant applications. It will not be allowed outside of those casting yards that are approved by the Department's Concrete Branch.

TABLE 1—CONCRETE MIX TABLE

English								
Class of Concrete	(2) Coarse Aggregate Size No.	(1 & 6) Minimum Cement Factor lb./yd³	Maximum Water/ Cement ratio lbs./lb.	(5) Slump Acceptance Limits (in) Lower - Upper		(3 & 7) Entrained Air Acceptance Limits (%) Lower - Upper		Minimum Compressive Strength at 28 days (psi)
"AAA"	67,68	675	0.44	2	4	2.5	6	5000
"AA1"	67,68	675	0.44	2	4	2.5	6	4500
"D"	57, 67	650	0.445	2	4	3.5	7	4000
"AA"	56,57,67	635	0.445	2	4	3.5	7	3500
"A"	56,57,67	611	0.49	2	4	2.5 (3)	6	3000
"B"	56,57,67	470	0.66	2	4	0	6	2200
"CS"	56,57,67 Graded Agg.*	280	1.4	-	3½	3	7	1000 (4)
Metric								
Class of Concrete	(2) Coarse Aggregate Size No.	(1 & 6) Minimum Cement Factor kg/m³	Maximum Water/ Cement ratio kg/kg	(5) Slump Acceptance Limits (mm) Lower - Upper		(3 & 7) Entrained Air Acceptance Limits (%) Lower-Upper		Minimum Compressive Strength at 28 days MPa)
"AAA"	67,68	400	0.44	50	100	2.5	6	35
"AA1"	67,68	400	0.44	50	100	2.5	6	30
"D"	57,67	385	0.445	50	100	3.5	7	28
"AA"	56,57,67	375	0.445	50	100	3.5	7	25
"A"	56,57,67	360	0.49	50	100	2.5 (3)	6	20
"B"	56,57,67	280	0.66	50	100	0	6	15
"CS"	56,57,67	165	1.4	-	90	3	7	7 (4)
	Graded Agg.*							

NOTES:

1. **Portland cement or Portland-limestone cement (Type IL) may be partially replaced with fly ash as provided in Subsection 500.3.04.D.4 or with granulated iron blast furnace slag as provide for in Subsection 500.3.04.D.5.**
2. **Specific size of coarse aggregate may be specified.**
3. **Lower limit is waived when air entrained concrete is not required.**
4. **The mixture will be capable of demonstrating a laboratory compressive strength at 28 days of 1000 psi (7 MPa) + 0.18 R*. Compressive strength will be determined based upon result of six cylinders prepared and tested in accordance with AASHTO T 22 and R 39.**

   *** Where R = Difference between the largest observed value and the smallest observed value for all compressive strength specimens at 28 days for a given combination of materials and mix proportions prepared together.**
5. **Designed slump may be altered by the Office of Materials and Testing when Type "F" water reducers are used.**
6. **Minimum cement factor shall be increased by 50 lbs/yd^3 (30 kg/m^3) when size No. 7 coarse aggregate is used.**
7. **When Class A is specified for bridge deck concrete, the entrained air acceptance limits shall be 3.5% to 7.0%.**

Submit all concrete mix designs to the Office of Materials and Testing (OMAT) for review. The Department will approve mixes that contain materials from approved sources and produce concrete that meets these Specifications.

Submit concrete mix design proportions for approval by one of the following methods:

1. Request Approval of Specific Proportions

   When requesting approval of specific concrete mix design proportions for classes of concrete, include the following information:

   - Source of each material
   - Apparent specific gravity of the cement and the fly ash, if used
   - Bulk specific gravity (saturated surface dry) of each aggregate
   - Percent absorption of each aggregate
   - Amount of each material required to produce a cubic yard (meter) of concrete
   - Proportions of admixtures per cubic yard (meter) of concrete and any use limitations
   - Proposed slump and air content of the design
   - Evidence that the proposed mixture complies with Subsection 500.1.03, .

   Concrete mix designs that do not have a proven performance record and have not been used by the Department must meet minimum laboratory strength requirements.
2. Obtain Ready-Mix Design Proportions for commonly used materials

   Get approved concrete mix designs from authorized ready-mix concrete plants.

   Ready-mix concrete plants approved according to Laboratory Standard Operating Procedure "Quality Assurance for Ready Mix Concrete Plants in Georgia" (SOP 10) are authorized to submit concrete mix designs for approval. See QPL 10 for a list of approved plants.
3. Use Laboratory-Designed Proportions for commonly used materials

   Use laboratory-designed concrete mix proportions from either of the following sources:

   a. Laboratory-designed proportions are available for commonly used combinations of materials. Request these mixes in writing from the State Materials and Testing Engineer. Request specific classes of concrete and specify the source of ingredients.

b. Select a combination of materials from approved sources and request that the laboratory determine a mix that meets requirements in the Table 1—Concrete Mix Table above. The laboratory will establish proportions for strength and workability under laboratory conditions.

4. Self-Consolidating Concrete Requirements

The Contractor is responsible for all concrete mix designs. Ensure that concrete mixes contain enough cement to produce performance requirements within the water-cement ratio specified in Table 1A—Self-Consolidating Concrete Mix Design Table.

Submit a mix design for approval to the Office of Materials and Testing. Include the sources, actual quantity of each ingredient, fine and coarse aggregate gradations, including gradation curves, design slump flow, design air and laboratory results that demonstrate the ability of the design to attain both the required compressive strength and chloride permeability.

Include laboratory results of the slump flow (spread) test, T-20 inch (T-500 mm) test, Visual Stability Index (VSI) Rating test (all according to ASTM C 1611), Passing ability by J-Ring according to ASTM C1621, Static Segregation using the Column Method according to ASTM C 1610, Static Segregation of Hardened SCC Cylinders according to AASHTO R 81, Rapid Assessment of Static Segregation according to ASTM C 1712, air content (according to GDT 26 or GDT 32), fresh concrete temperature (according to GDT 122) of at least two or more separate batches.

Include laboratory compressive strength test results tested according to AASHTO T 22 of at least two 1-day, two 3-day, two 7-day and eight 28-day test cylinders. For HPC-SCC, also include six 56-day test cylinders. Ensure these test cylinders are made from two or more separate batches with an equal number of cylinders made from each batch.

For HPC-SCC, include laboratory chloride permeability test results, at 56 days, of at least six test specimens prepared and tested according to AASHTO T 358. Ensure these test specimens are made from two or more separate batches with an equal number of specimens made from each batch.

The Certified Plant shall obtain written approval for each product type and each product size, from the Office of Materials and Testing Concrete Branch prior to producing any product with SCC or HPC-SCC. SCC and HPC-SCC will only be allowed in the fabrication of prestress/precast products.

As part of the mix design approval, the Contractor shall construct a test piece using the proposed SCC or HPC-SCC mix. This test piece shall be a mock-up of the precast element (i.e., beam, pile, etc). The test piece shall have the same dimensions of the precast element, except the minimum length shall be 10 feet (3 m). The test piece shall have the same bar reinforcement, pretensioning strand geometries, block outs and any other items required that will replicate a test pour of the complex portions of the precast element.

The Contractor shall use production equipment and operations to demonstrate concrete production, delivery, placement, finishing and curing. During concrete placement, the proposed mix will be evaluated for workability, flow and bleeding. After the concrete has cured, the forms will be removed and the concrete will be evaluated for surface finish and voids. The mock-up shall not be vibrated.

TABLE 1A—SELF-CONSOLIDATING CONCRETE MIX DESIGN TABLE

English										
Class of Concrete	**Maximum Water/ Cement ratio lbs./lb.**	**J-Ring (C 1621) (Δ Flow)**	**Column Segre-gation (C 1610) (S)**	**Rapid Segre-gation (C 1712) (Pd)**	**Hardened Visual Stability Index (R 81) (HVSI)**	**Slump Flow (C 1611) (in) Minimum**	**Entrained Air (%) Min**	**Max**	**Minimum Compressive Strength at 28 days (psi)**	**Surface Resistivity at 56 days (T-358) (kΩ-cm)**
"AAA SCC"	0.40	Δ Flow ≤ 2 in.	S ≤ 15%	Pd ≤ 15mm	≤ 1	20 (Time 20 in. = 3 to 8 seconds)	3.5	6.5	5000 or as shown on the plans (28 day)	N/A
"AAA HPC-SCC"	0.35	Δ Flow ≤ 2 in.	S ≤ 15%	Pd ≤ 15mm	≤ 1	20 (Time 20 in. = 3 to 8 seconds)	3.5	6.5	5000 or as shown on the plans (56 day)	(**4x8 Cylinders**) **Beams**- ≥16.5 Or as shown on the plans **Piling**-≥21 Or as shown on the plans (**6x12 Cylinders**) **Beams**- ≥13 Or as shown on the plans **Piling**- ≥16.5 Or as shown on the plans
Metric										
Class of Concrete	**Maximum Water/ Cement ratio kg/kg**	**J-Ring (C 1621) (Δ Flow)**	**Column Segre-gation (C 1610) (S)**	**Rapid Segre-gation (C 1712) (Pd)**	**Hardened Visual Stability Index (R 81) (HVSI)**	**Slump Flow (C 1611) (mm) Minimum**	**Entrained Air (%) Min**	**Max**	**Minimum Compressive Strength at 28 days (Mpa)**	**Surface Resistivity at 56 days (T-358) (kΩ-cm)**
"AAA SCC"	0.40	Δ Flow ≤ 50 mm	S ≤ 15%	Pd ≤ 15mm	≤ 1	500 (Time 500 mm = 3 to 8 seconds)	3.5	6.5	35 or as shown on the plans (28 day)	N/A
"AAA HPC-SCC"	0.35	Δ Flow ≤ 50 mm	S ≤ 15%	Pd ≤ 15mm	≤ 1	500 (Time 500 mm = 3 to 8 seconds)	3.5	6.5	35 or as shown on the plans (56 day)	(**4x8 Cylinders**) **Beams**- ≥16.5 Or as shown on the plans **Piling**-≥21 Or as shown on the plans (**6x12 Cylinders**) **Beams**- ≥13 Or as shown on the plans **Piling**- ≥16.5 Or as shown on the plans

B. Delivery Tickets

Have the concrete plant transmit delivery tickets (DOT Form 525) with each load of concrete delivered to the work site. Give the Engineer one of these delivery tickets.

Ensure that the following information is on the delivery ticket:

- Project designation
- Date
- Time
- Class and quantity of concrete
- Actual batch proportions
- Free moisture content of aggregates
- Quantity of water withheld
- Concrete mixing revolutions

If available forms do not provide the required information, ask the Engineer to provide one.

C. Formwork Plans

The Engineer may require detailed formwork plans for review. If so prepare the formwork plans and submit them to the Engineer. In no case will the Contractor be relieved of responsibility for the formwork plans.

When constructing permanent steel bridge deck forms, submit bar support details and types to the Department for approval before placing the deck form reinforcement.

D. Falsework Plans

Submit, for review by the Engineer, detailed falsework plans for spans under which traffic flows.

The Engineer may require plans for spans that do not accommodate traffic.

E. Shop and Erection Drawings

Submit fabricators' shop and erection drawings to the Engineer for review and approval. Indicate the following in the drawings:

- Grade of steel
- Physical and section properties for permanent steel bridge deck form sheets
- Locations where the forms are supported by steel beam flanges subject to tensile stresses

F. Hauling Vehicle Information

Before hauling starts on new bridges, submit the following information for each vehicle:

- Weight on each axle, empty
- Weight on each axle, fully loaded
- Center-to-center distances of axles
- Center-to-center distances of wheels measured parallel to each axle

G. Cold Weather Concrete Curing and Protection Plan

Secure the Engineer's approval of a "Cold Weather Concrete Curing and Protection Plan" for bridges and structures. Emphasize protection for the underside of bridge decks when using metal forms and include the protection procedures to be used.

Protection procedures shall keep the concrete above 50 °F (10 °C) for 72 hours after placement and above freezing for 6 days after placement. Choose the protection method from Table 2 based on the expected temperature within 48 hours after concrete placement. The contractor shall provide a suitable curing box for structural concrete to protect the cylinders. The box may be constructed of plywood and lined with insulation or a commercially made device.

TABLE 2—COLD WEATHER PROTECTION

Protection Procedure	Expected Temperatures Within 48 Hours
Heated enclosures	Below 25 °F (-4 °C)
Commercial blankets	Below 25 °F (-4 °C)
Batt insulation	Below 25 °F (-4 °C)
Heavy-duty polyethylene	25 °F (-4°C) or above

H. Color Additives

Submit to the Engineer the following:

1. Product Data: Manufacturer's specifications and instructions for color additives.
2. Samples for Concrete Color Selection: Submit sample chip of specified color indicating color additive number and required dosage rate. Submittals are for general verification of color.

500.2 Materials

Ensure that materials meet the Specification requirements of Table 3:

TABLE 3—MATERIALS SPECIFICATIONS

Material	Section
Coarse Aggregate (1)	800.2.01
Fine Aggregate Size No. 10	801.2.02
Damp proofing or Waterproofing Material (Bituminous)	826.2.01
Portland Cement and Blended Hydraulic Cement (2)	830.2.01
Portland-Pozzolan Cement (2)	830.2.03
Admixtures:	
Air-Entraining Admixtures	831.2.01
Retarding Admixtures	831.2.02
Water Reducing Admixtures	831.2.02
Granulated Iron Blast-Furnace Slag	831.2.03.A.3
Fly Ash	831.2.03.A.1
Raw or Calcined Natural Pozzolan (4) (5)	831.2.03.A.2
Microsilica (Silica Fume)	831.2.03.A.4
Curing Agents	832
Joint Fillers and Sealers	833
Special Surface Coating	836
Linseed Oil	870.2.06.A.1&2
Mineral Spirits	870.2.06.A.4
Water	880.2.01
Graded Aggregate (3)	815.2.01
Graffiti Proof Coating	838.2.01
Concrete used in Bridge Construction	500.3.04.F
1. Use either Class A or Class B coarse aggregate of the designated size, except when using limestone or dolomite in bridge structures. When using limestone or dolomite, use Class A coarse aggregate.	
2. Use Type I or Type II Portland cement, Type IL Portland-limestone cement, or Type IP Portland-Pozzolan cement unless otherwise specified. Do not use air-entraining cement.	
3. The gradation requirements of graded aggregate are modified to require 30% to 45% by weight passing the No. 10 (2.00 mm) sieve.	
4. Use Type I or III Portland cement or Blended Hydraulic Cement (Type 1L) in High Performance Self Consolidating concrete. Do not use air-entraining cement.	
5. Use Metakaolin as the raw or calcined natural Pozzolan unless otherwise specified.	

Construct bridge sections containing duct enclosures for stressing tendons using concrete with a maximum stone size of No. 7.

Use concrete manufactured at plants that qualify as approved sources according to the Standard Operating Procedure for Ready Mix Concrete (SOP 17). See QPL 10 for a list of approved plants.

Use colored concrete additive made with pure, concentrated mineral pigments especially processed for mixing into concrete and complying with ASTM C 979.

If adding color additives to the mix at the jobsite, furnish color additives in pre-measured Mix-Ready disintegrating bags to minimize jobsite waste.

Do not use accelerator admixtures containing calcium chloride in colored concrete mix.

Use aggregates manufactured to meet the gradation at the quarry. The blending of aggregates at the plant must be requested and approved by OMAT Concrete Branch 30 days prior to production and only used for SCC/HPC-SCC concrete mixes used in prestress/precast products. Use aggregates that are well graded without gradation gaps.

500.2.01 Delivery, Storage, and Handling

A. Aggregate Stockpile

Stockpile aggregate as follows:

1. Keep stockpile areas firm, reasonably level, well-drained, clean, and free of sod or foreign matter.
2. Stockpile aggregate separately by type and source.
3. Form stockpiles using methods and equipment that do not cause the aggregate to segregate, become contaminated, or degrade. The Engineer may reject improperly formed stockpiles.
4. Stockpile aggregate long enough for the moisture content to stabilize.
5. Do not use aggregates stored in pits or silos that contain water.

B. Aggregate Handling

Operate aggregate handling equipment carefully to minimize segregation, breaks, spills, contamination, and mixing of the sizes and types of aggregates.

C. Cement Storage

Store cement as specified below. Reject all caked, lumpy, or contaminated cement.

1. Bulk Cement

   Use bulk cement unless the Engineer allows bag cement to be used.

   Store bulk cement in bins or silos designed for this purpose. Provide moisture-proof storage containers with a mechanism that allows cement to flow freely from the discharge opening.

2. Different Brands

   Store and use cement of different brands and types, or from different mills separately.

D. Admixture Storage and Handling

Carefully store and dispense admixtures as recommended by the manufacturer to prevent contamination.

E. Concrete Handling and Placing

Handle and place concrete according to the following:

1. Haul Time Limitations

   Ensure that concrete reaches its final position in the forms within one hour after adding the cement to the aggregates.

   If retarders or water reducers are used, the allowable time limit increases to 1-1/2 hours. Test concrete immediately for acceptance tolerances before placing in forms using limits established in Table 1—Concrete Mix Table.

2. Placement Limitations

   After delivering the concrete to the job site or the staging area at the site or after mixing the concrete at the site, transport it carefully to the placement point to prevent excessive slump loss or segregation. Use any of the following equipment:

   - Buckets
   - Buggies
   - Pumps
   - Other approved means

F. Form Storage

Store forms off the ground.

G. Precast Unit Handling

Except as noted below, the applicable portions of Subsections 507.2.01, "Delivery, Storage, and Handling," 507.3.05.A, *Prepare Bearing Areas*, 507.3.05.B, *Erecting PSC Bridge Members*, and 507.3.05.D, "*Concrete Finish*, shall govern.

Handle precast, non-prestressed units as follows:

1. Do not lift the units from the casting bed until the concrete reaches a strength of at least 1,500 psi (10 MPa).
2. Do not transport or erect the units until they reach a strength of at least 3,000 psi (20 MPa).
3. Restrict live loads (including erection equipment) on the units until they reach a minimum strength of 4,500 psi (30 MPa).

H. Color Additives

Comply with manufacturer's instructions. Deliver to site or batch plant in original, unopened packaging. Store color additives in dry conditions.

500.3 Construction Requirements

500.3.01 Personnel

A. Supervision, Personnel, and Skilled Workers

Provide enough supervision, personnel, and skilled workers to do the following:

1. Properly produce, place, and finish concrete in each pour unit according to Subsection 500.3.05.P, Table 5—Minimum Placement Rates or as required by the Plans.
2. Check screed clearances and tolerances before beginning deck pours.
3. Place concrete without delays.
4. Provide Technicians possessing both a GDOT Plant Concrete Tester certification and an ACI Self Consolidating Concrete certification. The testing technicians shall be on site during mixing and placement operations of SCC/HPC-SCC and is responsible for all the required testing of SCC/HPC-SCC.

B. Plant Operator Certification

Volumetric proportioning requires that the operator be certified by the Office of Materials and Testing. The volumetric truck may be approved on a per project basis or listed on the Qualified Products List (QPL-100).

500.3.02 Equipment

A. Equipment Restrictions

Do not use delivery, conveyance, or vibratory units that leak grout, water, oil, or gas.

Provide enough equipment, tools, and materials to properly produce, place, and finish concrete in each pour unit according to the Subsection 500.3.05.P, Table 5—Minimum Placement Rates or as required by the Plans.

The Engineer may prohibit equipment that delays concrete placement.

B. Volumetric Proportioning Equipment

When concrete ingredients are proportioned volumetrically, equipment needs to be listed on QPL-100 or obtain the Engineer's approval for the equipment and its calibration and operation.

Ensure the following:

- The equipment meets the specifications in ASTM C 685.
- The concrete producer conducts calibration tests at least every 6 months.
- The equipment is calibrated for each new concrete mix before production.

C. Batching Plant Equipment

Ensure that batching plants have the following equipment and that the equipment meets the standards listed.

