

# **DIVISION 600**

# **Traffic Control**



**SOUTH CAROLINA**  
**DEPARTMENT**  
**OF TRANSPORTATION**

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# Section 601

## Work Zone Traffic Control

### 601.1 DESCRIPTION OF WORK

Section 601, Section 602 and Section 603 of the *Standard Specifications* govern the work zone traffic control, devices and procedures for SCDOT projects. The Contractor is responsible for providing a Traffic Control Plan for the control and maintenance of traffic during construction, which will include the methods of handling traffic, devices and procedures necessary for the safe passage of traffic through and around the work zone with minimum inconvenience to the public. The Resident Construction Engineer and Roadway Inspectors will be responsible for ensuring that the Contractor complies with the Contract Plans and Specifications, the Traffic Control Plan and the *MUTCD*. All construction personnel are obligated to immediately report for correction any problems identified with traffic control.

### 601.2 PRECONSTRUCTION CONSIDERATIONS

#### 601.2.1 Primary References

The following references should be reviewed, as needed, for work zone traffic control on SCDOT projects:

1. *MUTCD*. SCDOT has adopted verbatim the *Manual on Uniform Traffic Control Devices for Streets and Highways – Millennium Edition*. The purpose of the *MUTCD* is to establish uniformity in the design and use of traffic control devices. Major consideration is given to the standards for signs, signals and markings and how and when they should be used, with less emphasis placed on how and when a particular road should be marked. Part 6 – Temporary Traffic Control applies to traffic control in the work zone on SCDOT projects. The *MUTCD* is a minimum requirement. SCDOT reserves the right to exceed the requirements of the *MUTCD*.
2. *SCDOT Construction Manual and SCDOT Standard Specifications*. The following sections apply to work zone traffic control on SCDOT projects:
  - Section 104.6 – Detours and Haul Roads,
  - Section 104.7 – Maintenance and Maintaining Traffic,
  - Section 107.11 – Traffic Control,
  - Section 107.12 – Payment for Traffic Control,
  - Section 107.13 – Correcting Low Shoulder Conditions,
  - Section 107.14 – Railway Highway Provisions,
  - Section 107.20 – Opening of Section of Highway to Traffic,
  - Section 601 – Work Zone Traffic Control,
  - Section 602 – Traffic Control Devices in the Work Zone, and
  - Section 603 – Work Zone Traffic Control Procedures.

3. SCDOT Approved Products List for Traffic Control Devices in Work Zones. This publication presents SCDOT-approved products that are permitted on SCDOT construction projects for traffic control purposes. The products listed in this publication meet NCHRP Report 350 requirements for their intended application. Products not listed in this publication must be approved by the Director of Traffic Engineering prior to use. This publication is available on the SCDOT Internet Web Site.
4. South Carolina Advanced Work Zone Safety Guidelines. This publication presents background information, practical criteria and typical examples on topics related to work zone traffic control for multilane roadways, expressways and freeways and mobile operations. This information is intended to illustrate the principles of proper work zone traffic control, but is not a standard.
5. South Carolina Work Zone Safety Guidelines. This publication presents basic guidelines for work zone traffic control and examples of typical traffic control applications for two-lane and multilane work zones.
6. SCDOT Flagger's Handbook. This publication provides instructional guidance on proper flagging procedures.

#### **601.2.2 Traffic Control Plan**

The Contractor is responsible for submitting SCDOT Form 600.01 – Traffic Control Plan for the project, which may consist of drawings and documentation to address the traffic control devices and methods of handling traffic required for the project. The Traffic Control Plan will be project specific; and, in multi-phase projects, each method of handling traffic presented will be specific to its respective construction phase. The Traffic Control Plan must comply with all “shall” and “should” provisions of the *MUTCD* and all requirements specified in the Contract, including applicable Supplemental Specifications, Special Provisions and *Standard Drawings*. Note that documentation and drawings from the manufacturer of SCDOT-approved proprietary systems (e.g., crash attenuation systems) are included in this requirement, whether they are incorporated directly or by reference in the Contract.

At the Preconstruction Conference, the Contractor will submit the Traffic Control Plan to the Resident Construction Engineer for District Engineering Administrator approval. Review the Traffic Control Plan to understand the types and locations of traffic control devices required in each method of handling traffic for each construction phase of the project. Pay particular attention to how each method of handling traffic will be transitioned from one phase to the next. This review by the Resident Construction Engineer and Roadway Inspectors cannot be overemphasized. Some projects are straightforward, however, multi-phase projects can be rather complicated. Any revisions to the Traffic Control Plan proposed by the Contractor must be approved by the District Engineering Administrator prior to implementation. Any revisions to the Traffic Control Special Provisions in the Contract must be approved by the Director of Traffic Engineering.