1. Bins

   Ensure that bins and bin compartments meet the following standards:

   - Adequate capacity for the required concrete production
   - Supported on a rigid framework on a stable foundation capable of holding the bins securely
   - Designed to discharge efficiently and freely into the weigh hopper
   - Positive means of control that slows down and shuts off the material flow when the weigh hopper has the correct quantity.
   - Discharging mechanisms that prevent material leaks when closed
   - Leak-free aggregate storage bins
   - Divided aggregate storage bins for fine aggregate and each size of coarse aggregate
   - Partitioned aggregate storage bin compartment that prevents the materials from mixing
   - Leak-proof, moisture-proof cement bins with a vibrator or other mechanism to discharge cement

2. Weigh Hoppers

   Ensure that weigh hoppers meet the following standards:

   - Have suitable containers freely suspended from scales
   - Have adequate capacity to maintain the Subsection 500.3.05.P, Table 5—Minimum Placement Rates
   - Have a discharge mechanism that prevents material leaks when closed
   - Have vents to permit air to escape
   - Have vibrators or other equipment that ensures complete and efficient discharge of materials
   - Have a dust seal and a port or valve for sampling cement

3. Scales

   Scales used for weighing concrete materials shall have accuracy within plus or minus one percent under operating conditions.

   Ensure the following:

   - When directed by the Engineer, the owner demonstrates the accuracy of the scales.
   - Scales are kept clean and in good operating condition.
   - The scale operator can clearly see indicating devices.
   - The scale operator can easily access controls.

D. Mixers and Agitators

Ensure that mixers and agitators meet the following requirements:

1. General Requirements for Mixers and Agitators

   Provide mixers and agitators that meet these requirements:

   a. Capacity Plates

   Ensure that the mixer or agitator has a legible metal plate or plates attached in an easily visible location. The plates shall indicate the rated capacity in cubic yards (meters) for mixing and agitating.

   b. Concrete Production

   The mixer shall produce concrete that meets the requirements in the Table 1—Concrete Mix Table.

   c. Mixer Performance Test

   The mixer or agitator may be required to pass a mixer performance test. Mixer performance will be evaluated at the discretion of the Engineer.

   Mixer performance tests will include the following by the OMAT:

   1) Taking samples of concrete at the one-quarter and three-quarter points of the batch discharge
   2) Measuring the slumps of each concrete sample

      If the two slump values differ by more than 2 in. (50 mm), do not use the mixer or agitator until it meets the requirements of the test.

      The Engineer may permit the equipment to be used if the 2 in. (50 mm) tolerance can be met by using a longer mixing time or a smaller batch.

2. Mixing Speed

   Follow these guidelines for mixing speed:

   - Do not exceed 150 revolutions at mixing speed.
   - Discharge all concrete from truck mixers before drum or blades reach 300 revolutions, including revolutions at agitating speed.
   - Use the mixing speed defined by the manufacturer for the mixing equipment.
   - If the manufacturer's definition of mixing speed is not available, use a mixing speed of 6 to 18 revolutions per minute.

3. Mixer and Agitator Maintenance

   Maintain mixers and agitators as follows:

   a. When mixers and agitators are discharged, remove the entire contents before adding materials for the next batch.
   b. Clean mixers and agitators often to prevent concrete and grout accumulation.
   c. Do not discharge cleaning water into any pipe, catch basin, or structure.
   d. If cement or aggregates accumulate in mixers and agitators when cleaning water is discharged, remove them immediately at no expense to the Department.

4. Mixer Types

   Use stationary mixers or truck mixers.

   a. Stationary Mixers

   Ensure that stationary mixers meet the following standards:

   1) Combine the concrete ingredients into a homogeneous, uniform mass within the specified time and when loaded to capacity.
   2) Efficiently and uniformly discharge the concrete within the tolerances allowed in Subsection 500.3.02.D.1.c, *Mixer Performance Test*.
   3) Permit discharge only after the specified mixing time has elapsed using a locking device.

b. Truck Mixers

Ensure that truck mixers meet the following standards:

- Meets the requirements listed in Subsection 500.3.02.D.4.a, *Stationary Mixers*
- Has an approved revolution counting device in good operating condition
- Does not haul more than the rated capacity in cubic yards (meters) as shown on the attached capacity plates

5. Agitator Types

Use truck agitators or truck mixers operating at agitating speed.

Ensure that agitators meet the following requirements:

a. Keeps the mixed concrete in a homogeneous, uniform mass
b. Efficiently and uniformly discharges the concrete within the tolerances allowed in Subsection 500.3.02.D.1.c, *Mixer Performance Test*

E. Concrete Buckets

Keep concrete buckets clean and in good working condition.

F. Concrete Buggies

Keep concrete buggies clean and in good working condition.

G. Concrete Pumps

Concrete pumping equipment is subject to the Engineer's approval. Use pumping equipment that has adequate capacity and is suitable for the proposed work.

H. Chutes and Troughs

Do not use chutes longer than 50 ft. (15 m) without the Engineer's permission.

Flush chutes and troughs with water after each run. Do not discharge this water into freshly placed concrete or into conveyance unit.

Promptly remove hardened concrete from chutes and troughs.

Ensure that chutes and troughs meet the following requirements:

1. Metal or metal lined
2. Slope not exceeding one vertical to three horizontal
3. Baffles or a series of short lengths placed to reverse the direction of the concrete flow, when used on steep slopes

I. Pipes or Tubes

Use pipes or tubes to place concrete when the operation requires dropping the concrete more than 5 ft. (1.5 m). Thoroughly clean the pipes or tubes after each pour.

Use pipes made of metal or other approved material and long enough to deposit the concrete as close to its final position as possible.

J. Vibrators

Provide enough vibratory units, including at least one additional stand-by unit in good working condition, to compact concrete immediately after it is placed. Have a stand-by unit at the site before each pour is started.

On Projects consisting entirely of small pours (10 yd^3 [8 m^3] or less), the Engineer may waive the stand-by requirement.

Ensure that vibrators meet the following conditions:

- Approved internal rotation-type design
- A power supply that constantly vibrates the concrete at frequencies of not less than 4500 impulses per minute

- A vibration intensity that visibly affects a mass of concrete with a 1 in. (25 mm) slump through at least a 18 in. (460 mm) radius

The use of internal vibrators is permitted in congested reinforcing areas of prestress products for no longer than 3 seconds during the handling or placement of Self Consolidating Concrete. Any vibration must be approved, and supervised, by the on-site Quality Control Supervisor. No form vibrators are allowed.

K. Screeds

Do not use vibratory screeds (screeds that use a transverse strike-off motion) without the Engineer's approval. Use screeds that are:

- Mechanically operated
- Designed and constructed to screed with the strike-off parallel to the center line
- Readily adjustable
- Capable of maintaining proper adjustment throughout the screeding operation

The two screed types are:

1. Longitudinal Screeds

   Unless otherwise noted on the Plans, use longitudinal screeds only on pour lengths of 70 ft. (20 m) or less.

2. Transverse Screeds

   Use transverse screeds on any pour, unless otherwise noted on the Plans. However, transverse screeds are required on pour lengths above 70 ft. (20 m).

Support screeds outside the pour area that will receive a surface finish. Do not use intermediate supports or guides.

Adjust screeds to the camber specified on the Plans. Check the camber as often as necessary.

Have the Engineer approve the following for screeds and their supports:

- Weight
- Durability
- Adjustability
- Accuracy
- Mechanical condition
- Operational results

Furnish the equipment necessary to check screed clearances and tolerances before pouring decks.

L. Underwater Placement Equipment

Place concrete under water using the following underwater placement equipment:

1. Tremie

   Use a tremie when depositing concrete in water above 10 ft. (3 m) deep. Ensure that tremie is:

   - At least 8 in. in (200 mm) diameter
   - Constructed in sections with watertight couplings

2. Bottom Dump Bucket

   Where the Engineer permits, use a bottom dump bucket in water up to 10 ft. (3 m) deep.

   Ensure that the bottom of the bucket opens only when it touches the surface that receives the charge and that the top of the bucket has a lid or cover.

M. Fogging Equipment

To supply additional moisture to the concrete, use fogging equipment with the following characteristics:

- A heavy-duty pump capable of delivering 2-gal (7.6 L) of water per minute to a 0.062 in. (1.6 mm) diameter tip at an air pressure of 100 psi (700 kPa).

  An example of a suitable pump is the Alemite Pump 7878-A.
- The ability to consume approximately 22 ft³/min. (0.6 m³/min) of compressed air
- A 3/8 in. (10 mm) inside diameter hose long enough to reach all areas of the deck
- An adjustable spray gun and tip to provide various patterns of atomized spray or fog for changing finishing conditions

  An example of a suitable spray gun is the Gun Jet No. 43 with a 120-2 Multi Jet Nozzle.

If necessary, substitute other equipment that is capable of equal performance.

500.3.03 Preparation

A. Pre-Pour Conference

Before beginning deck placement operations on each Project, and for individual deck pours of an unusual nature, the Engineer will schedule a pre-pour conference with Project supervisory personnel, and a representative of the concrete supplier, if applicable. Project supervisory personnel will coordinate with a representative from the Concrete Branch of OMAT.

Conference topics of discussion include the following:

- Reinforcing steel support method
- Final screed setting check
- Anticipated placement rate
- Personnel number
- Equipment type
- Curing methods
- Adverse weather placement procedures
- Emergency procedures
- Other Work-related details

500.3.04 Fabrication

A. Measure Materials

Measure materials as follows:

1. **Cement.** Weigh bulk cement on scales to plus or minus one percent of the designated weight. If the Engineer allows bag cement, proportion the batch to use only whole bags.
2. **Aggregates.** Weigh all aggregates on scales to plus or minus two percent of the designated weight. Apply the proper corrections for aggregate surface moisture.
3. **Water.** Measure water by volume or weight to within plus or minus one percent.
   a. Construct the measuring system to be independent of water pressure fluctuation.
   b. Ensure that measuring systems have outside taps and valves to facilitate plant calibrations.
   c. You may use recycled wash water provided that it meets the requirements of Subsection 880.2.02.
4. **Admixtures.** Measure admixtures by weight or volume within plus or minus three percent of the required amount.

B. Control Concrete Batching

Control batching as follows:

1. Mix batches of concrete according to the proportions of an approved mix design.
2. Ensure that concrete materials are from the designated sources.
3. Correct the batch weights to account for surface moisture in aggregates.

4. Conduct batching control tests according to the procedures in the Sampling, Testing, and Inspection Manual.

C. Prestressed Concrete Deck Panel Requirements

Do not use prestressed concrete deck panels unless approved by the Engineer.

D. Add Admixtures to Concrete

Additives are required when specified herein or as directed by the Engineer.

1. Air-Entraining Admixtures
    a. All bridge structure concrete uses air-entraining additives, except for seal concrete and non-exposed footings.
    b. The Contractor may use air-entraining additives in other concrete to improve workability when job or material conditions dictate.

    When using air-entraining additives as an option to improve workability or when required, do not exceed the upper limit of the entrained air content requirement in the Table 1—Concrete Mix Table.
2. Retarding Admixtures

    Use concrete-retarding additives in bridge concrete when the average temperature is above 65 °F (18 °C) (the average of the expected high and the predicted low).
    a. Normally, concrete-retarding additives are not required for bridge curbs, handrails, crosswalks, or other appurtenances constructed separately from the decks.
    b. The Engineer may waive the use of retarders in substructure concrete when concrete can be placed within one hour after batching.
3. Water-Reducing Admixtures

    The Contractor may use water-reducing admixtures in Class AA or Class D concrete for bridge decks when conditions do not require a retarder. The Contractor may use water-reducing admixtures in other concrete when job or material conditions dictate a reduction in water requirements or when minimal set retardation is desired.

    The laboratory may allow Type F water-reducing admixtures when the Contractor requests it. The Contractor may construct bridge sections containing duct enclosures for stressing tendons with concrete using Type F (AASHTO M 194/ M 194M) water reducer as approved by the laboratory.

    The Contractor may use Type F or G high range water-reducing admixtures in combination with water-reducing admixtures or mid-range water-reducing admixtures in the production of SCC/HPC-SCC for prestress/precast products at the discretion of OMAT Concrete Branch.

    Ensure that the SCC/HPC-SCC mix meets the requirements of Subsection 500.1.03.A.4 and that water-reducing admixtures meet the requirements of Subsection 831.2.02, “Chemical Admixtures for Concrete”.

4. Fly Ash

    The Contractor may use fly ash as an additive in concrete to promote workability and plasticity. The Contractor may use fly ash as a partial replacement for Portland cement in concrete if the following limits are met:
    a. Replace no more than 15 percent of the cement by weight.
    b. Replace cement with fly ash at the rate of 1.0 to 1.5 lbs. (1.0 to 1.5 kg) of fly ash to 1.0 lb. (1.0 kg) of cement.
    c. Ensure that the fly ash mix meets the requirements of Subsection 500.1.03.A, Subsection 830.2.03, *Portland Pozzolan Cement* and Subsection 831.2.03.A, *Fly Ash*.
    d. Calculate water-cement ratio based on the total cementitious material in the mix including fly ash.
    e. Do not use Type IP cement in mixes containing fly ash.
5. Granulated Iron Blast-Furnace Slag

    If high-early strengths are unnecessary, the Contractor may use granulated iron blast-furnace slag as a partial replacement for Portland cement in concrete if the following limits are met:
    a. Replace no more than 50 percent of the cement by weight.

b. Replace the cement with slag at the rate of 1.0 lb. (1.0 kg) of slag to 1.0 lb. (1.0 kg) of cement.

c. Ensure that the slag mix meets the requirements of Subsection 500.1.03.A.3, Subsection 830.2.02, *Portland Blast-Furnace Cement* and Subsection 831.2.03.A.3, *Granulated Iron Blast-Furnace Slag*

d. Calculate the water-cement ratio based on the total cementitious material in the mix including granulated iron-blast furnace slag.

e. Do not use Type IP cement or fly ash in slag mixes.

6. Viscosity Modifying Admixtures

The Contractor may use viscosity modifying admixtures (VMA) to attain the desired SCC performance.

When using a VMA, ensure that the SCC mix meets the requirements of Subsection 500.1.03.A.4 and that the VMA causes no harmful effects in the hardened concrete.

Chemical admixtures may be used to increase the slump of the concrete if this is shown on the approved mixture design. Chemical admixtures may be used to alter the slump flow and stability of self-consolidating concrete if these admixtures are shown on the approved mix design sheet.

7. Supplementary Cementitious Materials

The Contractor may use supplementary cementitious materials (SCMs) as additives in SCC to promote workability, plasticity, and high-early strengths. The Contractor may use SCMs as a partial replacement for Portland cement in SCC if the following limits are met:

a. No more than three SCMs can be used in a SCC mixture.

b. When one SCM is used, replace no more than 20 percent of the cement by weight.

c. When two or three SCMs are used, replace no more than 40 percent of the cement by weight.

d. The SCMs can be fly ash, ground iron blast furnace slag, microsilica or metakaolin used singly or in combination.

e. Calculate the water-cement ratio based on the total cementitious material in the mix including all SCMs.

f. Fly Ash

- If Class F or Class C fly ash is used, the loss of ignition of the fly ash shall not exceed 3 percent.
- Ensure that the fly ash mix meets the requirements of Subsection 500.1.03.A.4 and Subsection 831.2.03.A.1, “Fly Ash”.

g. Granulated Iron Blast-Furnace Slab

Ensure that the slag mix meets the requirements of Subsection 500.1.03.A.4 and Subsection 831.2.03.A.3, “Granulated Iron Blast-Furnace Slag”.

h. Microsilica

Ensure that the microsilica mix meets the requirements of Subsection 500.1.03.A.4 and Subsection 831.2.03.A.4, “Microsilica”.

i. Metakaolin

Ensure that the metakaolin mix meets the requirements of Subsection 500.1.03.A.4 and Subsection 831.2.03.A.2, “Raw or Calcined Natural Pozzolan”.

E. Mix Concrete

1. Central-Mixed Concrete

Mix central-mixed concrete as follows:

a. Establish the mixing time.

The Engineer will determine the mixing time for central mixed concrete, but the minimum mixing time will be one minute for stationary mixers of up to 1 yd^3 (1 m^3) capacity. Mixing time may be adjusted in the following situations:

- The Engineer will increase the minimum time by 15 seconds for each additional cubic yard (meter) or fraction thereof.
- For mixers with a capacity above 3 yd^3 (2 m^3), the minimum mixing time may be 90 seconds if the resulting mixture is homogeneous and meets the requirements of Subsection 500.3.02.D.1.c, *Mixer Performance Test*.
- The Engineer may waive mixing time requirements for stationary mixers of improved types or new designs that produce homogeneous concrete in less time than that established for a particular capacity by the foregoing. For these types of mixers, the Engineer may establish a minimum mixing time of one minute.

b. Start the mixing time when all cement and aggregates have been placed in the mixer.

c. Add some water to the mixer before adding the cement and aggregates, but ensure all water is in the mixer by the end of the first 1/4 of the specified mixing time.

2. Shrink-Mixed Concrete

Mix shrink-mixed concrete as follows:

a. Mix the batches as specified in Subsection 500.3.02.D.2. *Mixers and Agitators*.

b. Do the initial mixing in a stationary mixer for at least 30 seconds to thoroughly mix the ingredients. Do the final mixing in truck mixers.

c. Discharge all concrete before the drum or blades exceed 300 revolutions.

d. Do not allow truck mixing at mixing speed to exceed 100 drum or blade revolutions except as allowed when adding water according to Subsection 500.3.05.M, *Add Water to Concrete*.

3. Transit-Mixed Concrete

Mix transit-mixed concrete as follows:

a. For concrete mixed completely in a truck mixer, place all concrete ingredients into the mixer at the concrete plant except the quantity of water that may be withheld according to Subsection 500.3.05.M, *Add Water to Concrete*.

b. After loading the truck, begin operating at either agitating or mixing speed; however, start the mixing speed within 30 minutes after loading the truck mixer.

c. Mix the concrete for 70 to 150 revolutions at mixing speed.

For revolutions above those specified for mixing speed, use agitating speed.

d. Discharge all concrete before exceeding 300 drum or blade revolutions.

4. Colored-Mixed Concrete

a. Proportion, batch and mix color additives in accordance with manufacturer's instructions. Mix until color additives are uniformly dispersed throughout mixture and disintegrating bags, if used, have disintegrated.

b. If mixed at batch plant, schedule delivery of concrete to provide consistent mix times from batching until discharge.

F. Concrete Used in Construction

1. Requirements

Use Type I or Type II Portland cement, Type IL Portland-limestone Cement or Type IP Portland-Pozzolan cement for bridge construction, unless otherwise specified.

NOTES:

1. Do not use air-entraining cement.

2. Do not use accelerators (24-hour accelerated strength concrete) that contain chlorides in any bridges where the concrete containing the additive will contact the reinforcing steel.

3. Type IL Portland-limestone Cement may be used anywhere that Type I or Type II Portland cement is specified.

Concrete Types: Use the tabulated results from the Table 1—Concrete Mix Table for the classes and specific requirements for each class of concrete. Use the appropriate class of concrete shown in the Plans or specifications for each component of a structure, of the type as follows:

a. Class AAA–Prestressed concrete and precast concrete as called for on the plans.

b. Class AA1–Precast concrete as called for on the plans

If approved by the Engineer, you may use this class as high early-strength concrete and may use Type III cement in concrete used for this purpose.

The Engineer may also specify the rate of compressive strength development when this concrete is used

NOTE: The Department will not add compensation to the Contractor for Class AA1 concrete when it is used at the request of the Contractor.

c. Class D – Bridge superstructure concrete as called for on the plans.

d. Class AA–Bridge concrete, cast in place concrete, or precast concrete as called for on the plans

e. Class A–General purposes

NOTE: Do not air-entrain Class A concrete deposited in water (seal concrete). Ensure that the concrete has 10 percent additional cement and sufficient water to provide a 6- to 8-in. (150- to 200-mm) slump.

f. Class B–Massive sections or lightly reinforced sections or miscellaneous non-structural concrete

g. Class CS– (Portland cement concrete subbase). Use this class as a subbase where required by the Plans. Concrete subbase may be composed of a mixture of Portland cement and graded aggregate or Portland cement, aggregate, and sand.

2. Acceptance of Design

Determine laboratory acceptance strength by at least 8 compressive test specimens prepared and cured according to AASHTO R 39.

a. Make the specimens from two or more separate trial batches.

b. Make an equal number of specimens from each batch.

c. Calculate the minimum average strength or acceptance strength (X) as follows:

$X = f'c + 2.0s$

Where:

f ‘c = required minimum compressive strength for each class of concrete from the Table 1—Concrete Mix Table

s = average standard deviation of all 28-day specimens made in the field representing concrete of a given class from all ready-mix plants

Use the standard deviations shown in Table 4:

Table 4—Standard Deviations for Calculating Acceptance Strength

Class of Concrete	Standard Deviation (s)	
	Psi	(MPa)
B	370	(2.5)
A	650	(4.5)
AA	620	(4.3)
D	590	(4.0)
AA1	540	(3.7)
AAA	500	(3.4)

500.3.05 Construction

A. Meet General Responsibilities

General construction responsibilities include:

1. Batch, mix, deliver, and place concrete according to the Specifications.
2. Have enough production and placement capacity to continuously mix, place, and finish the concrete in each pour unit during daylight hours.

   If necessary, place concrete at night when adequate lighting facilities exist, and the Engineer approves of the operations and facilities.
3. If a pour cannot be completed, do the following:
   a. Form an approved construction joint.
   b. Remove the partial pour.
   c. Take other remedial measures directed by the Engineer at no additional expense to the Department.
4. Schedule placement to minimize exposure of freshly poured concrete to potentially harmful drying elements such as wind and sun before curing materials are applied and protect freshly poured concrete from exposure to excess moisture and freezing for a minimum of 24 hours when such weather conditions exist.

B. Construct Falsework

Accept responsibility for the design, construction, protection, and performance of falsework. Repair or remove and replace (as the Engineer directs) concrete, other material, or portions of the structure that are damaged or destroyed due to falsework failure.

Construct falsework for prestressed post-tensioned concrete structures according to the Contract Special Provisions.

Construct falsework for structures other than post-tensioned box girders as follows:

1. Meet Design Criteria

   Ensure that falsework structural components that have similar functions in an individual permanent span have the same geometric properties and are made of the same materials.

   When designing and centering formwork, treat concrete as a liquid, and use the following weights:

   - 150 lbs./ft.³ (23.6 kN/m³) for vertical loading
   - 85 lbs./ft.³ (13.4 kN/m³) for horizontal loading
   - 75 lbs./ft.² (3.6 kN/m²) live load for deck placement operations

   Use the following falsework design criteria:

   - Design and construct falsework logically so the Bridge Design Office can analyze it using a commonly accepted structural design theory.

- Avoid exceeding safe working values for material stresses.
- Provide support for the imposed loads, without settling or deforming and a way to compensate for settlement, if it occurs.

2. Support Falsework

   Support falsework using one of these methods:

   - Support on piling driven and removed as directed
   - Found on a footing approved by the Engineer

3. Construct Falsework

   Construct and set falsework to provide the finished structure the specified camber and finished grade.

   Place “telltales” at locations directed by the Engineer to observe how much the falsework settles.

C. Meet Form Design Criteria

Ensure that forms meet the following design criteria:

- Provide wet concrete and other loads and forces of construction support without bulging between the supports or bracing and without deviating from the lines and contours shown on the plans.
- Meet the design criteria for falsework in Subsection 500.3.05.B.1, *Meet Design Criteria*.
- Account for the use of retarded concrete.

Ensure that bracing, ties, and supports are placed accurately.

If the formwork appears to be inadequately supported, tied, or braced (before or during concrete placement), the Engineer may require that the Work stop until the defects are corrected.

D. Use Acceptable Form Materials

Except as noted, fabricate forms from the following materials:

- Lumber
- Plywood
- Metal
- Plastic
- Combinations of these

Use material free of defects that materially affect form strength or materially impair the accuracy or appearance of the concrete surface.

Use the form materials as follows:

1. Lumber Forms

   Construct wood forms as follows:

   a. Size and dress the lumber.
   b. Use lumber at least 1 in. (25 mm) thick.
   c. Use lumber for header forms used as screed supports and for curb face forms at least 2 in. (50 mm) thick.
   d. Avoid using scrap material or doing patchwork.
   e. Stagger all joints but those between abutting panels.
   f. Line the lumber used to form outside vertical surfaces of exterior beams or girders with an approved form liner.
   g. Use chamfer strips mill-produced from high-quality lumber, free of defects.
   h. Dress and finish chamfer strips on all three sides.
   i. Size chamfer strips to the proper dimensions.

2. Plywood Forms

   Construct plywood forms as follows:

a. If plywood is the type made for general concrete forms and is at least 5/8 in. (16 mm) thick, use it in place of 1 in. (25 mm) thick lumber to construct forms, if necessary.
b. Ensure that plywood used to form open joints and to line forms is at least 1/4 in. (6 mm) thick.
c. When nailing plywood directly to form studs, do not space the studs more than 16 in. (400 mm) apart.
d. Use plywood in full sheets wherever practical. Do not do patchwork with small, irregular pieces.
e. Have the Engineer inspect and approve plywood sheet layout.

3. Metal or Plastic Forms
   a. Construct metal or plastic forms as follows:
   b. Use metal or plastic to form concrete only if the Engineer approves the forms and if the forms produce satisfactory results.
   c. Use metal forms that produce finished concrete equal to or superior to concrete made from comparable wooden forms.
   d. Countersink bolts and rivets in the surfaces of metal forms that touch concrete.
   e. Grind welds smooth in the surfaces of metal forms to provide a smooth plane surface.
4. Other Material Uses

   Use tempered fiberboard for form liners when necessary if it is at least 1/4 in. (6 mm) thick. Use tempered fiberboard 1/8 in. (3 mm) thick only to form open joints. Support the fiberboard with suitable spacers arranged properly.

   Use approved synthetic materials for forming open joints and for other special uses, if necessary.

E. Construct Form Supports

Construct form supports using metal ties, anchors, and hangers as follows:

1. Construct supports that will remain in the finished concrete so they can be removed from the concrete face to a depth of at least 1 in. (25 mm) without damaging the concrete.
2. Weld form supports to girder or beam flanges in continuous or cantilever spans only in the flange areas which are in compression.
3. When ordinary wire ties or snap ties are permitted, cut them back at least 3/8 in. (10 mm) from the face of the concrete.
4. Design metal tie fittings that minimize the cavities made when they are removed. Fill all cavities after removing metal tie fittings.

F. Construct Temporary Forms

Construct temporary forms as follows:

1. Construct and maintain forms in a mortar-tight condition.
2. Construct forms so that they can be removed easily without damaging the concrete, unless using forms that will remain in place.
3. Build, line, and brace forms so that the formed concrete surface conforms with the dimensions, lines, and grades shown on the plans.
4. Build headwall forms for skewed pipe parallel to the roadway centerline or at right angles to the radius on curves. Construct headwall forms as follows:
   a. Lay enough pipe to extend through the headwall form.
   b. After the concrete is poured and hardened, carefully cut and dress the protruding pipe ends so no ragged edges remain.

   The Contractor may choose, as an alternate to the above method, to build a circular form that exactly fits the pipe circumference and face of the headwall form.
5. Construct form liner using plywood or other approved form liner as follows:
   a. Use form liner in large sheets. Do not do patchwork.
   b. Avoid irregular joint location in form liners.

c. Have the Engineer inspect and approve the proposed liner layout.

6. Bevel forms at beam copings, girders, and other projections to ease removal.
7. Place chamfer strips to chamfer exposed edges of the concrete by the required amount. Use ¾ in. (19 mm) chamfers unless otherwise shown on the plans.
8. Patch with tin or other metal only in those areas of the superstructure lying between and including the inside faces of the exterior beams.
9. When shown on the plans, splice water stops to form continuous water-tight joints. Hold stops in position while placing concrete.
10. Immediately before erecting forms or just before placing bar reinforcement steel, coat forms with a clear oil or other bond breaker to keep concrete from sticking to the forms.
    a. Do not allow the substance to stain or soften the concrete surface.
    b. Do not apply by reaching or pouring through previously placed reinforcement steel.
11. Wait to place concrete in any form until the Department inspects and approves the form.

    Inspection and approval does not diminish the responsibility to produce concrete surfaces free of warping, bulging, or other defects.
12. When removing forms, remove chamfer strips, blocks, and bracing.
13. Do not leave any part of a wooden form in the concrete.
14. If concrete surfaces do not meet finish specifications, correct the problems with the following steps, as directed by the Engineer:
    - Repair the defects using approved methods.
    - Remove and replace the affected portion of the work.

G. Reuse Forms

Reuse forms and form material in good condition and satisfactory as determined by the Engineer. Do not use forms or form materials that are warped, cracked, split, bulging, have separated plies, or have unsatisfactory form liner.

Ensure that used forms are mortar tight and produce a finished concrete equivalent to that produced by new forms.

H. Construct Permanent Steel Bridge Deck Forms for Concrete Deck Slabs

Unless otherwise designated on the Plans, construct and use permanent steel bridge deck forms for concrete bridge deck slabs according to these Specifications. Do not use permanent steel bridge deck forms in panels where longitudinal deck construction joints are located between stringers.

Provide a structurally satisfactory slab when using permanent steel bridge deck forms.

1. Fabricate permanent steel bridge deck forms and supports from steel that conforms to ASTM A 653/653M Designation SS, Grade 60/400, Coating Designation G-165/Z-500 and ASTM A 924/924M.
2. Design permanent steel bridge deck forms as follows:
    a. Account for the dead load of the following:
        - Form
        - Reinforcement steel
        - Plastic concrete
    b. Add 50 lbs./ft² (2.4 kN/m²) for construction loads.
    c. Ensure that the unit working stress in the steel sheet does not exceed 0.725 of the specified minimum yield strength for the material furnished. However, do not allow the unit working stress to exceed 36,000 psi (250 MPa).
    d. Account for deflection under the weight of the forms, the plastic concrete, and the reinforcement as follows:
        1) If deflection exceeds 1/180 of the design span or 1/2 in. (13 mm), whichever is less, use intermediate supports.

2) Do not base deflection on a total load of less than 120 lbs./ft² (5.7 kN/m²).

e. Base the permissible form camber on the actual dead load condition.

f. Do not use camber to compensate for deflection that exceeds the above limits.

g. Compute the form sheets design span using the clear span of the form, plus 2 in. (50 mm), measured parallel to the form flutes.

h. Compute physical design properties according to the requirements of the latest published edition of the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members.

i. Ensure that all bottom reinforcement has a minimum concrete cover of 1 in. (25 mm) as shown in Figure 1. (Figure 1 metric).

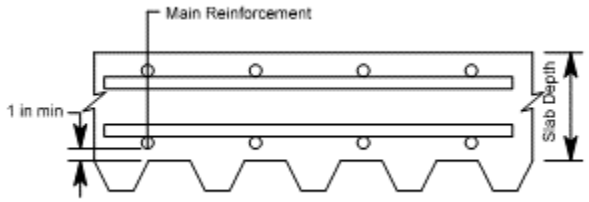


FIGURE 1

j. Maintain the Plan dimensions of both layers of primary deck reinforcement from the top surface of the concrete deck.

k. Do not use precast mortar blocks to support the deck reinforcement.

l. Do not treat permanent steel bridge deck forms as lateral bracing for the compression flanges of supporting structural members.

3. Do not weld to flanges in tension or to structural steel bridge elements fabricated from non-weldable steel grades.

   Have welders certified by the Department weld metal deck forms or supports for metal deck forms.

I. Install Forms

Install and maintain forms in a mortar-tight condition and according to approved fabrication and erection Plans.

Place transverse construction joints at the bottom of a flute. Field drill 1/4 in. (6mm) weep holes no less than 12 in. (300 mm) on center along the line of the joint.

1. Highway Bridge Forms

   Install highway bridge forms with a 1 in. (25 mm) minimum clearance between the top of the form and the bottom of the main deck reinforcement. See Figure 1.

2. Railroad Bridge Forms

   Install railroad bridge forms as follows:

   a. Place the forms so the tops of the form ribs adjacent to the beam flange are at the bottom of the deck slab specified by the plans.

   b. Maintain the full slab depth detailed on the plans.

   c. Do not allow form ribs to project above the plan bottom of the deck slab.

   d. Do not place form sheets directly on top of the stringer or floor beam flanges.

   e. Securely fasten form sheets to form supports using self-drilling screw fasteners, not by welding. If the Engineer approves, use fastener pins driven into place by a power tool.

   f. Ensure that form sheets have a minimum bearing length of 1 in. (25 mm) at each end.

   g. Do not leave loose sheets or accessories on the deck at the end of a day's work.

   h. Place form supports so that they contact the flange of the stringer or floor beam.

i. Attach form supports using welds, bolts, clips, or other approved means.

j. Do not weld form supports to the flanges of non-weldable steel or to portions of the flange subject to tensile stresses.

k. Ensure that welding and welds comply with AWS D 1.5 for fillet welds. However, 1/8 in. (3 mm) fillet welds are permitted.

J. Repair Damaged Forms

Repair permanently exposed form metal to the Engineer's satisfaction if the galvanized coating is damaged.

1. Clean the damaged area.
2. Go over the damaged area with a wire brush.
3. Paint the area with two coats of zinc oxide-zinc dust primer that meet Federal Specification TT-P-641d, Type II and has no color added.
4. Do not touch up minor heat discoloration in weld areas.

K. Construct Runways

Provide runways into a deck pour area for moving buggies. If the Engineer approves, use runways to bridge a previous pour that has not reached the minimum strength or age requirements in Subsection 500.3.05.AF.4, *Live Loads—Pouring Equipment*.

Construct and support runways to protect the forms and the reinforcement steel position.

L. Construct Work Bridges

Provide a work bridge on deck pours. Support the bridge outside the area of the pour receiving a surface finish. If two or more spans will be poured on the same day, the Engineer may require two work bridges.

Design and construct work bridges to meet the following:

- Do not allow the bridge to sag into the fresh concrete.
- Construct the bridge so that transverse finish and curing material can be applied easily regardless of the screed type.

M. Add Water to Concrete

Add water to the concrete at the concrete plant. Do not add indiscriminate amounts of water at the job site.

If placement conditions require concrete of a more workable consistency, add small amounts of water at the job site if approved by the Engineer.

Add water at the job site as follows:

1. Determine the quantity of water required to provide the necessary consistency.

   The Engineer will not approve additions of water that cause the total amount of water to exceed the maximum water/cement ratio established in the Table 1—Concrete Mix Table .

   The Engineer will reject concrete with water added to it that produces a higher slump than specified in the Table 1—Concrete Mix Table .
2. Do not add water to concrete that has begun to set because of excessive mixing or to concrete that has exceeded mixing or haul time limitations.
3. When adding the water, carefully control the conditions.
4. Position the delivery so the measuring operation is not affected.
5. Measure the water carefully.
6. Inject the water into the mixer forcefully to facilitate uniform mixing.
7. Add water before discharging an appreciable amount of concrete.
8. Do not add more water after concrete discharge begins.
9. After adding the water, mix the concrete an additional 30 revolutions.
10. Finish mixing the concrete before the total revolutions at mixing speed exceed 150.

N. Volumetrically Proportion Concrete

Concrete ingredients may be proportioned volumetrically when non-air entrained concrete is used in miscellaneous concrete, non-exposed footings, culverts smaller than bridge culvert size, or when approved by the Engineer.

O. Prepare for Concrete Placement

Prepare for concrete placement as follows:

1. Ensure that an adequate supply of concrete will be furnished and placed to meet the requirements specified in Subsection 500.3.05.P, Table 5—Minimum Placement Rates for Bridges, Culverts and Retaining Walls.
2. To ensure a full bond between prestressed concrete deck panels and the cast-in-place concrete, clean the panel before placing the slab concrete.
3. Immediately before placing cast-in-place slab concrete, saturate the prestressed concrete deck panels with water.
4. Immediately before placing concrete in the forms, the concrete will be measured for acceptance tolerances. Acceptance tolerances for each class of concrete are listed in the Table 1—Concrete Mix Table .

   Conduct the applicable tests according to the procedures in the Sampling, Testing, and Inspection information.

P. Meet the Minimum Placement Rates

If concrete is not produced, placed, and finished according to the minimum placement rates, the Engineer may reject the pour. Concrete pours of a similar nature and size will not be allowed until the problem is corrected and the placement rate met.

The minimum placement rates are listed in Table 5:

TABLE 5—MINIMUM PLACEMENT RATES FOR BRIDGES, CULVERTS AND RETAINING WALLS

1. Bridge Substructure

Pour Size in Cubic Yards (Meters)	Minimum Placement Rate in Cubic Yards (Meters) per Hour
0-25 (0-19)	10 (8)
26-50 (20-39)	15 (12)
51-75 (40-59)	20 (15)
76-100 (60-75)	25 (20)
101 and over (76 and over)	30 (25)or as designated on the Plans or in the Special Provisions

The minimum placement rate for columns shall be the same as for culvert sidewalls and wingwalls.

2. Bridge Superstructure

Pour Size in Cubic Yards (Meters)	Minimum Placement Rate in Cubic Yards (Meters) per Hour
0–25 (0-19)	15 (12)
26–50 (20–39)	20 (15)
51–75 (40–59)	25 (20)
76 and over (60 and over)	30 (25) or as designated on the Plans or in the Special Provisions

Pour handrail, parapet, curb, and barriers at a rate satisfactory to the Engineer.

3. Culverts

Structure	Minimum Placement Rate in Cubic Yards (Meters) per Hour
Footings and slabs	Same as for bridge substructures
Sidewalls and wingwalls	Use placement rates so that fresh concrete is not placed on concrete that has attained its initial set. Cover all concrete with fresh concrete within 45 minutes.

4. Retaining Walls

Structure	Minimum Placement Rate in Cubic Yards (Meters) per Hour
Footings	Same as for bridge substructures
Walls	Same as for culvert sidewalls and wingwalls

Q. Place Concrete

Place concrete as follows:

1. Do not allow aluminum to touch the concrete while mixing, transporting, handling, or placing it.
2. Transport, handle, and place concrete quickly so that it reaches its final position in the forms within the haul time limitations in Subsection 500.2.01.E.1, *Haul Time Limitations*.
3. Manipulate the delivery or conveyance unit to avoid vibration damaging to partially set concrete.
4. Immediately before placing the concrete, thoroughly clean and wet the forms.
5. Place concrete as close as possible to its final position in the forms.
6. Use chutes, troughs, or tubes to pour the concrete in the forms, without displacing reinforcement steel.
7. Modify or stop using the equipment if chutes, troughs, or tubes cause honeycombed or otherwise inferior concrete.
8. When placing concrete by pumping, operate the pumping equipment so that the concrete is produced in a continuous stream without air pockets.

NOTE: Convey and place concrete by pumping only when specified in the Contract or when authorized by the Engineer.

9. When concrete placement requires dropping the concrete more than 5 ft (1.5 m), use pipes or tubes to place the concrete.

   Do not allow concrete to free-fall more than 5 ft. (1.5 m) from the pipe or tube.
10. Place concrete in horizontal layers no more than 18 in. (0.5 m) thick.
11. Place and compact succeeding batches in each layer before the preceding batch takes its initial set.
12. Place each succeeding layer before the underlying layer sets.
13. Consolidate the concrete to avoid cold joints between layers.
14. If the forms sag or bulge while concrete is being placed, remove the concrete causing the distortion and the concrete in adjoining areas if the Engineer requires. Removal prevents cold joints and displaced or damaged reinforcement.
15. Work the concrete around reinforcement bars without displacing them.
16. Compact concrete using suitable tools and vibration.
17. Vibrate concrete where it is deposited and vibrate other concrete while it is fresh. Vibrate as follows:
    a. Insert and withdraw vibrators slowly.
    b. Manipulate vibrators to work the concrete around reinforcement and embedded fixtures and into corners of forms.

c. Vibrate sufficiently to compact the concrete but avoid causing the concrete to segregate.
d. Stop vibrating before local areas of grout are formed.
e. Apply vibrators no farther apart than twice the radius through which the vibration is visibly effective.
f. Do not use vibrators or any other means that could cause segregation to move masses of concrete in the forms.
g. Do not apply vibrators to sections of concrete that are no longer plastic.
h. Vibrate concrete-filled steel grid floors by applying the vibrators to the steel.
i. Vibrate concrete for precast or prestressed units as specified above in steps **a through g**, unless the Engineer approves alternate methods.
j. Stop vibration when a mortar line appears on the face of the form and when the coarse aggregate particles are submerged in the concrete mortar.

18. Supplement vibration with spading to ensure smooth surfaces and dense concrete along form faces and in locations difficult to reach with vibrators.
19. After concrete sets initially, do not disturb the forms or the projecting reinforcing bars.

R. Create Construction Joints

Place construction joints according to the Plans or as directed by the Engineer.

If an emergency affects continuous placement, the Engineer will decide if a construction joint is allowed. If allowed, the Engineer will provide instructions about where and how to make the joint.

The Engineer may eliminate certain construction joints if placement, finishing and forming methods can produce satisfactory results.