### **601.2.3 Responsibilities of Project Personnel**

#### **601.2.3.1 Contractor Personnel**

The Traffic Control Supervisor (i.e. the Contractor's responsible person as indicated on SCDOT Form 600.01) must have a current copy of the *MUTCD*, the SCDOT-approved Traffic Control Plan and the Contract Plans and Specifications, including applicable Supplemental Specifications, Special Provisions, *Standard Drawings* and manufacturer's documentation and drawings. All traffic control activities (i.e., devices and methods) must comply with the governing provisions of these documents. The Traffic Control Supervisor and Contractor personnel, such as flaggers, must be properly trained in their respective traffic control duties. The Traffic Control Supervisor must be available 24 hours a day, be prepared to contact emergency response personnel (e.g., Highway Patrol, ambulance, sheriff, Resident Construction Engineer) and ensure that the appropriate devices are on hand for use at night in case of an emergency. The Traffic Control Supervisor will inspect the job site during working and non-working hours to ensure that traffic control devices and methods of handling traffic are established and maintained in compliance for each phase of the project.

#### **601.2.3.2 SCDOT Personnel**

The Resident Construction Engineer and Roadway Inspectors will be responsible for inspecting work zone traffic control devices and methods to verify compliance with the *MUTCD*, the Traffic Control Plan and the Contract Plans and Specifications, including applicable Supplemental Specifications, Special Provisions, *Standard Drawings* and manufacturer's documentation and drawings. Immediately notify the Contractor of any non-compliance. At a minimum inspections will be performed on a weekly basis. Additional nighttime inspections will be conducted at least once a month and each time the method of handling traffic is changed. Use SCDOT Form 600.02 – Work Zone Traffic Control Inspection and the Daily Work Report to document findings, specifically noting non-compliance and directives to the Contractor. Obtain the concurrence signature of the Contractor's Traffic Control Supervisor on each completed Form, which will be retained by the Resident Construction Engineer. Contact the Director of Traffic Engineering, as appropriate, for any needed assistance. Traffic Engineering conducts random semi-annual inspections of SCDOT construction projects to verify the quality of traffic control provided statewide and to ensure the acceptability of the traffic control activities performed by both Contractor and SCDOT construction personnel.

#### **601.2.3.3 South Carolina Highway Patrol**

The South Carolina Highway Patrol may be required for protective and enforcement services. This will depend on the particular needs of the method of handling traffic in place for the active construction phase of the project. SCDOT maintains a standing Agreement with the South Carolina Department of Public Safety for such services. When required, the procedures for securing the services of the Highway Patrol are detailed in the Agreement.

## **601.2.4 Materials Considerations**

### **601.2.4.1 Certification of Traffic Control Devices**

All traffic control devices used on SCDOT projects must meet NCHRP Report 350 requirements for their intended application and must be listed on the SCDOT publication *Approved Products List for Traffic Control Devices in Work Zones* available on the SCDOT Internet Web Site under Traffic Engineering. Obtain from the Contractor the certification letter for all Category II and Category III devices that will be used on the project. Certification by the Contractor for Category I devices will not be necessary. The certification letter will state that all the traffic control devices intended for use on the project are NCHRP Report 350 compliant and will include the device name, model number, description, manufacturer and a copy of the portion of the *Approved Products List* for each device. In addition, for those devices that must be reflectorized, the letter will include certification for the reflective sheeting. Contractor certification will be as follows:

1. Category I Devices. Certification will not be required for the following Category I devices:
  - cones,
  - oversized cones, and
  - portable plastic drums.
2. Category II Devices. Certification will be required for the following Category II devices:
  - Type II barricades,
  - Type III barricades,
  - portable sign supports, and
  - sign substrutums for portable sign supports.
3. Category III Devices. Certification will be required for the following Category III devices:
  - truck-mounted attenuators,
  - portable terminal impact attenuators,
  - water-filled longitudinal barriers,
  - concrete longitudinal barriers,
  - ground-mounted U-channel posts,
  - breakaway assemblies for ground-mounted U-channel posts, and
  - ground-mounted square post anchor and breakaway assemblies.