Create construction joints as follows:

1. Remove mortar splashed on form surfaces and projecting reinforcement steel before concrete reaches its initial set.
   a. Do not puddle dried mortar chips and dust into the plastic concrete.
   b. If excess mortar is not removed from reinforcement steel before the concrete reaches its initial set, delay cleaning until the concrete is thoroughly hardened.
2. If joining fresh concrete and hardened concrete, clean the hardened surface of laitance and incompletely bonded, loose, or foreign material.

   Ensure that laitance is completely removed from the following:

   - Joints between decks and curbs
   - Tops of seal courses
   - Construction joints in concrete exposed to sea water
3. Ensure that the surface of the concrete is dry before pouring the concrete against it.
4. Immediately before placing fresh concrete, tighten the forms against the existing concrete.
5. Use tremies or pumps to coat areas where fresh concrete will be poured with mortar or cement grout.
6. Begin placing concrete immediately after placing the mortar or grout.
7. Apply enough vibration to blend the material with the concrete at the construction joint.

S. Protect Fresh Concrete

Do not drive pile, blast, or perform other operations that vibrate the formwork or the concrete noticeably before the concrete reaches a strength of 2,000 psi (15 MPa) and is 3 days old.

Protect fresh concrete from rainfall with waterproof material such as tarpaulins or plastic film. Ensure that the waterproof material is ready before pouring and is sufficient to cover the area of the pour.

T. Place Bridge Deck Concrete

Do not use calcium chloride or any other admixture containing chloride salts in concrete placed on permanent steel bridge deck forms.

Ensure that the tolerances are accurate for bar reinforcement placement in cast-in-place concrete so the top clearance to the bar reinforcement complies with Subsection 511.3.05.G.6, *Bridge Deck Slab Tolerances*.

Place bridge deck concrete according to the Contract Specifications and as follows:

1. Before pouring decks, set substantial bulkheads or headers and shape them to the required deck surface cross-section.
2. Ensure that pouring sequences, procedures, and mixes comply with the plans and specifications.
3. Pour the deck according to the numbered sequence as follows:
    a. Unless otherwise shown on the Plans, pour each deck in one continuous operation.
    b. When dividing deck pours within any one complete unit (a simple span or a continuous or cantilever unit), pour and finish the concrete in the numbered sequence shown on the plans, beginning with the lowest number.
    c. Make pours with the same number before pours with higher numbers. Make pours with the same number in any sequence.
    d. The numbered sequence shown on the plans also applies to sidewalk pours, but it need not apply to curb, parapet, and handrail pours.
    e. Pour diaphragms between steel or prestressed concrete roadway beams at least 24 hours before pouring the deck slab.
    f. Unless otherwise authorized by the Engineer, pour all diaphragms within a complete unit before pouring decks.
    g. When constructing concrete T-Beams, place girder stems in uniform layers before placing slabs.
    h. If T-Beam spans are supported without intermediate false bents, begin deck placement as soon as the first four stems are placed. After the first four stems, avoid getting more than three stems ahead of the advancing line of the deck pour and lagging by more than the space between stems.
    i. If T-Beam spans are supported by intermediate false bents, place decks and stems the same as for T-Beam spans supported without intermediate false bents. However, ensure that the slab is placed before a cold joint develops between the stem and slab.
4. Do not make the deck pour until any previously poured concrete in the complete unit has set for 24 hours.

    This requirement may be waived under certain conditions if the succeeding pour can be completed (except for final finishing) within four hours of the initial placement of the day. The Engineer must give written approval for this requirement to be waived.

    Unless otherwise shown on the plans, do not place handrail, sidewalks, parapets, and curbs in a complete unit until all the deck slabs in the unit have been poured.
5. Ensure that the pour is the same as the overlap direction (as shown in the shop drawings).
6. Use the following deck pour method:
    a. If there is super-elevation, begin deck pours on either the high or the low side.
    b. Dump each batch against previously placed concrete.
    c. Pour at a rate that ensures fresh concrete along the advancing line of the pour.
    d. Vibrate or tamp concrete dumped on fresh concrete to make the grout flow as follows:
        - Forward with or slightly ahead of the concrete
        - Along the bottoms and sides of the forms
        - Around the reinforcement steel
7. Once the concrete is poured, vibrate it enough to avoid honeycomb and voids, especially at the following locations:
    - Construction joints
    - Expansion joints
    - Valleys and ends of form sheets Screed the concrete as follows:

a. Use finishing devices operating parallel to the center line. As pouring proceeds, keep the concrete surface screeded to the required grade.
b. Fill depressions ahead of the screed, and keep a small roll of grout on the leading edge of the screed. Perform further screeding with minimum disturbance to the surface already brought to the grade.
c. Take care during the placement and screeding to obtain sound concrete at the construction joint located where the slab joins the curb, parapet, or sidewalk.
d. Do not place excess grout on the leading edge of the screed and do not allow it to remain in this area.
e. Use either a longitudinal screed or a transverse screed.
   - Longitudinal Screed

     Before doing the final screeding, place enough concrete in front of the screeding position to deflect the dead load.
   - Transverse Screed

     On beam or girder-supported spans with skew angles of 65° or less, place and operate the truss or beam supporting the strike-off parallel to the skew and make the advancing pour line parallel to the skew.

     On beam or girder-supported spans with skew angles between 65° and 90°, position the screed either on the skew or at right angles to the bridge center line.

     On superstructures supported by non-deflecting falsework and on beam- or girder-supported spans with a total dead load deflection no more than 1/2 in. (13 mm), position the screed at right angles to the bridge center line and make the advancing line of pour at right angles to the bridge center line.
f. As the pouring proceeds, keep the concrete surface screeded to the required grade.
g. Fill depressions ahead of the screed. Keep a small roll of grout on the leading edge of the screed.
h. Continue to screed without disturbing the surface already brought to the required grade.
i. Avoid producing unsound concrete where the slab joins the curb, parapet, or sidewalk. Remove excess grout from the leading edge of the screed at these construction joints.

8. Edge joints to be sealed, including dummy joints, as follows:
   a. Edge before the initial set or after the final set.
   b. If edging before the initial set, use edging tools of the proper radius as shown on the plans.
   c. Carefully remove concrete from pouring operations on adjacent pours to achieve the required rounded edge.
   d. If edging after the final set, allow the joints to harden. After at least 12 hours, grind joints to approximate the plan radius either by hand or by mechanically operated grinding stones.
   e. To achieve full and uniform bearing, finish areas that are recessed for receiving joint members.
9. Finish bridge decks as follows:
   a. As soon as the concrete is hard enough and standing water and moisture sheen disappear, give the concrete a final finish by belting, brooming, or dragging.
      - Belt longitudinally using a wet canvas belt. Limit belting to spans no longer than 40 ft. (12 m).
      - Drag transversely or longitudinally with a wet burlap drag.
      - Broom transversely using a stiff-bristled broom.
   b. Finish the following areas carefully:
      - Gutter lines
      - Joints
      - Drains
   c. After belting, dragging, or brooming and when shown on the plans, groove the bridge deck and approach slabs perpendicular to the center line as follows:
      1) Do not begin grooving until the bridge deck is cured according to Subsection 500.3.05.Z, *Cure Concrete*.

2) If necessary, groove in conjunction with planing required to make the surface corrections specified in Subsection 500.3.06.D, *Bridge Deck Surface Check*. Wait until the concrete is hard enough to support the equipment without distorting.
3) Cut grooves into the hardened concrete using a mechanical saw device capable of producing grooves 0.125 in. (3 mm) wide, 0.125 in. (3 mm) deep, and 0.50 in. (13 mm) apart, center-to-center.
4) Extend the grooves across the slab to within 1ft. (300 mm) of the gutter lines.
5) Do not groove within 3 in. (75 mm) of bridge joints, including “dummy” joints detailed in the plans.

U. Place Concrete Parapet on Bridge Decks

Place concrete barrier or parapets on bridge decks. The slip form method with an approved self-propelled extrusion machine as specified in Section 621 is optional.

V. Place Seal Concrete

Deposit concrete in water only when required by the Plans or when considered necessary by the Engineer.

When depositing the seal concrete, follow these guidelines:

- Keep the water as motionless as possible.
- Place the concrete continuously from beginning to end.
- Ensure that the concrete surface remains as horizontal as possible.

Place seal concrete as follows:

1. Place seal concrete carefully in a compacted mass as near to its final position as possible using a tremie, a bottom dump bucket, or other approved means.
    a. Use tremies to place seal concrete as follows:
        1) Support tremies so that the discharge end can move freely over the entire top surface of the work.
        2) Support tremies so that they can lower rapidly to stop or retard the flow of concrete.
        3) At the beginning of the work, close the discharge end to keep water out of the tube.
        4) Keep the tube sealed.
        5) Keep the tremie tube full to the bottom of the hopper.
        6) When dumping a batch into the hopper, induce concrete flow by slightly raising the discharge end and keeping it within the previously deposited concrete. This maintains a seal and forces the concrete to flow into position by hydraulic head.
    b. Use bottom-dump buckets to place seal concrete as follows:
        1) Ensure that the bottom-dump bucket is level full.
        2) Open the bucket only when it rests on the surface that will receive the charge.
        3) In lowering and raising the bucket, do not move the water unnecessarily.
    c. When approved by the Engineer, place seal concrete by pumping.
2. Wait at least 24 hours after placement to begin dewatering seal concrete, unless the Engineer determines a longer waiting period is necessary.
3. Remove laitance from the seal concrete before placing the footing.
4. Bore seals under spread footings the entire depth of the seal as specified for foundations in Subsection 211.3.05.C, *Boring of Foundations and Seals*.
5. If laitance buildup on seals under spread footings exceeds 1/4 in./ft. (20 mm/m) of seal depth, the Engineer may decide to core the seal to determine acceptability.
6. When placing concrete exposed to sea water, control the water content to produce concrete of maximum density and create construction joints and prepare their surfaces according to the requirements of Subsection 500.3.05.R, *Create Construction Joints*.

W. Pour CS Concrete

Pour CS concrete as follows:

1. Meet CS concrete depth and surface finish requirements.
   - Ensure that the minimum depth is the same as shown on the plans.
   - Do not vary the depth variation more than 1 in. (25 mm).
   - Ensure that the surface finish is generally smooth and uniform.
   - Smooth or fill float marks, voids, and other deformities exceeding 1/2 in. (13 mm) before placing approach slabs.
2. To prevent bonding:
   a. Lay clean polyethylene sheeting uniformly over the CS concrete in the approach slab area before placing the slabs.
   b. Use new, unused polyethylene sheeting free of holes, rips, and tears.
   c. Use polyethylene bond-breaking material at least 8 mils (0.2 mm) thick with an overlap of at least 6 in. (150 mm).
3. Maintain polyethylene sheeting in good condition throughout the construction process.

   Repair or replace sheeting deemed unsatisfactory as directed by the Engineer.
4. Cure CS concrete with the polyethylene sheeting used for bond breaking.

X. Pour Concrete in Cold Weather

When pouring concrete in cold weather, keep the concrete temperature at the point of delivery at least 50 °F (10 °C). Do not use accelerator-containing chlorides.

Mix and pour concrete in cold weather as follows:

1. Keep concrete materials at the right temperatures.
   - Do not use materials in concrete mix that contain frozen lumps.
   - Do not incorporate water and aggregates into the mix with temperatures more than 150 °F (65 °C).
   - If aggregates or water temperatures are above 100 °F (40 °C), discharge the aggregates and water into the mixer and allow the temperatures to equalize before adding the cement.
   - Heat aggregate with steam, hot water coils, or other methods that do not damage the aggregates. Do not heat aggregates with direct flame.
2. Protect the poured-concrete.
   - Keep concrete above 50 °F (10 °C) for at least 72 hours after placement.
   - Protect concrete from freezing for 6 days after placement.

Y. Pour Concrete in Hot Weather

Reduce hazards and difficulties related to placing and finishing concrete in hot weather before pouring. The Engineer may require measures to prevent concrete workability reduction, losses from cement hydration, evaporation, drying, or elevated concrete temperatures.

1. Place Concrete

   Cool forms and reinforcement with water immediately before placing concrete. Meet the minimum placement rates specified in Subsection 500.3.05.P, Table 5—Minimum Placement Rates for Bridges, Culverts, and Retaining Walls.
2. Keep Concrete Cool

   Keep concrete cool as follows:
   a. Keep the concrete used for construction at no more than 95°F (35°C) when measured at the point of discharge from the delivery unit.
   b. If the concrete temperature might exceed 95°F (35°C) during concrete placement, begin placement when the air temperature cools if the Engineer requires.

c. Cool the aggregates by fogging or other means that do not affect moisture content.

d. Use chipped or crushed ice in the mix as a portion of the mixing water on a pound (kilogram) basis. If using ice, ensure that the ice melts before the batch is discharged from the mixing unit.

e. If necessary, cool water by refrigeration to provide a lower concrete temperature.

3. Finish Concrete

Do not “splash on” water to aid screeding or finishing operations.

For bridge decks, fog the surface when required, according to Subsection 500.3.05.Z.3, *Bridge Deck Curing*.

If needed, use wind screens to prevent thermal or shrinkage cracks caused by rapid concrete surface drying.

Z. Cure Concrete

Concrete curing is an integral part of the concrete placement operation. Improperly cured concrete will be considered defective.

If the Engineer determines that curing procedures do not comply with these Specifications, stop placing concrete. Resume concrete placement after taking remedial measures to ensure proper curing.

Begin curing unformed surfaces when the water sheen disappears from the surface or immediately after applying the surface finish. Continue curing for 5 days.

Cure the formed surfaces after removing the forms. Remove them within 5 days after placing concrete. Continue curing until the concrete is 5 days old (from the time it is poured).

Cure concrete surfaces exposed to air using methods that prevent premature drying or moisture loss. Ensure that curing conditions are the same throughout separate curing areas.

Use either or a combination of the two methods specified for curing concrete except bridge decks. Cure bridge decks as described in Subsection 500.3.05.Z.3, *Bridge Deck Curing*.

Cure colored concrete in accordance with manufacturer’s instructions.

1. General Curing—Supplying Additional Moisture

Do not use a method that causes the concrete to be alternately wet and dry.

Cure concrete properly by supplying additional moisture through ponding, sprinkling, or fogging and then retaining the moisture as follows:

a. Use cotton mats, burlap, sand, hay, or straw coverings.

Cover with at least 2 in. (50 mm) of sand. Cover with at least 3 in. (75 mm) of hay or straw.

b. Do not use sawdust or coverings that cause unsightly discoloration of concrete.

c. Place coverings after completing the finishing operations when there is no danger of surface damage.

d. Keep coverings moist continuously.

2. General Curing—Preventing Moisture Loss

Keep concrete moist before and during the rubbing from the Type III—Rubbed Finish.

Start curing immediately after the rub using approved waterproof paper, plastic sheets, or membrane-forming curing compounds, except when curing compounds are prohibited.

a. Waterproof Paper or Plastic Sheets

Ensure that the sheets and paper meet the requirements of AASHTO C 171 and use them as follows:

- Use the widest possible widths.
- Lap adjacent sheets at least 6 in. (150 mm).
- Seal the laps with tape, mastic, glue, or other approved methods to form a waterproof cover of the entire area.
- Keep the curing material from being displaced by wind.
- Immediately replace or repair sheets or paper that tear, break, or become damaged during the curing period.

b. Membrane-Forming Curing Compounds

Use as the curing agent AASHTO C 309, membrane-forming curing compounds, Type 1-D, Class A or B, or Type 2, Class A or B, white pigmented. Use the curing agent as follows:

- Do not use membrane-forming curing compounds on bridge decks or prestressed concrete bridge members, or in construction joint areas.
- When the water sheen disappears from the concrete surface, apply the curing compound uniformly to unformed areas.
- Apply the compound to formed surfaces if the forms are removed during the 5-day curing period.
- Cure the areas to be rubbed with liquid membrane-forming compounds for curing concrete, Type1-D, Class A or B (non-acrylic).
- Apply curing compound with fine-spraying equipment.
- Thoroughly agitate the compounds just before using them.
- Spray the surface again immediately after the first application at right angles to the first application.

  Apply at least 1 gal (1 L) for each 150 ft.² (3.7 m²) of surface.
- Do not apply curing compound to the following:
  - Joints where a concrete bond is required
  - Reinforcement steel
  - Joints where joint sealer will be placed
- Close the surface to pedestrian or vehicular traffic for 7 days unless the surface is protected by planks, plywood, or a layer of sand at least 1 in. (25 mm) thick.

  Do not place this protection until at least 12 hours after applying the curing compound.

3. Bridge Deck Curing

Fog all bridge deck placements. Begin fogging bridge decks behind the finishing operation for the entire deck width. Continue fogging to produce a semi-gloss water sheen on the surface until application of the curing material. Reduce fogging if water accumulates on the surface and begins to run off. Ensure the fogging nozzles atomize the droplets and dampen without creating pools of water. Do not use water from fogging as an aid in finishing the concrete.

Continuously wet cure the concrete immediately after finishing for at least 5 days. If the contractor elects to use an approved curing compound, the wet cure may be reduced by 2 days.

Cure bridge deck concrete as follows:

a. Water with Waterproof Cover

- Continuously apply fog after the concrete strike-off prior to placing soaker hoses.
- Place soaker hoses on the deck surface once the concrete has set enough to allow foot traffic.
- Supply water to the soaker hoses to maintain a moist surface and to saturate the curing material over the entire concrete surface during the curing period. Water used for bridge deck wet curing shall meet the requirements of subsection 880.2.01, *Water for Portland Cement Mixtures.*
- Place White Burlap-Polyethylene Sheeting, with the burlap side down, over the soaker hoses and covering the entire concrete surface including bridge deck overhangs. If using separate layers of burlap and polyethylene sheeting, ensure that the burlap layer is used on the bottom and the white polyethylene is used on top. All sheet materials shall meet the requirements of ASTM C171, *Sheet Materials for Curing Concrete.* Use the widest available sheets and overlap adjacent sheets at least 6 inches. Secure the polyethylene film to prevent displacement by the wind. Repair or replace sheet portions that become damaged before the end of the curing period or lose waterproofing ability.

b. Curing Membrane

A curing compound is only required if the wet cure is reduced by the 2 days.

- Provide curing compounds in accordance with 832.2.03 Membrane Curing Compound. All concrete curing compounds shall be in compliance with GDOT QPL 16 and /or ASTM C309. Ensure that the curing compound has not expired. Within 30 minutes of removing the curing covers and soaker hoses, apply two coats of curing membrane while the surface is damp. Apply the curing membrane at a coverage rate of at least 1 gallon per 160 ft^2 unless otherwise required by the contract. If the concrete surface dries, fog spray to maintain a damp condition. Spray the second coat of curing membrane immediately after and perpendicular to the first.
- Allow the curing membrane to dry before allowing any construction traffic on the surface. Protect the membrane for an additional 7 days after initial application. Apply an additional coat to marred areas of the membrane during this time.

4. Parapet, Sidewalk, End Post, and Curb Face Curing

The surface of parapets, sidewalk, end post, and horizontal and vertical faces of curbs are not considered part of the bridge deck. Cure these structures using the general curing methods in Subsections 500.3.05.Z.1, *General Curing—Supplying Additional Moisture*, and 500.3.05.Z.2, *General Curing—Preventing Moisture Loss*, unless the surfaces will receive a special surface coating (Subsection 500.3.05.AB.4, *Type III—Special Surface Coating Finish*).

Do not cure surfaces receiving a special surface coating with membrane-forming curing compounds.

Do not cure surfaces receiving protection surface treatment (75 percent boiled linseed oil and 25 percent mineral spirits solution) with membrane-forming curing compounds that contain acrylics.

AA. Prevent Plastic Shrinkage Cracking

Take precautions to prevent plastic shrinkage cracking of concrete by doing the following:

- Provide wind screens
- Provide fogging equipment
- Apply temporary wet coverings before moisture loss begins

The Engineer will evaluate the effects of plastic shrinkage cracks and will require repair of cracks that create structural defects and corrode reinforcement steel.

AB. Finish Concrete

Concrete surface finishes are classified according to whether the surfaces are formed or unformed. Refer to Table 6.

When other Sections of the Specifications for concrete work state that the requirements of Section 500 apply, finish the concrete according to the other sections.

TABLE 6—CONCRETE FINISH TYPES

Surface	Finish Type
Formed	Type I—Ordinary Formed Surface Finish
	Type II—Special Formed Surface Finish
	Type III—Rubbed Finish
	Type III—Special Surface Coating Finish
Unformed	Type IV–Floated Surface Finish
	Type V–Sidewalk Finish
	Type VI–Stair Tread Finish

Except for bridge deck finishes, which are covered in Subsection 500.3.05.T, *Place Bridge Deck Concrete*, step 9, finish all structural concrete surfaces with one or more of the finishes described here, unless otherwise shown on the plans.

1. Type I—Ordinary Formed Surface Finish

   Complete formed concrete surfaces with this finish. However, leave concrete exposed directly to sea water undisturbed unless the Engineer requires additional work. See Subsection 500.3.05.V, *Place Seal Concrete*, step 6.

   Achieve a Type I finish as follows:

   a. Immediately after removing the forms, remove fins and surface irregularities.
   b. Fill or point up the following:
      - Cavities produced by forms or ties
      - Holes
      - Broken corners or edges
      - Defects
      - Honeycombed edges
   c. Remove and patch honeycombed areas to sound concrete.
   d. Use patch mortar that consists of the same sand and cement as the concrete. Use the sand and cement in the same ratio as in the concrete.

   Use epoxy mortars in areas where heat generation and moisture will not decrease patch performance.

   e. Cure the patches using one of the general curing methods specified in Subsection 500.3.05.Z.1, *General Curing—Supplying Additional Moisture* and 500.3.05.Z.2, *General Curing—Preventing Moisture Loss*.
   f. Produce a sound and uniform finish.
   g. If the Type I finish is not satisfactory, give the surfaces a Type III—Rubbed Finish where the Engineer considers it necessary to achieve a uniform and pleasing appearance.

2. Type II—Special Formed Surface Finish

   Give a Type II finish to the following:

   - Exposed portions of pipe headwalls and culverts
   - Parapets and wingwalls
   - Ends of culvert slabs and walls

   Achieve a Type II finish as follows:

   a. Use a form liner unless the forms are made of plywood or steel.
   b. Rub only when necessary if the surface has a pleasing, uniform appearance after completing the Type I finish and blending all pointed and patched areas.
   c. If the surface finish is not satisfactory, give surfaces the Type III—Rubbed Finish where the Engineer considers it necessary to achieve a uniform and pleasing appearance.

3. Type III—Rubbed Finish

   Apply a Type III finish to bridge areas checked in the table of Bridge areas Requiring a Type III Finish, below and to exposed areas of retaining walls, unless the Plans specify otherwise.

   Achieve a rubbed finish as follows:

   a. Begin the first rub immediately after removing forms, completing the Type I finish, and ensuring that all patches are thoroughly set, but before applying the required curing compound.

      If finishing is postponed or there is not enough labor to keep it up-to-date, the Engineer will order a stop to any other work until the finishing is satisfactory.
   b. Rub chamfered surfaces only once, but not during the first rubbing. Rub chamfered surfaces during either the second or the final rubbing.

c. To rub, wet the moist concrete on the curing surface with a brush and rub with a medium-coarse carborundum stone or equal abrasive until a paste comes to the surface.

   Keep the entire concrete surface moist during rubbing to assure adequate curing.

d. Continue rubbing until all form marks and projections disappear, leaving a smooth, dense surface with no pits or irregularities.

e. Spread the paste material carefully and uniformly over the entire surface and leave it.

f. No earlier than 24 hours after the first rub, do the final rub with a fine carborundum stone or equal abrasive, leaving a smoothly textured surface that is uniform in color.

g. Finish the final rub before applying protective surface treatment required by the plans.

h. Do not “whitewash” finished areas by using separately mixed grout or paste on the rubbing stone or by spreading it on the surface to be rubbed.

i. Thoroughly clean and blend into the surrounding surfaces any areas that are disfigured by drips from concrete placement or rubbing.

Bridge Areas Requiring a Type III Finish (X)								
	Single Bridge Over Stream	Multiple Bridges Over Stream	Single Bridge Over Railroad	Multiple Bridges over Railroad	Single Bridge over Traffic Artery	Multiple Bridges Over Traffic Artery	Railroad Bridge Over Traffic Artery	Pedestrian Bridge Over Traffic Artery
All exposed substructure areas, except tops and bottoms of caps. (5)					X	X	X	X
Outside surface of any exterior concrete beam, Lt. or Rt. (1), (2)		X		X				
Outside surface of any exterior concrete beam, LT. and Rt. (1), (3)					X	X	X	X
Vertical surfaces of overhangs, curb, or sidewalk	X	X	X	X	X	X	X	X
All vertical surfaces outside exterior beam, Lt. or Rt. (2)		X		X				
All vertical surfaces outside exterior beam, Lt. and Rt. (3)					X	X	X	X
End bent cap beyond outside beam or girder	X	X	X	X				
End bent end walls beyond outside beam or girder	X	X	X	X	X	X	X	X
End bent posts and end bent wingwalls all exposed surfaces	X	X	X	X	X	X	X	X
Traffic face of curbs	X	X	X	X	X	X		X
Entire handrails and posts, handrail parapets, and barriers (4), (5)	X	X	X	X	X	X	X	X
All other locations specified on Special Provisions	X	X	X	X	X	X	X	X
Notes:								
(1) - Including Prestressed Concrete Bridge Members								
(2) - "Lt. or Rt." - Rub the applicable surface when it can be seen from any adjoining/adjacent bridges.								
(3) - "Lt. and Rt." - Rub the applicable surfaces on both sides of centerline of each bridge.								
(4) - Rubbing of bottom surface of rail not required.								
(5) - Bottoms of Caps and handrails shall be given a Type II finish.								
For bridges using PSC Beams or PSC Deck Units, a Type III Special Surface Coating Finish shall be used where a Type III finish is required for exterior beams. For bridges using PSC Beams or PSC Deck Units, a Type III Special Surface Coating Finish shall be used where a Type III finish is required for exposed substructure areas. The Type III Special Surface Coating Finish shall also be used on the exterior vertical faces of the parapet, barrier, and overhangs where PSE Beams or PSC Deck Units are used.								

4. Type III—Special Surface Coating Finish

   A Type III—Special Surface Coating Finish may be substituted for a Type III—Rubbed Finish.

   The special surface coating finish consists of either a Class A or a Class B coating system, applied to produce a masonry-like textured finish on concrete surfaces.

   For contiguous structures, whether in the same Contract or in separate Contracts, use the same brand of special surface coating.

   If contiguous structures are in separate contracts, coordinate the Work with the other Contractor so that coating is applied as near as possible to the same time.

   If contractors cannot coordinate Work, the one who finishes the work last shall use the same brand or shall recoat all contiguous areas to provide a uniform appearance.

   Achieve a special surface coating finish as follows:

   a. Ensure that surface coating material meets the requirements of Section 836.

      Select coating material from the QPL 17.

   b. Do not use form oils that affect the bonding of surface coatings.

   c. Do not use wax-based or other curing compounds incompatible with surface coatings.

      Have the coating manufacturer or the laboratory determine compatibility.

   d. Use the coating color required in Section 836.

   e. On surfaces that will receive a coating finish, do not cure with membrane-curing compound or remove forms with bond-breaking agents or excessive oil.

   f. Apply coatings as follows:

      - Class A coatings at a rate that develops a 1/16 in. (1.5 mm) thick coating.
      - Apply Class B coatings at a maximum rate of 60 ft.² per gallon (1.5 m² per liter).
      - Ensure that the temperatures of the air, concrete, and compound are above 50 °F (10 °C).
      - Apply a test section as directed by the Engineer to determine the acceptance of a coating under field conditions.
      - Apply the coatings using a method that produces an acceptable finish, such as spraying, rolling, or a combination of these.

   g. Protect coated surfaces from rain or freezing temperatures for 24 hours after application.

   h. Ensure that the final coating produces a smoothly textured surface that is uniform in color, thickness, and appearance.

   i. Remove and reapply coatings that chip, crack, blister, peel, or present an unsatisfactory appearance.

   j. If the final appearance is unsatisfactory, apply a rubbed finish to slip-formed and formed walls and barriers.

5. Type IV—Floated Surface Finish

   Use a Type IV finish only on the horizontal surfaces of the following:

   - Curbs and sidewalks
   - Tops of caps and footings
   - Surface of slope paving
   - Other similar structures

   Apply the Type IV finish as follows:

   a. After compacting the surface and screeding to the correct cross sections, float the surface with a wood float.

   b. While floating the surface, bring enough mortar to the surface to achieve the desired finish, but do not reduce the wearing quality of the surface.

   c. Make the final finish with a wood float or stiff-bristle broom.

d. If brooming, make the marks transverse to the traffic.

6. Type V—Sidewalk Finish

   Apply a Type V finish as follows:

   a. After placing and compacting the concrete, strike it off and give it a Type IV finish.
   b. Use an edging tool on all edges and along expansion joints unless the Plans require chamfers.
   c. Mark off sidewalk surfaces in blocks with suitable grooving tools when required by the plans or the Engineer.
   d. Extend the rubbed finish on the traffic face of the curb to include the horizontal area of sidewalk between the curb corner and the longitudinal sidewalk groove.

7. Type VI—Stair Tread Finish

   Achieve a Type IV finish using a stiff-bristled broom.

AC. Remove Forms

Do not remove forms and their supports, including falsework, until the Engineer approves. Use a removal method approved by the Engineer. Approval does not relieve responsibility for the safety of the Work.

1. Form Removal Time

   Use a removal time shown on the Plans or specified by the Engineer.

   Use Table 7 to help establish when forms can be removed safely. However, do not count days where the temperature at any time during the day is at or below 40 °F (4 °C), unless the cold weather concrete protective measures described in Subsection 500.1.03.G, *Cold Weather Concrete Curing and Protection Plan* were used.

TABLE 7—ESTIMATE OF FORM REMOVAL TIME

Form	Time Required
Bottom of beams	10 days
Bottom of caps, trestle pile bents	4 days
Bottom of all other caps	7 days
Overhangs and slabs, including culverts	7 days
Columns and retaining walls	18 to 48 hours
Sides of beams, posts, rails, caps, footings, wingwalls, and parapets	12 to 24 hours
Bottoms of cast-in-place rails and diaphragms	48 hours
Front face of curbs	3 hours

   If using high-early strength concrete, the Engineer may reduce the time limitations if the concrete develops satisfactory strengths.

2. Form Removal Method

   Remove forms and falsework without injuring the concrete surface or overstressing the concrete members.

   Ensure that the stress from the weight of the removal process is transferred gradually and uniformly to the concrete.

   At the Contractor's request, time of removal may be controlled by field tests on cylinders, subject to the following conditions:

   a. No tests will be performed until concrete is a least 3 days old.
   b. Required strengths will be shown on the Plans, as noted elsewhere in these Specifications, or as determined by the Engineer.
   c. The Engineer may specify a minimum time in conjunction with minimum strength requirements.

d. Falsework and forms for culverts may be removed at such time as 75% of the concrete design strength is achieved.

AD. Apply Protective Surface Treatment

When the Plans specify a protective surface treatment, apply a boiled linseed oil mixture of 75 percent boiled linseed oil and 25 percent mineral spirits by volume to the concrete surfaces.

Use linseed oil that meets the requirements of ASTM D 260, Type I or Type II. Use a quality commercial mineral spirit that passes infrared spectroscopic analysis to the satisfaction of the laboratory.

Unless otherwise noted on the Plans or the manufacturer's recommendations, apply the mixture as a preservative seal coat to the top surfaces of bridge decks, curbs, and sidewalks and to the inside vertical faces of curbs, parapets, and end posts. Protect metal handrailing and metal handrail posts from treatment.

Apply the protective surface treatment as follows:

CAUTION: Because the linseed oil-petroleum spirits mixture has a low flash point and is readily flammable, protect the mixture from fire, especially cigarettes and sparks. Prohibit traffic from the treated area until the Engineer determines the concrete has regained its dry appearance.

1. Do not place the protective surface treatment until concrete work, including final rubbing, is completed and expansion joint sealing compound is placed.
2. Do not apply the treatment until the concrete is at least 14 days old.
3. Unless otherwise permitted by the Engineer, apply the treatment when the temperature of the concrete and air is at least 50 °F (10 °C).
4. Apply in time to allow the treatment to dry thoroughly before allowing traffic, including haul traffic, on the structure.

   If the structure meets the following exceptions, apply the treatment after using the structure for hauling.

   - Temperature limitations prohibit application.

     The Engineer will send a written notification to the Contractor (or Bridge Contractor) if temperature requirements prohibit application.

   - The structure is absolutely required for hauling to complete a Contract.

     Request a written approval from the Engineer if hauling across a structure before the treatment is placed.
5. If applying the treatment after using the structure for hauling, thoroughly clean the surfaces to be treated to allow the treatment to penetrate completely.
6. If there are separate bridge and roadway Contracts, have the roadway Contractor clean the surfaces immediately upon request by the Engineer.
7. Prepare the surface for the treatment as follows:
   a. Clean off oil, grime, and loose particles that prevent the mixture from penetrating.
   b. Ensure that the concrete surfaces have at least 48 hours to dry after rainfall or wet cleaning operations.
   c. Immediately before applying the treatment, direct an air blast over the surfaces to remove dust.
   d. Mask the exposed plates of joints.
8. Apply the mixture by hand or by spraying in one application at the rate of 1 gal (1 L) of mixture per 37.5 yd² (8.5 m²).
   a. Thoroughly clean the inside of spraying equipment before putting the surface treatment in.
   b. Keep spray nozzles within 18 in. (600 mm) of the concrete unless otherwise directed by the Engineer, plans, or manufacturer.

AE. Apply Graffiti-Proof Coating

When the Plans specify a graffiti-proof coating, apply the coating system to concrete surfaces or over special surface coatings. Use material that complies with Section 838.

Apply the coating as follows:

1. Clean loose particles, dirt, grease, oil, and other foreign particles off the surface.
2. Apply the coating according to the manufacturer's recommendations for:
   - Weather conditions
   - Material preparation
   - Coating application
   - Number of coats

AF. Expose New Concrete to Loads

Prohibit dead or live loads during or after construction except as described in this section. If using high early strength concrete, the Engineer may reduce time limitations if the concrete develops adequate strength.

1. Dead Loads on the Substructure

   After pouring footings, do not begin work on columns or piers for at least 12 hours.

   After pouring columns, do not begin cap construction for at least 24 hours.

   Do not place beams on caps or place falsework and forming for concrete T-Beam construction before the cap concrete reaches a minimum strength of 2,500 psi (17 MPa).

2. Dead Loads on the Superstructure

   If necessary, stockpile construction materials on decks within a complete unit (a simple span or continuous or cantilever unit) if the following conditions exist:

   - The deck concrete of the complete unit reaches its 28-day cylinder strength.
   - The deck concrete is at least 10 days old.
   - The curbs are at least 5 days old.

   The Engineer must approve the location, height, and spread of the loads.

   On composite-design bridges (those that have prestressed concrete beams or steel beams with shear connectors), do not pour curbs, parapets, or sidewalks until the deck concrete reaches a minimum strength of 1,500 psi (10 MPa) or is at least 3 days old.

3. Dead Loads on Concrete Box Culverts and cast-in-place walls

   Do not backfill any section of a concrete box culvert or cast-in-place wall until the last concrete placed in that section is at least 14 days old, unless early cylinder breaks indicate otherwise.

   If early cylinder breaks indicate that design strength has been achieved, backfill sections of culverts or cast-in-place walls when the concrete placed last is at least 7 days old.

4. Live Loads—Pouring Equipment

   Do not allow power-operated concrete buggies to cross a deck until the concrete reaches a minimum strength of 1,500 psi (10 MPa) or is at least 3 days old.

   Allow hand-operated buggies to cross after the concrete is 24 hours old.

5. Live Loads—Mixing and Lifting Equipment

   Do not place mixers on a deck in a complete unit (a simple span or continuous or cantilever unit) until the deck concrete of the complete unit reaches its 28-day cylinder strength and is at least 10 days old.

   When deck concrete reaches its 28-day cylinder strength and is at least 10 days old, allow mixer trucks on the unit during the curb concrete pour only if the pour is completed within 45 minutes of being started.

   Do not allow any equipment on the unit for 5 days after curb pours.

   The Engineer may allow concrete placement procedures that use heavy lifting equipment on the decks if the following conditions exist:

   - The deck concrete reaches its 28-day cylinder strength.
   - The deck concrete is at least 14 days old.
   - The curbs on the deck are at least 10 days old.

6. Live Loads—Hauling over Bridges

Use a new bridge for hauling only if no other practical haul routes are available and only if the Engineer permits it.

a. Govern hauling by the restrictions and requirements listed in Table 8. If any of the restrictions and requirements are violated, the Engineer will limit loads to the following:

- Single 32,000 lb. (14 515 kg) axle when the bridge design loading is HL-93 or HS 20-44 Single 24,000 lb. (10 886 kg) axle when the bridge design loading is HS 15-44 or H 15-44

TABLE 8—WEIGHT LIMITS FOR HAULING ON NEW BRIDGES

Axle Criteria	Bridge Design Loading	
	HL-93 or HS 20-44 Loading	HS 15-44 or H 15-44
Maximum Axle Load Per Axle	60,000 lbs. (27 216 kg)	44,000 lbs. (19 958 kg)
Maximum Axle Load on Dual Axles Per Axle	45,000 lbs. (20 412 kg)	33,000 lbs. (14 969 kg)
Maximum Total Load	100,000 lbs. (45 360 kg)	73,000 lbs. (33 113 kg)

b. Ensure that bridge concrete, including curbs, parapets, barriers and sidewalks, is at least 14 days old and has a minimum compressive strength of 3,000 psi (20 MPa).

c. Apply the linseed oil special protective treatment, if required see (Subsection 500.3.05.AD, *Apply Protective Surface Treatment*).

d. After applying the protective treatment (if required), apply water-repellent silicone materials to the handrail, handrail posts, end posts, and curb faces before hauling begins.

e. Do not allow more than one vehicle at a time on a simple or multiple-span unit.

f. Ensure that vehicle speeds, loaded or unloaded, do not exceed 5 miles/hr. (8 km/hr.) when the following loads occur:

- Bridges designed for HL-93 or HS 20-44 Loading:
  - — Loads on single axles exceed 32,000 lbs. (14 515 kg)
  - — Loads on each dual axle exceed 24,000 lbs. (10 886 kg)
- Bridges designed for HS 15-44 or H 15-44 loading:
  - — Loads on single axles exceed 24,000 lbs. (10 886 kg)
  - — Loads on each dual axle exceed 16,000 lbs. (7257 kg)

When axle loads do not exceed these loads, ensure that vehicle speeds are 15 mph (24 kph) or less.

g. Place temporary guides on beams so wheels will track directly.

h. Keep earth approaches smooth and level with the bridge floor or approach slab to minimize impact.

Stabilize sandy and other unstable soils (at no expense to the Department) with crushed stone or other suitable material for at least 10 ft. (3 m) from the end of the bridge or approach slab.

i. Protect the ends of bridges or approach slabs with a timber strip at least 4 in. (100 mm) wide, cut to rest on either the paving rest of the bridge end or the pavement subgrade at the end of the approach slab. Keep the strip in place for protection during incidental hauling. Remove it before constructing the adjacent pavement.

Keep the top of each timber strip flush with the top of the concrete surface. Fit the strip tightly against the end of the bridge or approach slab. If the timber strip is displaced, stop hauling until the strip is reset or replaced.

j. Clean spills off the bridge floor.

AG. Complete Corrective Work

After the Department gives the deck surface a Ride Quality Test described in Subsection 500.3.06.E, “Ride Quality Test,” complete corrective work at no cost to the Department and before doing the final surface texturing.

Complete corrective work as follows:

1. Plane the deck according to Section 431.
2. Limit concrete removal by planing so that the final bar cover is not less than the Plan cover minus 1/2 in. (13 mm), and the final deck thickness is in compliance with subsection 500.3.06.C.12.
3. If the final bar cover limits cannot be met, perform the corrective work as directed by the Engineer.
4. Ensure that the final riding surface complies with this Specification and the requirements for a grooved finish.
5. If necessary, use a bump grinder to correct bumps with a profile base line of 5 ft. (1.5 m) or less.
6. Have planed decks retested as described in Subsection 500.3.06.E, *Ride Quality Test*, to ensure that the ride quality meets the requirements of this Specification.

AH. Plane the Deck

The Contractor shall schedule the ride quality test at least 7 days before needed by contacting the Office of Materials and Testing, Concrete Branch. Ensure that the area to be tested is clean and clear of obstructions.

When possible, delay expansion joint installation and temporarily bridge the joint to operate Lightweight Profiler and planing equipment across the joint.