### **601.2.4.2 Construction Signs and Reflective Sheeting Materials**

Verify compliance of sign blank, roll-up sign and sign stand materials. Verify that sign blanks are the proper thickness and material. Reflective sheeting used on drums, barricades, cones, tubular markers and vertical panels must be Type III (i.e., high intensity, encapsulated glass bead). Reflectorize all rigid construction signs with either Type VII, Type VIII or Type IX prismatic retroreflective sheeting. Type III High Intensity Retroreflective Sheeting is no longer

approved for reflectorization of rigid construction signs. Sheeting must be supplied from a source listed on SCDOT Approval Sheet 20. Obtain the certification letter for these materials.

### **601.2.4.3 Pavement Marking and Delineation Materials**

Verify compliance of the types of materials required for pavement markings and delineation. Sampling and testing will be in accordance with the Quality Control Samples and Tests presented in Section 106. Where used for marking and delineation purposes, the following materials must be supplied from a source listed on the material's respective SCDOT Approval Sheet:

- Approval Sheet 21 – Preformed Markings,
- Approval Sheet 40 – Methyl Methacrylate Acrylic Traffic Marking Material,
- Approval Sheet 42 – Adhesives for Raised Pavement Markers,
- Approval Sheet 47 – Hot Applied Preformed Thermoplastic Pavement Markings, and
- Approval Sheet 50 – Flexible Delineator Post.

Traffic paint will be pretested and approved by the Research and Materials Engineer prior to delivery to the project. Samples from the manufacturer will be submitted directly to the Research and Materials Engineer for testing and approval. A material approval number will be issued to the manufacturer for use in identifying the paint as being pretested and approved for the project. The approval number will appear on the delivery ticket and the manufacturer's certification letter. Obtain and forward a copy of the certification letter to the Research and Materials Engineer. If the material is of questionable quality, contact the Research and Materials Engineer to sample the material at the job site.

Thermoplastic and epoxy pavement marking materials will be accepted based on the manufacturer's certified test results. Obtain and forward a copy of the manufacturer's certified test results to the Research and Materials Engineer. Check to ensure that the batch number of the material corresponds to the test results provided.

Raised pavement markers must be tested and approved prior to use. The Resident Construction Engineer can check if a particular Lot of pavement markers has been previously tested by searching Matlab on the Department's Intranet site for the appropriate lot number. If pavement markers have been tested, no additional tests are needed. Otherwise, obtain and forward samples to the Research and Materials Laboratory for testing. A minimum of 25 markers of each type to be placed, selected at random from each shipment or Lot, will constitute a representative sample. Obtain and forward with the samples a copy of the manufacturer's certified test results. Ensure that the manufacturer's application recommendations are followed. Ensure that the adhesive material is supplied from a source listed on SCDOT Approval Sheet 42. Obtain from the Contractor and forward to the Research and Materials Engineer the manufacturer's certification letter stating that the material complies with specified requirements. Sampling of adhesive will not be necessary.

#### **601.2.4.4 Temporary Concrete Barriers**

Temporary concrete barriers must be produced from a source listed on SCDOT Approval Sheet 54 and on the Traffic Engineering Section of the SCDOT Internet Web Site. The *Standard Drawings* should be reviewed to determine the proper size and shape.

#### **601.2.5 Procedure for Reporting Emergency Road Conditions**

When a situation such as a multi-vehicle pileup or tanker crash causes serious damage to traffic control or a highway structure, the Resident Construction Engineer will be responsible for assessing the seriousness of the situation and determining whether or not it is necessary to close the facility. If such action is warranted, the Resident Construction Engineer will immediately notify the District Engineering Administrator of the following and follow up by e-mail:

- road number and name,
- closure termini,
- date and time closed,
- reason for closure, and
- estimated date and time to re-open.

The District Engineering Administrator will immediately notify the Director of Maintenance and Director of Construction. The Communications Office will be responsible for informing the media. Every effort should be made to re-open the facility at the earliest practical time to minimize public inconvenience. Notification of re-opening will be handled with equal dispatch.

### **601.3 INSPECTION DURING CONSTRUCTION**

#### **601.3.1 Overview**

Check for compliance of the placement or installation of all traffic control devices (e.g., signs, pavement markings, cones, barricades, barriers, attenuators) required for the active method of handling traffic, as documented in the Traffic Control Plan, with respect to type, size, dimension, color, reflectorization, message, lateral and longitudinal placement, spacing and taper, as appropriate. Verify that the Contractor maintains the travel pattern in compliance with the Traffic Control Plan for the project phase under construction. Pay attention to the requirements for detours. Ensure that traffic control devices are being properly maintained, all lights operating, reflective sheeting kept clean, damaged devices replaced, worn markings replaced, correct placement of devices maintained, etc.