Planing responsibilities are shown in Table 9:

TABLE 9—PLANING RESPONSIBILITIES

Area Planed	Person Responsible
Bridge decks	Bridge Contractor
Approach slabs constructed under the bridge Contract	Bridge Contractor
Approach slabs constructed under the roadway Contract	Roadway Contractor

AI. Perform Retaining Wall Incidentals

Retaining wall incidentals are as follows:

1. Drainage

   Unless otherwise shown on the Plans or in the Special Provisions, ensure that drainage for retaining walls is either Alternate A or Alternate B on Georgia Standards 4941B and 4949 Series.

   Ensure that the Number 10 concrete sand complies with Subsection 801.2.02, *Fine Aggregate for Portland cement Concrete of All Types and for Mortar* and has a permeability coefficient of at least 100 ft. (30 m) per day.

   The Engineer may waive the grading requirement for Number 10 concrete sand if the permeability coefficient of the material does not exceed 500 ft. (150 m) per day.

   Omit the drainage blanket and stone for retaining walls only when the height does not exceed 6 ft. (1.8 m).

   When the Plans specify different drainage details, furnish, place, or build the various items according to the plan requirements.
2. Waterproofing and Damp proofing

   When waterproofing and damp proofing are specified in the Plans, comply with the requirements of Sections 530 and 531.

AJ. Place Utility Installation Hardware

When the Plans require placing utility installation hardware, the utility company involved will furnish the items.

Place the items as directed on the plans or Shop Drawings. All other work, including painting as required, is the utility company's responsibility.

AK. Widen Bases and Pavement

When using narrow sections of Portland cement concrete to widen existing bases or bases and pavements, use Class B concrete as shown on the Plans or as directed by the Engineer.

AL. Open the Structure to Traffic

Open a structure to traffic other than haul traffic after all concrete in the decks, parapets, or curbs (sidewalks) reaches its 28-day cylinder strength and is at least 14 days old.

500.3.06 Quality Acceptance

A. Strength Requirement Tests

1. At the Contractor's request, the Department will determine the removal time for forms by conducting field tests on cylinders.

   Tests are subject to the following:

   a. Tests will be performed when the concrete is at least three days old.

   b. The Plans will show the required strengths.

   c. At the Contractor's request, the Engineer may specify a minimum time with minimum strength requirements.

2. When job site test specimens fail to meet the 28-day strength requirements in the Table 1 – Concrete Mix Table, determine the Final Acceptance at a reduced price (% of the latest Item Mean Summary as unit cost) or rejection/removal of concrete in place by coring for structural concrete materials or by conducting non-destructive testing for non-structural concrete materials, as specified by the Engineer:

   d. 1.00 pay factor will be applied if the average 28-day strength of the cylinder set meets strength requirements in the Table 1 – Concrete Mix Table.

   e. If average strength of the cylinders set does not meet 28-day strength requirements in the Table 1, but meets these requirements at 56 days strength requirements, then the following pay factors for the amount the 28-day compressive strength is less than specified strength, will be applied:

psi (below 28-day compressive strength)	Pay Factor
1-499	0.90 (90%)
500-549	0.80 (80%)
550-599	0.70 (70%)
600 or above	Remove & Replace

   f. If average strength of the cylinders set does not meet 28-day strength requirements in Table 1 (the cylinders marked with "A" and "B") and also does not meet them at 56 days (the cylinders marked with "C" and "D"), then core samples (for structural concrete), or non-destructive test (for non-structural concrete) should be obtained within 7 calendar days – three at a time, for each strength test/non-destructive test. If the core or non-destructive test meets the strength requirements in the Table 1, then reduce price concrete with the pay factor in Section 500.3.06.A.2.b above may be accepted.

      (1) Coring for Determination of Structural Adequacy: Notify the Engineer 48 hours prior to taking core samples. The Engineer will select the size and location of the drilled cores so that the structure is not impaired and does not sustain permanent damage after repairing the core holes. Sample three undamaged cores taken from the same approximate location where the questionable concrete is represented by the low strength concrete test cylinders. Repair core holes after samples are taken.

      (2) Core Testing: Test the cores in accordance with ASTM C 42. Test the cores after obtaining the samples within three calendar days.

   g. If average strength of the cores does not meet a minimum pay factor of 0.70 (or 70%), then concrete will be rejected, and will be removed and replaced at no additional cost to the Department. For all concrete materials including both structural concrete and non-structural concrete, core samples have to be obtained for testing and for the decision of rejection. Non-destructive test results will not be used for the decision of rejection of the concrete in-place.

B. Honeycombed Area Check

If there are honeycombed areas that extend beyond the reinforcement steel, the Engineer may reject the entire pour with the honeycombed area.

C. Bridge Deck Slab Concrete Inspection

The Engineer will carefully observe the construction methods used during all phases of the bridge deck slab construction. These phases include the following:

- Metal form installation
- Reinforcement location and fastening
- Concrete item composition
- Mixing procedures
- Concrete placement and vibration
- Bridge deck finishing

Provide the needed facilities for the Engineer to safely and conveniently inspect the concrete.

The concrete inspection procedure is as follows:

1. After the deck concrete has been in place for at least two days, the Engineer will sound a hammer on at least two areas of the deck for each slab pour. This test checks for concrete soundness and form bonding.

   The two areas will encompass at least 10 percent of the total area of the deck pour.
2. The Engineer will sound other areas of the deck randomly.
3. If the Engineer doubts the soundness of an area, or if the Engineer decides that the concrete placement procedures used call for an inspection of the underside of the deck, remove at least one section of the forms for each span in the Contract.
4. Remove the form section after the pour is strong enough and when the Engineer desires to provide visual evidence that the concrete mix and the placement procedures are acceptable.
5. Remove another form section if the Engineer decides changes in the concrete mix or in the placement procedures warrant additional inspection.
6. Where form sections are removed, do not necessarily replace the forms, but repair the adjacent metal forms and supports neatly and securely.
7. When the form is removed, the Engineer will examine the concrete surfaces for cavities, honeycombing, and other defects.
8. If the Engineer finds irregularities but determines that the irregularities do not justify rejection of the Work, repair the concrete as the Engineer directs and give it an ordinary surface finish according to the Contract Specifications.
9. If the concrete where the form is removed is not acceptable, remove additional forms as necessary to inspect and repair the slab.
10. Modify the construction methods as required by the Engineer to create satisfactory slab concrete.
11. Remove or repair all unsatisfactory concrete as the Engineer directs.
12. Final deck thickness shall be within plus/minus 1/4 in. (6mm) of the dimensions shown in plans after corrective work is completed.

    If the construction methods used and the inspection results indicate that the slabs have sound concrete, the Engineer may moderate the amount of random sounding and form removal after a substantial amount of slab has been constructed and inspected.

D. Bridge Deck Surface Check

After the final strike-off of the concrete and as close behind the final strike-off as possible, the Engineer will check the surface with a 10 ft. (3 m) straightedge.

Attach the straightedge to a broom-type handle for easy control and use.

Bridges and approach slabs must meet a 1/8 in. in 10 ft. (3 mm in 3 m) straightedge check made longitudinally and transversely.

E. Ride Quality Test

After the bridge decks and approach slabs are completed, the Contractor will contact the Department's Office of Materials and Testing, Concrete Branch to schedule to have a Ride Quality Test performed using the Lightweight Profiler and a profile index value determined according to GDT 134.

The Department will conduct the test as follows:

1. Obtain Profile Index Values for all bridge decks and approach slabs not detailed to include an overlay.
2. Bridges and approach slabs must meet the straightedge check limits described in Subsection 500.3.06.D, Bridge Deck Surface Check. Straightedge check longitudinally and transversely all shoulders, safety areas, and future lanes to the barrier or curb lines. The deck surface must meet a 1/8 in. in 10 ft. (3 mm in 3 m) straightedge check made longitudinally and transversely.
3. Obtain profiles in the wheel paths of the bridge deck and approach slabs with the Lightweight Profiler.
4. Average the profile index values for bridge decks including the approach slabs for the left and right wheel path for each lane. If the approach slabs are not in place at the time of testing, they will be tested with the 100' roadway approaches.

   The average value must not exceed 15 in./mile (235 mm/km) for each lane.

   After the test is complete, correct individual bumps or depressions that exceed 2/10 in. (5 mm) from the blanking band on the profiler trace.

Correct bridge decks and approach slabs that do not pass the Ride Quality Test as described in Subsection 500.3.05.AG, Complete Corrective Work.

F. Cap Step Elevations

Ensure that the constructed bridge bearing seat elevations conform to the Plan elevations within an acceptable tolerance of ± 1/4 in (± 6mm). The differential elevation between any two adjacent bridge bearing seat elevations shall not exceed ± 3/8 in (± 10 mm).

G. Concrete Mix Acceptance Tolerances of Fresh Concrete

Immediately before placement of Self-Consolidating Concrete or HPC Self-Consolidating Concrete, perform and record the results of the following tests:

1. Concrete temperature tested according to ASTM 1064 will be 50 °F (10 °C) to 95 °F (35 °C).
1. Slump flow (spread) tested according to ASTM C 1611 will be +/- 2 in (50 mm) from design slump flow.
2. Air content tested according to ASTM C 138 or ASTM C 231 will be 3.5% to 6.5%.
3. Visual Stability Index according to ASTM C 1611 will be ≤ 1.
4. Rapid Assessment of Static Segregation Resistance according to ASTM C 1712 will be ≤ 15mm.

500.3.07 Contractor Warranty and Maintenance

General Provisions 101 through 150.

500.4 Measurement

This work is measured for payment either per cubic yard (meter), per Lump Sum, or per linear foot (meter), whichever is shown on the plans.

- **Seal Concrete.** The quantity of seal concrete to be measured for payment is calculated using the horizontal seal dimensions specified on the Plans.
- **Grooving.** Grooving on bridge decks and approach slabs, completed acceptably according to Subsection 500.3.05.T, *Place Bridge Deck Concrete*, step 9.c, will be measured and paid for by the square yard (meter). Payment is full compensation for furnishing the necessary equipment and performing the Work.
- **Class B Concrete.** Class B concrete used for base and pavement widening will be measured and paid for by the cubic yard (meter) complete in place and accepted.

500.4.01 Limits

A. Measurement for Separate Payment

There will be no separate measurement and payment for the following:

1. On permanent steel bridge deck forms for concrete deck slabs:
   - Extra reinforcing
   - Extra concrete
   - Other costs incurred because of the requirements of this specification

   All costs are included in the Lump Sum prices bid for superstructure concrete and superstructure reinforcement.

B. Payment per Cubic Yard (Meter)

Measurement limits on payment per cubic yard (meter) are:

1. Bridges, Concrete Culverts, Headwalls, and Retaining Walls

   The quantity of concrete measured for payment is the algebraic summation of the Base Pay Quantity and authorized quantity changes.

   If additional quantities are necessary because of any of the following, these quantities are measured separately for payment:
   - Rocks were removed carefully but additional quantities are needed because footing depth and keyway dimension are irregular from unanticipated rock removal.
   - Voids or crevices exist within the spread footing area.
   - The Engineer authorized filling trenches cut in rock outside footing areas to ease dewatering.

   These additional quantities will be paid as filler concrete per cubic yard (meter).
2. Seals

   When the Plans do not require a seal but a seal becomes necessary, or when the Plans do not show seal dimensions, the maximum pay dimensions in each direction will be the Plan dimension of the structural footing plus 3 ft. (1 m), with 18 in. (460 mm) on each side.

   If the Contractor uses lesser dimensions, measurement is based on the lesser dimensions. Concrete placed beyond the maximum pay limits are not measured.

C. Payment per Lump Sum

For Lump Sum payment, determine the quantities required before submitting the bid.

The concrete quantity must conform to the Plan dimensions. Measurement is made as a unit, complete in place, and includes the following:

- Diaphragms
- Sidewalks
- Concrete parapets

Measurement does not include concrete in the following items that will be paid for separately:

- Concrete handrailing
- Barriers
- Prestressed bridge members.

Payments for parapets placed by slip-form method is included in the Lump Sum price bid for superstructure concrete.

Unless otherwise shown on the Plans, the cost of steel joints and metal bearing assemblies used in structures where there is no structural steel Pay Item are included in the Contract Price for superstructure concrete.

D. Retaining Wall Incidentals

Retaining wall incidentals will be measured for payment as follows:

1. Drainage Systems

   Drainage items required by Special Plans are measured for payment by the unit specified on the plans only when they are set up as specific Pay Items and are paid for separately. Otherwise, their costs are included in the Contract Price for concrete.

   Payment is full compensation for the costs of excavation and backfill necessary to place the drainage items required by Special Plans.

   The following are not measured for separate payment. Costs are included in the Contract Price for concrete.

   - Sand blankets
   - Crushed or broken stone
   - Weep holes

2. Miscellaneous

   The following are not measured for separate payment. Costs are included in the Contract Price for concrete.

   - Expansion material
   - Rubber or polyvinyl plastic water stops

E. Utility Installation Hardware

The cost of placing utility hardware items is included in the Contract Price for the class of concrete the items are placed in.

500.5 Payment

This Work will be paid for at the Contract Price per cubic yard (meter), per Lump Sum, or per linear foot (meter), each complete in place and accepted.

Payment is full compensation for all things, including incidentals, and direct and indirect costs, to complete the Work.

Payment will be made under:

Item No.	Item	Payment
500	Superstructure concrete class_____, Bridge no._____	Per lump sum
500	Concrete handrailing (designation)	Per linear foot (meter)
500	Class_____concrete	Per cubic yard (meter)
500	Class_____concrete, high-early strength	Per cubic yard (meter)
500	Seal concrete	Per cubic yard (meter)
500	Class B concrete base or pavement widening	Per cubic yard (meter)
500	Class_____concrete including reinforcement steel	Per cubic yard (meter)
500	Class A concrete—filler	Per cubic yard (meter)
500	Class_____concrete—retaining wall	Per cubic yard (meter)
500	Grooved concrete	Per square yard (meter)
500	Concrete barrier	Per linear foot (meter)

500.5.01 Adjustments

A. Contractor Costs

Assume the following costs:

1. Costs related to rejected concrete and removing rejected concrete
2. Costs of forming an approved construction joint, removing a partial pour, or completing other remedial measures requested by the Engineer unless the fault lies solely with the Department
3. Costs of repairing, removing, and replacing falsework as directed by the Engineer
4. Costs of repairing, removing, or replacing forms
5. Costs of air-blown mortar to repair honeycombed areas, if required by the Engineer
6. Costs of using a higher class of concrete to widen existing bases or bases and pavements
7. Costs related to obtaining an approved specialty mix design.

B. Ride Quality Testing

The Department will conduct ride quality testing of bridge decks and approach slabs only twice per bridge at no cost to the Contractor.

The Department will conduct additional ride quality testing at the cost of $2000 per test.

The Department may issue a pay reduction based on the square yards (meters) of the span not passing the required 15 in./mi (235mm/km), and not having any bumps or depressions greater than 2/10 in. (5mm) required in Subsection 500.3.06.E. This pay reduction will be calculated based on SOP 48 for Bridge and Approach Penalties. A minimum of $1500.00 per bridge will be assessed for any pay reductions.

C. Plastic Shrinkage Crack Repair

The Engineer will determine how to repair cracks caused by plastic shrinking. Repair cracks at no cost to the Department.

D. Plan Quantities

For all bridges (except seal concrete), concrete culverts, headwalls, and retaining walls, the quantities shown on the Contract Plans, including Standard Plans, will be considered the Base Pay Quantity.

For seal concrete, the Plan quantities are approximate and are for estimating purposes only. The quantities will not be considered as Base Pay Quantities.

Calculated additions or deductions will be applied to the Base Pay Quantity when the Engineer makes authorized changes. Changes include, but are not limited to, authorized changes in the following:

- Footing dimensions
- Lengthening or shortening of concrete culverts
- Correcting Plan Quantities
- Dimension errors
- Multi-barrel culvert wall thicknesses
- Lengthening or shortening bridge columns
- Raising or lowering foundations

Calculations of the Base Pay Quantity and any changes will be made as follows:

1. No deductions will be made for the volume of concrete used by scorings, panels, and chamfers if the individual areas are less than 1 in.² (645 mm²).

   The volume of concrete in fillets of the same area will be neglected.
2. The volume of structural steel and of steel and concrete piling encased in concrete will be deducted.
3. The volume of timber piling encased in concrete will be deducted on the basis of 0.8 ft.³/linear foot (0.07 m³/linear meter) of pile.
4. No deduction will be made for the volume of concrete displaced by the following:
   - Steel reinforcement
   - Shear connectors
   - Floor drains (unless they are paid for as separate Pay Items)
   - Incidentals such as expansion material
   - Joint sealing compound
   - Utility thimbles and hangers

E. Filler Concrete

Filler concrete, measured as described in Subsection 500.4.01.B.1, *Bridges, Concrete Culverts, Headwalls, and Retaining Walls*, will be paid at 40 percent of the Contract Price per cubic meter for Class A Concrete or Class AA Concrete.

F. Seal Concrete

If there is no Contract Price for seal concrete, payment will be per cubic yard (meter), measured as described in Subsection 500.4.01.B.2, *Seals*, and will be paid at 60 percent of the Contract Price per cubic yard (meter) for Class A concrete.

G. Lump Sum Payment Adjustments

Adjust the payment as follows:

1. Authorized Change Adjustments

   When authorized changes are made as described in Subsection 500.5.01.D, *Plan Quantities,* the lump sum payment may be adjusted on a pro rata basis or according to Section 104 and as determined by the Engineer.

   The Plans show tabulated quantities as a service. This does not relieve any responsibility to conform to plan details.
2. Optional Plan Feature Adjustments

   If exercising an optional Plan feature, the Base Pay Quantity will not be changed if it is the only quantity change involved.

   However, if other changes are necessary, the quantity change resulting from the optional feature will be considered in the necessary quantity adjustments.

3. Falsework for Post-Tensioned Box Girder Bridge Adjustments

   When the falsework is completed for post-tensioned box girder bridges, 20 percent of the Lump Sum superstructure concrete price will be paid.

   Additional payments made as the concrete is placed must be adjusted for the payment for falsework. In other words, payment for concrete placed will be based on 80 percent of the superstructure bid price.

4. When Metal Deck Forms are used and have been placed, payment in the amount of 5% of the Lump Sum Superstructure Concrete price will be made. For Post-Tensioned Box Girder Bridges, this percentage (5%) will apply to that part of the superstructure.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

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.

Audible profiled thermoplastic markings consist of a thermoplastic stripe with raised bumps placed atop a thermoplastic stripe simultaneously as a system according to Plans and Specifications.

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 Program (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

3. Color

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

   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

a. 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

b. 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.

c. 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

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 yd^2 (1m^2) 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 Polmer 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.

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) =	[(lbs. used) ÷ (total linear feet)] x 0.236
(For 150 mm wide stripe)	
*Average Thickness (mm) =	[(kg used) ÷ (total linear meters)] x 4.0
(For 12 in wide stripe)	
* Average Thickness (in) =	[(lbs. used) ÷ (total linear feet)] x 0.118
(For 250 mm wide stripe)	
* Average Thickness (mm) =	[(kg used) ÷ (total linear meters)] x 2.0

b. Audible Profiled Thermoplastic – Apply a flat edge line or center 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/or center line markings 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) to 3 in (75 mm) in the longitudinal direction and 6 in. (150 mm) in the transverse direction.

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 18 in. (475 mm) center to center.

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

1. 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 the10 ft. (3 m) segment for skip stripe and the 30 ft. (9 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).
2. The longitudinal spacing of raised bumps may vary plus or minus 1 in (25 mm)
3. Stop work when deviation exceeds the above dimensions and remove the nonconforming stripe.
4. 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.
5. 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.
6. 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

   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/m^2.

   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.

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 by 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 (Including Audible Stripe)

Skip stripe is measured by the gross linear foot (meter), or 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 (10 ft. [3 m] skip stripe and 30 ft. [9 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.

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.

March 6, 2024

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SUPPLEMENTAL SPECIFICATION

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, 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 (for Type II Wood Fiber Blanket, see Application Rate Table Section 713.2.D), 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 of mat (blanket) selected for use.

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 within 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)

716.5.01 Adjustments

General Provisions 101 through 150.

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 801—Fine Aggregate

Replace Section 801 with the following:

801.1 General Description

This section includes the requirements for fine aggregate. All aggregate shall be the specified type, class, and grade.