#### **601.3.2 Conflicting Devices and Markings**

Ensure that permanent signs (e.g. speed limit) that conflict with temporary traffic control signs are completely covered or removed, as appropriate. Verify that conflicting pavement markings are properly eradicated. Painting over markings for the purpose of eradication is strictly prohibited. When temporary traffic control devices (e.g., construction signs, changeable

message signs) are not in effect or have served their purpose, verify that they are changed, covered, obscured or removed, as appropriate.

### **601.3.3 Construction Signs**

Verify compliance of construction signs, changeable message signs and advance warning arrow panels with respect to sign material, type, size, color, message, mounting base and height, lateral placement, distance between signs and longitudinal placement from the work zone. Ensure these devices are visible from all approach lanes and adjusted, as necessary, for vertical and horizontal alignment. The faces of construction signs must be kept clean and the message conveyed must be clearly visible and appropriate. All signs mounted on portable sign supports will have a minimum mounting height of 5 feet from the ground to the bottom of the sign. All signs mounted on ground-mounted U-channel posts will have a minimum mounting height of 7 feet from the ground to the bottom of the sign.

### **601.3.4 Temporary Pavement Markings**

Check for proper eradication of pavement markings. Painting over markings for the purpose of eradication is strictly prohibited. Verify compliance of markings with respect to surface preparation, material (e.g., paint, tape), type (e.g., lines, words), application (e.g., no passing), color, reflectorization (e.g., glass beads), lateral and longitudinal placement, length, width, spacing and message, as appropriate. The purpose of these markings is to channelize traffic and provide delineation for the travel lanes during each construction phase. Verify the Contractor re-establishes pavement markings within the specified time period once eradicated, covered by a subsequent course or upon changing traffic patterns. The typical application of pavement marking materials is as follows:

1. Paint. Paint is typically used on pavement courses other than the final surface course, unless permanent pavement markings will be placed directly over them. When no longer needed, these markings must be eradicated by an acceptable method as directed by the contract specifications or preferably overlaid by a subsequent course.
2. Temporary Thermoplastic. Thermoplastic is typically applied to asphalt pavement courses where the traffic must be maintained for greater than 4 months or as specified in the Traffic Control specifications. Its use is prohibited on the final surface course in a temporary marking scheme. When no longer needed, these markings must be eradicated by an acceptable method as directed by the contract specifications or preferably overlaid by a subsequent course.
3. Temporary Epoxy. Epoxy is typically applied to concrete pavement courses where the traffic must be maintained for greater than 4 months or as specified in the Traffic Control specifications. Its use is prohibited on the final surface course in a temporary marking scheme. When no longer needed, these markings must be eradicated by an acceptable method as directed by the contract specifications or preferably overlaid by a subsequent course.

4. Tape. Tape is typically applied to areas where the Contractor will modify the pattern but maintain the traffic on an existing pavement or final surface. These markings are removable.
5. Temporary Raised Pavement Markers. Ensure that temporary raised pavement markers are applied in accordance with the *Standard Specifications*.

Ensure that the Contractor properly maintains or re-establishes worn or damaged temporary pavement markings. The use of temporary raised pavement markers in a temporary scheme will be specified in the Contract for each project, normally under the Staging Section of the Special Provisions.

### **601.3.5 Cones, Barricades and Barriers**

Verify compliance of the installation and maintenance of all cones, oversized cones, barricades, concrete median barriers and other traffic control devices required for the active method of handling traffic with respect to type, size, dimension, color, reflectorization, mounting base and height, lateral and longitudinal placement, spacing and taper, as appropriate. Consider the following:

1. Oversized Cones. The substitution of oversized cones for portable plastic drums is permitted only within lane closures. Oversized cones are prohibited for any purpose other than as the traffic control device used within lane closures. Substitution of portable plastic drums with oversized cones during nighttime shoulder closures is prohibited.
2. Barricades. Pay particular attention to the supplementary signs and warning lights that are permitted to be attached to Type III barricades.
3. Reflectors on Temporary Concrete Barriers. Verify that the reflective discs, or approved equal, and delineators affixed to temporary concrete barriers placed parallel to the roadway are of the specified material, proper size and color and properly mounted at the correct spacing, as detailed on the *Standard Drawings*.
4. Guardrail. Verify that guardrail is removed and replaced within the specified period and that the operation does not occur during restricted hours. Verify compliance of the allowable length of removal. Pay particular attention to the restrictions in the vicinity of bridge piers. Verify that the Contractor closes the shoulder or lane, as appropriate for hourly restrictions, at locations where more guardrail is removed than can be replaced in the same day.