801.1.01 Related References

A. Standard Specifications

Section 800—Coarse Aggregate

Section 441—Miscellaneous Concrete

B. Referenced Documents

GDT 4

GDT 5

GDT 63

GDT 75

GDT 132

QPL 1

SOP 1

AASHTO T 11

AASHTO T 21

AASHTO T 27

AASHTO T 112

AASHTO T 303

ASTM C 295

801.2 Materials

801.2.01 Fine Aggregate for Cushion

A. Requirements

Use the type, class, and grade of fine aggregate specified.

1. Types

   Use fine aggregate for cushion under granite curb or brick that is natural or manufactured sand with hard, strong, durable particles. Make manufactured sand from crushed gravel or stone meeting the requirements of Section 800. For a list of fine aggregate sources, see QPL 1.

2. Grades

   Use fine aggregate for cushion with less than 10 percent total silt and clay. Grade as follows:

Size	Percent by Weight
Passing No. 4 (4.75 mm) sieve	100
Passing No. 16 (1.18 mm) sieve	25-75
Passing No. 100 (150 µm) sieve	0-25

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Test as follows:

- Sieve analysis—AASHTO T 27

D. Materials Warranty

General Provisions 101 through 150.

801.2.02 Fine Aggregate for Portland Cement Concrete of All Types and for Mortar

A. Requirements

1. Concrete and Mortar

   Use fine aggregate for concrete and mortar that consists of natural sand, manufactured sand, or blends of natural and manufactured sands, having hard, clean, strong, durable, uncoated particles, meeting the requirements of the Specifications.

2. Manufactured Sand

   Manufactured sand used in concrete for construction of Portland cement concrete pavement, approach slabs, and bridge decks, shall be made from Group II aggregates as specified in Subsection 800.2.01.A.2.

3. Miscellaneous Concrete

   Sand manufactured from synthetic aggregate may be blended with natural sands or manufactured sands made from crushed stone or gravel for use in miscellaneous concrete as described in Section 441.

   Blend at least 50 percent natural sand or manufactured sand made from crushed stone or gravel.

4. Concrete Sand

   Concrete sand that passes the No. 10 (2 mm) sieve shall have these characteristics:

Characteristic	Requirement
Durability index	70 or greater
Sand equivalent	70 or greater

5. Detrimental Substances

   Keep detrimental substances within these limits:

Substance	Maximum Percent by Weight
Clay lumps	0.5 maximum in total sample
Coal and lignite	0.5 maximum in total sample
All detrimental substances (any combination)	2.0 maximum in total sample
NOTE: Do not use fine aggregate in Portland cement concrete that is capable of producing a deleterious reaction with Portland cement	

   a. Provided the material passing the No. 16 (1.18 mm) sieve is petrographically determined to be essentially free of detrimental substances, test results for coal and lignite and other detrimental substances listed will be based upon a petrographic analysis of material retained on the No. 16 (1.18 mm) sieve.

   b. Calculations will be based upon the weighted average for the total sample.

   c. Other detrimental substances include constituents such as shale, weathered or decomposed rock, soft or friable particles, coated grains, or other substances that might be considered detrimental for the use intended.

6. Organic Impurities (natural sands only)

   Ensure all fine aggregate is free from detrimental amounts of organic impurities.

   If the color of the supernatant liquid is darker than the Reference Standard color plate (AASHTO T-21), the fine aggregate shall be considered to possibly contain injurious organic compounds, and further test (AASHTO T-71) should be run before approving the fine aggregate for use in concrete. Comparison is made between compressive strengths of mortar made with washed and unwashed fine aggregates. Calculate strength ratio at 3 and/or 7 days in accordance with Section 11 of AASHTO T-71. However, if 24hr mix is being used test the specimens at age of 24hr, in accordance with Table 3 of AASHTO T-106 and calculate the strength per T-71. Do not use materials that have strength ratio less than 95%.

7. Grades

   Grade fine aggregates for Portland cement concrete and mortar as follows:

Size No.	Description	Total Percent by Weight Passing Each Sieve					
		3/8 in. (9.5 mm)	No. 4 (4.75 mm)	No. 16 (1.18 mm)	No. 50 (300 µm)	No. 100 (150 µm)	No. 200 (75 µm)
10 NS	Natural concrete sand	100	95-100	45-95	5-30	0-10	0-3
20 NS	Natural mortar sand	100	100	90-100	15-50	0-15	0-5
10 SM	Standard manufactured concrete sand	100	95-100	45-95	8-30	1-10	0-4
10 FM	Fine manufactured concrete sand	100	95-100	45-95	15-42	6-22	0-9

B. Fabrication

General Provisions 101 through 150.

C. Acceptance

Test as follows:

Test	Method
Petrographic analysis	ASTM C 295
Material that passes a No. 200 (75 µm) sieve	AASHTO T 11
Organic impurities	AASHTO T 21
Sieve analysis	AASHTO T 27
Sand equivalent	GDT 63
Reactivity	AASHTO T 303
Durability index	GDT 75
Clay lumps	AASHTO T 112
Friable Particles	GDT 132
NOTE: The percent passing the No. 200 sieve (75 µm) for size 10FM will be based upon the total percent determined by AASHTO T-11 and AASHTO T-27. The percent passing the No. 200 sieve (75 µm) for sizes 10NS, 20NS and 10SM will be as determined by AASHTO T-11 only.	

D. Materials Warranty

General Provisions 101 through 150.

April 13, 2026

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

SPECIAL PROVISION

Section 828—Hot Mix Asphaltic Concrete Mixtures

Delete Section 828 and substitute the following:

828.1 General Description

This specification includes the requirements for hot mix asphaltic concrete mixtures, including:

- Open-Graded Friction Course (OGFC)
- Porous European Mix (PEM)
- Stone Matrix Asphalt (SMA) mixtures
- Superpave mixtures
- Fine-graded mixtures (4.75 mm)

828.1.01 Definitions

The Nominal Maximum Sieve Size is one standard sieve size larger than the first sieve to retain more than ten percent of the aggregate, per AASHTO R35. Mixture types in this section are identified according to Nominal Maximum Sieve Size.

828.1.02 Related References

A. Standard Specifications

Section 400–Hot Mix Asphaltic Concrete Construction

Section 402–Hot Mix Recycled Asphaltic Concrete

Section 800–Coarse Aggregate

Section 802–Aggregates for Asphaltic Concrete

Section 819–Fiber Stabilizing Additives

Section 820–Asphalt Cement

Section 829–Ground Tire Rubber

Section 831–Admixtures

Section 882–Lime

Section 883–Mineral Filler

B. Referenced Documents

AASHTO R30

AASHTO R35

AASHTO T 112

AASHTO T 209

AASHTO T 245

AASHTO T 283
AASHTO T 305
AASHTO T 312
AASHTO T 321
AASHTO T 324
AASHTO T 331
AASHTO T 340
AASHTO T 401
ASTM D8225
SOP-2
SOP-36
GDT 1
GDT 56
GDT 63
GDT 114
GDT 115
GDT 123
GDT 139
GDT 140
GSP 21
QPL 1
QPL 2
QPL 7
QPL 26
QPL 41
QPL 77
QPL 81

828.2 Materials

A. Requirements

Use approved hot mix asphaltic concrete mixtures that meet the following requirements:

1. Produce each asphalt mixture according to the Department approved Asphalt Mix Design and Job Mix Formula. See Subsection 400.1 for submittal and approval of Job Mix Formulas.
2. Ensure individual acceptance test results meet the Mixture Control Tolerances specified in the appropriate table below, Subsections 828.2.01 through 828.2.04.
3. Ensure the Engineer approves all materials used to prepare and place the mixtures before incorporating them into the Work. Use only the ingredients listed in the approved Asphalt Mix Design and Job Mix Formula. For virgin aggregates, use sources meeting the requirements of Section 802 and are listed in QPL 1 or QPL 2; for mixtures in which local sand is permitted, use the approved sand source identified in the mix design. For mixtures containing

Reclaimed Asphalt Pavement (RAP), use only RAP from the approved stockpile identified in the mix design. Use asphalt cement meeting the requirements of Section 820, from a source listed in QPL 7.

4. Obtain approved Open-Graded Friction Course (OGFC), Porous European Mix (PEM), Stone Matrix Asphalt Mix (SMA), Superpave, and 4.75 mm mix designs from a mix design laboratory certified by the Department.

   Ensure all SMA mix designs are designed in accordance with GDT 123 “Determining the Design Proportions of Stone Matrix Asphalt Mixtures”. Ensure all OGFC and PEM mix designs are designed in accordance with GDT 114 “Determining Optimum Asphalt Content for Open-graded Bituminous Paving Mixtures” and Sub-section 828.2.01. Ensure OGFC, PEM, and SMA mix designs are verified and approved by the Department prior to use. Batched materials and gyrated specimens where applicable, for required mix design verification, are to be submitted with the initial mix design approval request. Ensure Superpave and 4.75 mm mix designs are designed in accordance with SOP 2 "Control of Superpave Bituminous Mixture Designs" and are approved by the Department as provided therein. Ensure all mixtures are designed by a laboratory and technician certified in accordance with SOP 36 "Certification of Laboratories and Personnel for Design of SMA and Superpave Asphalt Mixtures". Mix Design Technicians certified to design SMA mixtures are approved to design OGFC and PEM mixtures. The Department approves submitted mix designs for compliance with specified requirements and laboratory performance test data. The Contractor is responsible for the placement in accordance with Sections 400 and 402 for the GDOT approved mix designs.

5. Use only mixtures composed of the aggregate groups and blends indicated in the Proposal and Plans by their pay item designations, defined as follows:

TABLE 1 – AGGREGATE GROUPS

Pay Item Designation	Allowable Aggregate Groups
Group I or II	Group I, Group II, or Blend I
Group II only	Group II only
Blend I	Either 100% Group II material or a blend of Group I and Group II. Do not use Group I material for more than 60%, by weight, of the total aggregate nor more than 50%, by weight, of the coarse aggregate fraction.

6. For patching or leveling use Group I, Group II, or Blend I. Mix types for patching and leveling are specified in Subsection 400.3.03.B.

7. Include an approved anti-stripping agent from an approved source and meeting the requirements of Sections 882 and/or 831 in all paving courses except as otherwise provided in the Contract. For a list of approved sources of lime, see QPL 41. For a list of approved sources of heat-stable Liquid Anti-Stripping Additives (LASA), see QPL 26.

   a. Add lime to each mixture at the rate prescribed in the approved mix design. GDT 140 “Test to Detect the Presence of Hydrated Lime in Unwashed Ignition Oven Burned Asphaltic Concrete Samples”, will be used to verify the presence of hydrated lime during production in accordance with GSP 21, subsection 8.c.

   b. Ensure mix designs using only virgin aggregate include lime at a minimum rate of 1.00% of the total dry aggregate weight. Ensure mix designs using RAP include lime at a minimum rate equal to 1.00% of the virgin aggregate fraction plus 0.50% of the aggregate in the RAP fraction.

   c. Add more lime or add lime plus an approved heat-stable LASA meeting the requirements of Section 831, if necessary to meet requirements for mixture properties, and pursuant to an approved mix design. However,

the Department will not make additional payment for these materials. For a list of sources of heat-stable LASA, see QPL 26.

d. An approved heat-stable LASA meeting the requirements of Section 831 and listed on QPL 26 may be substituted for hydrated lime for non-interstate roadways with two-way ADTs < 25,000 vehicles per day (VPD). LASA will be allowed for use in recycled 4.75 mm mixes and Superpave asphaltic concrete mixes using ≥ 15% RAP and Open-Graded Crack Relief Interlayer (OGI) mix types regardless of the RAP percentage. LASA can be terminally blended or blended in-line at the asphalt plant when approved for in-line blending and listed on QPL 45 "Georgia's List of Approved Hot Mix Asphalt Plants". Add a heat-stable LASA at the specified dosage rate, by weight of the virgin asphalt cement portion, to meet the mix design requirements for Sub-section 828.2.B.2 including AASHTO T283 and AASHTO T324. All test results must conform to specified performance testing requirements in Sub-section 828.2.B.2. An approved asphalt mix design using the approved heat-stable LASA meeting all specified performance testing criteria is required. OGFC, PEM, SMA, and all asphaltic concrete mixtures used on interstates or on roadways with two-way ADT ≥ 25,000 VPD, are required to use hydrated lime, as specified herein.

8. Use Performance Grade (PG) 64-22 or PG 67-22 asphalt cement in all mix designs and mixtures except as follows:

   a. Use only PG 76-22, excluding non-specified shoulder construction in the following mixes: all SMA, 12.5 mm PEM, 9.5 mm and 12.5 mm OGFC. PG 76-22 shall be used in 12.5 mm Superpave, as specified in the pay item, on projects with two-way ADT ≥ 25,000; and in all mixtures for which polymer-modified bituminous materials is specified in the pay item.

   b. PG binders incorporating a heat-stable LASA shall be evaluated at the asphalt plant in accordance with GDT 139 "Test Method to Detect and Verify the Presence of Amine Based LASA in Asphalt Cement" in accordance with GSP 21, subsection A.10. PG binders incorporating non-Amine based LASA will be evaluated at the asphalt plant in accordance with GSP 21 subsection A.4.

9. Use of local sand is restricted as follows:

   a. Do not place mixtures containing local sand on the Interstate System.

   b. Ensure local sand will not constitute more than 20% of the total aggregate weight of any mix design or production mix.

   c. Subject to the above limits, 19 mm, 12.5 mm, and 9.5 mm Superpave mix designs and 4.75 mm mix designs containing local sand may be used on projects with a current ADT not exceeding 10,000 VPD providing that all performance testing meets specified requirements.

   d. 25 mm Superpave mix designs containing no more than 20% local sand may be used on all facilities except the Interstate System.

   e. Mixtures containing no more than 20% local sand can be used in thin lift leveling placed at < 90 lbs/yd^2 and in limited isolated areas requiring patching at depths ≤ 4 inches (100 mm) at lengths of no more than 10 ft (3 m) of a continuous linear distance. These mixtures may be used on all facilities except the Interstate System.

   f. Obtain local sand for use in asphalt mixtures from a source approved by the Department.

   g. The Department will sample, test, and approve sources of local sand. Ensure local sand contains no more than 7.0% clay by weight and is free of foreign substances, roots, twigs, and other organic matter. Ensure sand is free of clay lumps, as determined by AASHTO T 112, and has a sand equivalent value exceeding 25%, as determined by GDT 63.

10. Quick Guide to allowable material and additive usage in asphaltic concrete mixtures:

    Detailed in Table 2.

TABLE 2 – QUICK GUIDE TO ALLOWABLE USE OF MATERIALS AND/ADDITIVES

MATERIAL	USAGE
USE OF HYDRATED LIME	Required for all mix types used on interstates including but not limited to mainline, shoulders, gore areas, and ramps
	Required in SMA, OGFC, and PEM mix types
	Required for all mix types used on roadways with ADTs ≥ 25,000 VPD
	Required for all mix types, other than OGI, using <15 % RAP
USE OF LASA	Permitted in all mix types using ≥ 15 % RAP on non-interstate roadways with ADT < 25,000 VPD, except LASA is not permitted for use in SMA, OGFC and PEM mix types
	Permitted in OGI, regardless of RAP Usage, on all non-interstate roadways with ADT < 25,000 VPD
USE OF PG 76-22	Required in all SMA, PEM, OGFC mix types, excluding non-specified shoulder construction
	Required in 12.5 mm Superpave mix, as specified in the pay item, on projects with two-way ADT ≥ 25,000 VPD
	Required in all mixtures when polymer modified bituminous material is specified in the pay item
USE OF LOCAL SAND	Permitted at a maximum rate of 20% of total aggregate weight, and as specified
	Permitted in 4.75 mm, 9.5 mm, 12.5 mm and 19 mm Superpave mix types of non-interstate roadways with ADTs ≤ 10,000 VPD
	Permitted in 25 mm Superpave mixes on all non-interstate roadways regardless of ADT
	Permitted in 4.75 mm and 9.5 mm Superpave mix types used as thin lift leveling, when placed at < 90 lbs/yd^2 and in 12.5 mm, and 19 mm Superpave mix types placed in isolated areas of patching at thicknesses ≤ 4 inches (100 mm) at lengths of < 10 ft (3m) of a continuous linear distance

B. Fabrication

1. Design procedures: For all Superpave and 4.75 mm mixes, ensure conformance with the Superpave System for Volumetric Design (AASHTO T 312 and AASHTO R30), as adapted in SOP-2. Ensure Superpave mixes are designed at a design gyration number (N_{des}) of 65 gyrations and initial gyration number (N_{ini}) of 6 gyrations. Ensure 4.75 mm mixes, (N_{des}) are designed at 50 gyrations, and (N_{ini}) at 6 gyrations. Design open-graded mixes in accordance with GDT 114. In all cases, the procedure for measuring Maximum Specific Gravity (G_{mm}) is AASHTO T 209. In addition to gradation and volumetric analysis, ensure mix designs include the following performance tests, as applicable.

2. Performance Test:

   a. Permeability test: Ensure Superpave and Stone Matrix mix designs include testing according to GDT 1 “Measurement of Water Permeability of Compacted Asphalt Paving Mixtures”. Ensure specimen air voids for this test are 6.0% (±1.0%). The average permeability of three specimens may not exceed 3.60 ft per day (125 ×10^{-5}cm per sec).

b. Moisture Susceptibility test: For all mixtures, excluding OGI, using an approved heat-stable LASA meeting the requirements of Section 831 in lieu of hydrated lime, fabricate and test specimens in accordance with AASHTO T 283. When required by the Office of Materials and Testing due to visible signs of stripping in any laboratory fabricated or plant produced asphaltic concrete mixtures, AASHTO T 283 shall be performed for continued validation of the mix design. Ensure specimen air voids for this test are 7.0% (±1.0%) for all mixes excluding Stone Matrix mixes. When AASHTO T 283 is required due to visible signs of stripping in any Stone Matrix Mix sample, ensure specimen air voids for this test are 6.0% (±1.0%). For all mix types, the minimum tensile splitting ratio is 0.80, except a tensile splitting ratio of no less than 0.70 may be acceptable if all individual strength values exceed 100 psi (690 kPa). Ensure individual splitting strength of the three conditioned and three controlled samples are not less than 60 psi (415 kPa). Ensure retention of coating as determined by GDT 56 is not less than 95%.

c. Hamburg Wheel-Tracking Test for rutting and moisture susceptibility test: Ensure mix designs of all mix types except Open-graded Surface Mixes (OGFC and PEM), and OGI mix, include testing in accordance with AASHTO T 324. Ensure specimen air voids for this test are 7.0% (±1.0%) for all mix types, other than SMA mixes and at a testing temperature of 50°C (122°F). Ensure specimen air voids for this test are 6.0% (±1.0%) for SMA mixtures and at a testing temperature of 50°C (122°F). Use the testing and acceptance criteria established in Table 3.

TABLE 3 – HAMBURG WHEEL TRACKING DEVICE TESTING AND ACCEPTANCE CRITERIA

Binder Performance Grade (PG)	Mix Type	Number of Passes	Maximum Rut Depth	Minimum Stripping Inflection Point
PG 64-22 and PG 67-22	4.75 mm, and 9.5 mm SP Type I	15,000	≤ 12.5 mm	> 10,000 Passes
PG 64-22 and PG 67-22	9.5 mm SP Type II	15,000	≤ 12.5 mm	> 15,000 Passes
PG 64-22 and PG 67-22	12.5 mm SP, 19 mm SP and 25 mm SP	20,000	≤ 12.5 mm	> 20,000 Passes
PG 76-22	All Mix types	20,000	≤ 12.5 mm	> 20,000 Passes

Tested specimens shall be inspected for any visible signs of stripping and any mix design's tested specimens that fail to maintain 95% of asphalt cement coating, as described in GDT 56 section III, A will be required to meet specified requirements for AASHTO T 283 as detailed in 828.2.B.2.b. Failure to conform to specified maximum rutting tolerance or minimum stripping inflection point (SIP) will result in non-approval of the submitted mix design.

d. Fatigue testing: The Department may verify dense-graded mix designs by fatigue testing according to AASHTO T 321 or other procedure approved by the Department.

e. Abrasion Loss of Asphaltic Mixture testing: The Department will evaluate fabricated specimens submitted with all mix design approval request for OGFC, PEM, and SMA mix types in accordance with AASHTO T 401. Superpave mixes used on interstate mainline shall require fabricated specimens be submitted for AASHTO T 401 testing with mix designs approval requests. In accordance with AASHTO T 312, compact OGFC and PEM specimens using the Superpave Gyratory Compactor to a specimen height of 115 mm (± 5 mm) and specimen air void content range specified in Sub-section 828.2.01.A. Specimen air voids for the SMA specimens shall be 6.0% (± 1.0%) with a specimen height of 115 mm (±5 mm). Specimen air voids for all Superpave Mix Types specimens, when required, shall be 7.0% (±1.0%) with a specimen height of 115 mm (±5 mm). Bulk Specific Gravity of the compacted open-graded mixtures shall be determined using

Corelok vacuum-sealing device in accordance with AASHTO T 331. Individual specimen and average of three specimens for OGFC, PEM, SMA, and interstate mainline Superpave Mix Types shall comply with mix design and acceptance criteria established in Table 4 for Interstate pavements. Abrasion Loss results shall be reported in mix design approval submissions for all OGFC, PEM, SMA Mix and interstate mainline Superpave mix types.

TABLE 4 –ABRASION LOSS PERFORMANCE TESTING AND ACCEPTANCE CRITERIA

Asphaltic Concrete Mix Type	Mix Design and Quality Acceptance Maximum Abrasion Loss Percent
All Superpave Mix Types used on Interstate Mainline	Report
All SMA Mix Types	10
All Open-graded Mix Types	20

f. Indirect Tensile Asphalt Cracking Test (IDEAL-CT): Ensure all dense-graded and gap-graded mix designs of all mix types, include testing in accordance with ASTM D8225. Ensure all specimens of dense-graded mix types are tested at 7.0% (±1.0%) air voids. SMA mixture specimens shall be tested at 6.0% (±1.0%) air voids. Ensure individual and average of three (3) specimens' CT Index results are included with mix design approval submission. The mix design laboratory shall fabricate and submit IDEAL CT specimens with all asphaltic concrete mix design approval request to the Asphalt Mix Design Unit at the Office of Materials and Testing for verification testing. All IDEAL CT index results shall be compiled by OMAT for future inclusion of specified tolerances.

C. Acceptance

See Subsection 106.03 and Section 400. Ensure individual test results meet the Mixture Control Tolerances listed in Subsections 828.2, 828.2.01 ,828.2.02, 828.2.03, or 828.2.04, whichever applies with the following exception. Ensure field verification results for rutting and moisture susceptibility tests performed on laboratory fabricated and/or roadway cores obtained from asphalt plant produced mixtures meet specified requirements for AASHTO T 324 as detailed in Subsection 828.2.B.2.c. and AASHTO T 283 as detailed in Subsection 828.2.B.2.b. All GDOT approved asphalt mix designs are required to have full field mix design verifications, using plant produced mixture, sampled by the Contractor and submitted to the applicable GDOT laboratory (Central or District) at a minimum of once per two years. Approved mix designs produced using heat-stable LASA are required to have full field mix design verifications, using plant produced mixture, sampled and submitted to the applicable GDOT laboratory (Central or District) at a minimum frequency as detailed in GSP 21, Sub-section A.12. Failure to meet performance testing specified in Sub-section 828.2B.2 will require the use of hydrated lime in lieu of a heat-stable LASA until the mix design can be properly validated.

Field mix design verification results that fail to comply with performance testing specified in Subsection 828.2.B will require a complete laboratory mix design verification, to be completed by a GDOT certified mix design laboratory, as decided by the mix design owner for continued use of that design. If an asphalt mix design has not been produced within two years, a full field mix design verification will be sampled by the Contractor and submitted to the applicable GDOT laboratory (Central or District) on the first Lot produced thereafter. Any mix design that fails to meet performance test requirements established in Subsection 828.2.B, using laboratory fabricated specimens due to failing field mix design results, will subject that mix design to invalidation and is no longer approved for use by GDOT. Field mix design verifications as specified in Section 402, Section 400, SOP 2 and GSP 21, are not precluded by the requirements specified herein.

D. Materials Warranty

See General Provisions 101 through 150.

828.2.01 Open-Graded Surface Mixtures

A. Requirements

Produce the mixture according to the approved Asphalt Mix Design and Job Mix Formula. Ensure Open-Graded Surface Mixtures meet the following mixture control tolerances and mix design criteria:

Sieve Size	Mixture Control Tolerance, %	Design Gradation Limits, % Passing		
		9.5 mm OGFC	12.5 mm OGFC	12.5 mm PEM
3/4 in. (19 mm) sieve	±0.0		100*	100*
1/2 in. (12.5 mm) sieve	±6.1	100*	85-100	80-100
3/8 in. (9.5 mm) sieve	±5.6	85-100	55-75	35-60
No. 4 (4.75 mm) sieve	±5.7	20-40	15-25	10-25
No. 8 (2.36 mm) sieve	±4.6	8-15	5-15	5-10
No. 200 (75 µm) sieve	±2.0	4-6	3-5	2-4
Range for % AC	±0.4	6.25-7.25	6.00-7.25	5.75-7.00
Range for Mix Design Air Voids %		15 - 18	15 - 20	18 - 22
Class of stone (Section 800)		“A” only	“A” only	“A” only
Drain-down (AASHTO T 305), %		<0.3	<0.3	<0.3
Abrasion Loss % (AASHTO T 401)		<20%	< 20%	< 20%

* Mixture control tolerance is not applicable to this sieve for this mix.

1. In 12.5 mm OGFC, 9.5 mm OGFC, and 12.5 mm PEM mixes, use only PG 76-22 asphalt cement (specified in Section 820).
2. Ensure all OGFC and PEM mixes include a stabilizing fiber of the type (cellulose or mineral) specified in the mix design and meeting the requirements of Section 819. Ensure the dosage rate is as specified in the mix design and sufficient to prevent drain-down exceeding the above tolerance.
3. When using an approved GTR modifier and additive, a fiber stabilizing product is not required when all drain down requirements are met. This includes a visual inspection and GDT 127 “Determining Drain-Down Characteristics in Uncompacted Bituminous Mixtures”

B. Fabrication

See Section 400.

828.2.02 Stone Matrix Asphalt Mixtures

A. Requirements

Produce the mixture according to an approved Asphalt Mix Design and Job Mix Formula. Ensure SMA mixtures meet the following mixture control tolerances and mix design criteria:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		9.5 mm SMA	12.5 mm SMA	19 mm SMA
1 in. (25 mm) sieve	±0.0			100*
3/4 in. (19 mm) sieve	±7.0	100*	100*	90-100
1/2 in. (12.5 mm) sieve	±6.1	98-100**	85-100	44-70
3/8 in. (9.5 mm) sieve	±5.6	70-100	50-75	25-60
No. 4 (4.75 mm) sieve	±5.7	28-50	20-28	20-28
No. 8 (2.36) mm sieve	±4.6	15-30	16-24	15-22
No. 50 (300 µm) sieve	±3.8	10-17	10-20	10-20
No. 200 (75 µm) sieve	±2.0	8-13	8-12	8-12
Range for % AC (Note 1)	±0.4 (Note 2)	6.0-7.5	5.8-7.5	5.5-7.5
Design optimum air voids (%)		3.5 ±0.5	3.5 ±0.5	3.5 ±0.5
% aggregate voids filled with AC (VFA)		70-90	70-90	70-90
Tensile splitting ratio after freeze-thaw cycle AASHTO T 283		≥ 80%	≥ 80%	≥ 80%
All individual tensile strength values exceed 100 psi (690 kPa). AASHTO T 283		≥ 70%	≥ 70%	≥ 70%
Abrasion Loss % (AASHTO T 401)		<10%	< 10%	< 10%

*Mixture control tolerance is not applicable to this sieve for this mix.

**Mixture control tolerance is ± 2.0% for this sieve for 9.5 mm SMA mixes placed at spread rates greater than 135 lb./yd^2. For 9.5 mm SMA mixes placed at spread rates of 135 lb./yd^2 or less, 100 % passing is required on this sieve.

Note 1: Range for percent AC is Original Optimum AC (OOAC) at 50 blows (Marshall compactor) prior to Corrected Optimum AC (COAC) calculation detailed in GDT 123 (Appendix A)

Note 2: Quality Acceptance Test Results for AC content that deviate > ± 0.3% from the approved Job Mix Formula (JMF), consistently over three lots, may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

1. Ensure SMA mixtures are compacted at 50 blows with the Marshall compactor.
2. Ensure SMA mixtures contain mineral filler and fiber stabilizing additives and meet the following requirements:
   a. Asphalt cement PG-76-22 (specified in Section 820) is required in all SMA mixtures.
   b. Aggregates for SMA meet the requirements of Subsection 802.2.02.A.3.
   c. Use the approved mineral filler specified in the mix design and meeting the requirements of Section 883. Approved sources of mineral filler are listed in QPL 81.

Use the approved Fiber Stabilizing Additive of the type (cellulose or mineral) specified in the mix design and meeting the requirements of Section 819. Approved sources of Fiber Stabilizing Additive are listed in QPL 77. The dosage rate will be as specified in the mix design and sufficient to prevent drain-down exceeding the above tolerance.

B. Fabrication

See Section 400.

828.2.03 Superpave Asphalt Concrete Mixtures

A. Requirements for Superpave Mixtures (except Parking Lot Mixtures)

Produce the mixture according to an approved Asphalt Mix Design and Job Mix Formula. Ensure Superpave Asphalt Concrete mixtures meet the following mixture control tolerances and mix design limits:

1. Gradation limits for Superpave mixtures are as follows:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing				
		9.5 mm Superpave Type I	9.5 mm Superpave Type II	12.5 mm Superpave (Note 1)	19 mm Superpave	25 mm Superpave
1½ in. (37.5 mm)						100*
1 in. (25.0 mm)	± 8.0			100*	100*	90-100
3/4 in. (19.0 mm)	±8.0**	100*	100*	98-100****	90-100	55-89**
1/2 in. (12.5 mm)	±6.0***	98-100****	98-100****	90-100	60-89***	50-70
3/8 in. (9.5 mm)	±5.6	90-100	90-100	70-89	55-75	
No. 4 (4.75 mm)	±5.6	65-85	55-75			
No. 8 (2.36 mm)	±4.6	48-55	42-47	38-46	32-36	30-36
No. 200 (75 µm)	±2.0	5.0-7.0	5.0-7.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for % AC (Note 3)	± 0.4 (Note 2)	5.50-7.25	5.25-7.00	5.00-6.25	4.25-5.50	4.00-5.25

* Mixture control tolerance is not applicable to this sieve for this mix.

** Ensure mixture control tolerance is within ± 10.0% for this sieve for 25 mm Superpave.

***Ensure mixture control tolerance is within ± 8.0% for this sieve for 19 mm Superpave.

****Ensure mixture control tolerance is within ± 2.0% for this sieve for 12.5 mm and 9.5 mm mixes.

Note 1: Use PG 76-22 in 12.5 mm Superpave, excluding shoulder construction, on all projects with ADT ≥ 25,000 as detailed in the Contract Pay Item.

Note 2: Quality Acceptance Test Results for AC content deviating > ± 0.3% from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 3: Range for percent AC is Original Optimum AC (OOAC) at 65 gyrations prior to the Corrected Optimum AC (COAC) calculation detailed in SOP 2 (Appendix D).

2. Volumetric limits are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (Gmm) at design gyrations, (Ndes)	All	96%
% Gmm at the initial number of gyrations, Ni	All	91.5% maximum
% voids filled with asphalt (VFA) at Ndes	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 76
	19 mm	Min. 71; Max 76
	25 mm	Min. 69; Max 76
Fines to effective asphalt binder ratio (F/Pbe)	9.5 mm Type I	0.6 to 1.4
	All other types	0.8 to 1.6
Minimum Film Thickness (microns)	All	> 7.00
Tensile splitting ratio after freeze-thaw cycle AASHTO T283 (All specimens minimum 60 PSI)	All	≥ 80%
All individual tensile strength values exceed 100 psi (690 kPa). AASHTO T 283	All	≥ 70%
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (Gse). See SOP-2SP.	25 mm	13.0
	19 mm	14.0
	12.5 mm	15.0
	9.5 Type I	16.0
	9.5 Type II	16.0

B. Requirements for Superpave Parking Lot Mixes (NOT FOR STANDARD HIGHWAY/STREET PAVING)

1. Surface layers for parking facilities:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		4.75 mm Mix	9.5 mm Superpave Type I	9.5 mm Superpave Type II
3/4 in. (19.0 mm) sieve	±8.0**		100*	100*
1/2 in. (12.5 mm) sieve	±6.0	100*	98-100****	98-100****
3/8 in. (9.5 mm) sieve	±5.6	90-100	90-100	90-100
No. 4 (4.75 mm) sieve	±5.6	75-95	65-85	55-75
No. 8 (2.36 mm) sieve	±4.6	60-65	48-55	42-47
No. 50 (300 µm) sieve	+3.8	20-50		
No. 200 (75 µm) sieve	±2.0	4-12	5.0-7.0	5.0-7.0
Range for Total AC	+ 0.4	6.00 - 7.50	5.50 - 7.25	5.25 - 7.00

2. Subsurface layers for parking facilities:

Sieve Size	Mixture Control Tolerance	Design Gradation Limits, Percent Passing		
		12.5 mm Superpave	19 mm Superpave	25 mm Superpave
1½ in. (37.5 mm)				100*
1 in. (25.0 mm) sieve	± 8.0	100*	100*	90-100
3/4 in. (19.0 mm) sieve	±8.0**	98-100****	90-100	55-89**
1/2 in. (12.5 mm) sieve	±6.0***	90-100	60-89***	50-70
3/8 in. (9.5 mm) sieve	±5.6	70-89	55-75	
No. 8 (2.36 mm) sieve	±4.6	38-46	32-36	30-36
No. 200 (75 µm) sieve	±2.0	4.5-7.0	4.0-6.0	3.5-6.0
Range for Total AC	+ 0.4	5.00 - 6.25	4.25 - 5.50	4.00 - 5.25

All * and notes apply to both 828.2.03.B.1 and 828.2.03.B.2.

*Mixture control tolerance is not applicable to this sieve for this mix.

**Ensure mixture control tolerance is within ±10.0% for this sieve for 25 mm Superpave mixes.

*** Ensure mixture control tolerance is within ±8.0% for this sieve for 19 mm Superpave mixes.

****Ensure mixture control tolerance is within ±2.0% for this sieve for 12.5 mm and 9.5 mm Superpave mixes.

Note 1: Quality Acceptance Test Results for AC content deviating > ± 0.3% from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 2: Range for percent AC is Original Optimum AC (OOAC) at 65 gyrations prior to the Corrected Optimum AC (COAC) calculation detailed in SOP 2 (Appendix D).

3. Volumetric limits for parking facilities are as follows:

Design Parameter	Mix Type	Limits
% of Max. Specific Gravity (Gmm) at design gyrations, (Ndes)	All	96%
% Gmm at the initial number of gyrations, Ni	All	91.5% maximum
% voids filled with asphalt (VFA) at (Ndes)	9.5 mm Type I	Min. 72; Max. 80
	9.5 Type II and 12.5 mm	Min. 72; Max. 78
	19 and 25 mm	Min. 71; Max 76
Fines to effective asphalt binder ration (F/Pbe)	9.5 mm Type I	0.6 to 1.4
	All other types	0.8 to 1.6
Minimum Film Thickness (microns)	4.75 mm	> 6.00
	All other types	> 7.00
Tensile splitting ratio after freeze-thaw cycle AASHTO T283 (All specimens minimum 60 PSI)	All	≥ 80%
All individual tensile strength values exceed 100 psi (690 kPa). AASHTO T 283	All	≥ 70%
Minimum % Voids in Mineral Aggregate (VMA) Note: VMA shall be calculated using the effective specific gravity of the aggregate (Gse). See SOP-2	25 mm	13.0
	19 mm	14.0
	12.5 mm	15.0
	9.5 mm Types I, II	16.0

C. Fabrication

See Section 400.

828.2.04 Fine-Graded Mixtures

A. Requirements

Produce the mixture according to an approved Asphalt Mix Design and Job Mix Formula. Ensure that fine-graded mixtures meet the following mixture control tolerances and design limits:

		4.75 mm Mix
Sieve Size	Mixture Control Tolerance	Design Gradation Limits, % passing
1/2 in. (12.5 mm) sieve*	±0.0	100*
3/8 in. (9.5 mm) sieve	±5.6	90-100
No. 4 (4.75 mm) sieve	±5.7	75-95
No. 8 (2.36 mm) sieve	±4.6	60-65
No. 50 (300 μm) sieve	±3.8	20-50
No. 200 (75 μm) sieve	±2.0	4-12
Range for % AC[1 and 2]	±0.4	6.00 – 7.50
% of Max. Specific Gravity (Gmm) at design gyrations, (50) (Ndes)		93% - 96%
Tensile splitting ratio after freeze-thaw cycle AASHTO T283 (All specimens minimum 60 PSI)		≥ 80%
All individual tensile strength values exceed 100 psi (690 kPa). AASHTO T 283		≥ 70%

* Mixture control tolerance is not applicable to this sieve for this mix.

Note 1: Quality Acceptance Test Results for AC content deviating > ± 0.3% from the approved Job Mix Formula (JMF) consistently over three Lots may subject the mix to a revised AC content on the project JMF at the discretion of the State Materials Engineer based on statistical trend.

Note 2: Range for percent AC is Original Optimum AC (OOAC) at 50 gyrations prior to the Corrected Optimum AC (COAC) calculation detailed in SOP 2 (Appendix D).

B. Fabrication

See Section 400.

C. Acceptance

See Subsection 106.3 and Section 400. Ensure individual test results meet the Mixture Control Tolerances listed in Subsections 828.2, 828.2.01, 828.2.02, 828.2.03, 828.2.04, whichever applies.

D. Materials Warranty

See General Provisions 101 through 150.

828.2.05 Revisions of Approved Designs for Single Ingredient Changes

When a particular ingredient of a mix design becomes unavailable, the Contractor must provide a different asphaltic concrete mix design in order to continue working on a project. The Contractor is always responsible for the supply of materials. Should an ingredient become unavailable due to the manufacturer or supplier of that ingredient, a revised mix design request using a reduced number of AC points, (two at a minimum, in some cases three may be necessary), may be submitted to the State Bituminous Construction Manager. The revised mix design's AC points must bracket the Original Optimum AC (OOAC) content for all mixtures as well as the Corrected Optimum AC (COAC) content for recycled mixtures. In addition to the mix design AC points, all performance testing applicable to that mix type must be conducted and submitted. The State Bituminous Construction Manager will consider the revised mix design request under the following conditions.

- Any change in a single coarse aggregate source
- Any change in a RAP source
- Any change in PG Binder grade other than PG64-22 to PG67-22 or vice versa
    - This includes any change in GTR source or workability additive
- Any change from Hydrated lime to a LASA
    - A change from a LASA to Hydrated Lime will require an AC Calibration Factor, gradation update and field mix design verification
- Any change in one Organosilane product to another Organosilane product. A change from an amine-based product to an Organosilane product, or vice versa)

The State Bituminous Construction Manager may consider reduced testing requirements on a case-by-case basis for extenuating circumstances, by request only, for the following conditions.

- Any change in mineral or cellulose fiber type, product and/or source
- Any change in mineral filler type, product, and/or source

In all of these cases, only the entity, person or company assigned as owner in the submission of the original mix design, may submit a design revision using a reduced number of AC mix design points (2 minimum) for consideration. Design revisions will be subject to the following conditions:

A. Actual Shortage Required

The revision must be necessitated by an actual shortage, sufficient to delay work in progress, of a ingredient of an approved design.

B. Similar Substitute Ingredient

The substitute ingredient must be similar to the replaced ingredient in mineralogy, particle size and shape, specific gravity, and abrasion resistance for aggregate substitutions.

C. Revised Design Support Requirements

The proposed revised design shall be supported by volumetric tests on a minimum of two pairs of specimens at asphalt content checkpoints above and below the original optimum asphalt content of the mix design. The original mix design COAC shall be used for mix design performance and AC Calibration Factor tests as defined in SOP 2. For heat-stable LASA type, product or source change, moisture damage and rutting susceptibility testing, in accordance with AASHTO T 283 and AASHTO T 324, are required for all revised mix designs regardless of the approval process such as submitted checkpoint designs or field mix design verification testing. For all other ingredient substitutions, verification of tests for susceptibility to rutting, fatigue, permeability, and moisture damage shall be provided in accordance with this subsection.

D. Fabrication

See Section 400.

E. Acceptance

See Subsection 106.3 and Section 400. Ensure individual test results meet the Mixture Control Tolerances listed in Subsections 828.2, 828.2.01, 828.2.02, 828.2.03, 828.2.04, whichever applies.

F. Materials Warranty

See General Provisions 101 through 150.