### **601.3.6 Portable Terminal Impact Attenuators**

The posted speed limit in place prior to construction will be used to determine attenuation. Test Level 3 – 70 mph units are required on all roadways with speed limits of 65 mph or greater. Test Level 3 – 60 mph units are only permitted on roadways with speed limits of 60 mph or less. Test Level 2 units are only permitted on roadways with speed limits of 45 mph or less. Ensure that attenuators are installed in compliance with the manufacturer's recommendations. Ensure that the grade is flat and that the studs and diagonal sign are properly installed. Check

installation height, orientation and direction of cartridges for compliance. Closely inspect all parts of the attenuator and all anchors after being hit. Verify that rails are kept clean from construction debris and concrete splatter and the proper clear zone is maintained around the attenuator.

### **601.3.7 Equipment Operation and Backup**

Ensure that Contractor personnel know how to operate and maintain devices such as changeable message signs, arrow panels, shadow vehicles and crash attenuators. Verify the availability of backup devices for immediate replacement of any failed or damaged units. If an advance warning arrow panel, changeable message sign, truck mounted attenuator or portable terminal impact attenuator is struck by an errant vehicle or has a failure, notify the Contractor to eliminate the hazard immediately. Verify that the repair or replacement is in strict accordance with the manufacturer's criteria. If the Contractor fails to provide proper notification and evidence of conformity, the Resident Construction Engineer will immediately suspend all work. The suspension will remain in effect until the needed repair or replacement is resolved.

### **601.3.8 Flagger Operations**

The need for flaggers may occur when two opposing directions of traffic must share a common travel lane, during a lane closure on a two-lane, two-way roadway, during an intermittent ramp closure or an intermittent encroachment of the Contractor's equipment on the roadway. Also, a flagging operation may be necessary to direct traffic around construction activities or when it is necessary to maintain continuous traffic at reduced speeds. Verify training of all flaggers, that they are equipped with regulation equipment and that they are positioned properly and conducting the flagging operation in accordance with the Traffic Control Plan and the *MUTCD*. Verify the proper placement of advance warning signs for flaggers. Ensure that each flagger is equipped with a proper "Stop/Slow" paddle and an approved safety vest. SCDOT prohibits the use of flags, except during emergency situations.

### **601.3.9 Detour Considerations**

Where detours are required, verify that the Contractor has an approved Detour Plan. Ensure that the media has been notified. Verify compliance of all detour signs in place and ensure they are being maintained as specified by the Traffic Control Plan and the *MUTCD*.

### **601.3.10 Lane Closure Restrictions**

Where lane closures are required, check compliance of the signing, channelization and taper at the lane transition. The contract will specify the requirements based on traffic volume and the physical characteristics of the roadway and construction activity. Verify that lanes are not closed to traffic during periods for which they are specified to remain open. Strictly enforce the monetary penalties associated with non-compliance. Where unusual backups occur during

periods when lane closure is permitted, immediately notify the Resident Construction Engineer to determine if it is necessary to direct the Contractor to open the lane.

### **601.3.11 Construction Vehicle Access**

Verify that construction vehicles that access open travel lanes do not create a hazard or impediment to the normal flow of traffic. Verify the proper use of lead and shadow vehicles with advanced warning panels and truck-mounted attenuators where disruption occurs. Ensure that these vehicles maintain the proper speed and distance from one another.

### **601.3.12 Lane and Shoulder Drop-Offs**

Pay attention to vertical drop-offs within the traveled way (i.e., between adjacent lanes, along shoulders). If the drop-off exceeds 1 inch when the pavement is planed or milled, or 2 inches when the new pavement is placed, notify the Contractor immediately and follow-up in writing if the problem is not mitigated immediately.

### **601.3.13 Overhead Structure Work**

During work on bridge beams or overhead sign structures, verify that temporary lane closures or pacing operations, with assistance of the Highway Patrol, are properly conducted. When working over traffic, ensure that the Contractor provides suitable safety platforms to catch falling materials and that the platforms do not encroach on the required vertical clearance.

### **601.3.14 Widths, Tapers and Clear Zone Considerations**

Verify that travel lane and shoulder widths are maintained as specified by the Traffic Control Plan. Where needed in the method of handling traffic, verify that traffic control devices are placed and maintained at the proper spacing and taper at lane transitions, as defined in the Traffic Control Plan and the *MUTCD*. Verify that all clear zones are being maintained. The Special Provisions will define the lateral offset from the edge of the traveled way for which it is permissible for the Contractor to work, operate equipment, store materials and park vehicles. This lateral distance will depend on the type, location and speed of the facility. In general, excavation, structures, stockpiles, equipment and vehicles must be located outside the clear zone or, if within the clear zone, located behind a protective barrier, such as guardrail or concrete median barrier. If work encroaches the clear zone, the Contractor will need to establish a shoulder closure or lane closure, as appropriate. If signs or other types of traffic devices are within the clear zone, they must meet NCHRP Report 350 criteria for their intended application (e.g., yielding or breakaway assemblies).

## **601.4 POST-CONSTRUCTION CONSIDERATIONS**

When the work is substantially complete and normal traffic flow has resumed, the Resident Construction Engineer will request the Contractor in writing to remove the permanent

construction signs and traffic control. Ensure that all construction signs and traffic control devices are promptly removed from the project after all major items of work have been completed. Ensure compliance of the re-establishment of permanent signing, permanent pavement markings and permanent barriers. SCDOT assumes the responsibility of maintenance of traffic upon removal of the temporary traffic control.

#### **601.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS**

Check the provisions of the Contract for the measurement and basis of payment for individual pay items related to temporary traffic control. Many variations exist, which will vary on a project-to-project basis. Lump sum payment, scheduled on a percentage completed basis, is common. Record all measurements for payment in the Daily Work Report. Record observations and directives to the Contractor on SCDOT Form 600.02 – Work Zone Traffic Control Inspection and reference the activity in the Daily Work Report. Retain these Forms and a copy of all manufacturer's certifications.



## **Section 602**

### **Traffic Control Devices in the Work Zone**

Work zone traffic control devices will be governed under the provisions of Section 602 of the *Standard Specifications*, including applicable Supplemental Specifications, Special Provisions, *Standard Drawings* and manufacturer's documentation and drawings for the SCDOT-approved proprietary devices used on the project. The Resident Construction Engineer and Roadway Inspectors will be responsible for inspections to ensure that the Contractor is operating in compliance with the approved Traffic Control Plan and the Contract Plans and Specifications. See Section 601 for additional information.



## **Section 603**

# **Work Zone Traffic Control Procedures**

Work zone traffic control procedures will be governed under the provisions of Section 603 of the *Standard Specifications*, including applicable Supplemental Specifications and Special Provisions. The Resident Construction Engineer and Roadway Inspectors will be responsible for ensuring that the Contractor operates in compliance with the approved Traffic Control Plan and the Contract Plans and Specifications. See Section 601 for additional information.



## **Section 604**

# **Permanent Pavement Markings**

### **604.1 DESCRIPTION OF WORK**

When pay items governed under Section 604 of the *Standard Specifications* are designated in the Contract, the Contractor will be responsible for furnishing, preparing the surface and applying reflectorized pavement markings of the type specified (e.g., paint, thermoplastic, epoxy). The markings will be either white or yellow of the width, length, thickness and pattern as designated in the Pavement Marking Plans of the Contract, including appropriate *Standard Drawings* and the MUTCD. Note that the Contractor will be responsible for determining no passing zones and for providing the Resident Construction Engineer with the data used to establish these pavement marking applications. During the work, the Contractor also will be responsible for the temporary traffic control and protection of the pavement markings during construction. The Resident Construction Engineer and Roadway Inspectors will be responsible for ensuring that the work and materials comply with the requirements of the *MUTCD* and the Contract Plans and Specifications.

### **604.2 PRECONSTRUCTION CONSIDERATIONS**

#### **604.2.1 Materials Considerations**

Verify compliance of the types of materials required for pavement markings. Sampling and testing will be in accordance with the Quality Control Samples and Tests presented in Section 106. Where used for pavement marking, the following materials must be supplied from a source listed on the material's respective SCDOT Approval Sheet:

- Approval Sheet 21 – Preformed Markings,
- Approval Sheet 40 – Methyl Methacrylate Acrylic Traffic Marking Material, and
- Approval Sheet 47 – Hot Applied Preformed Thermoplastic Pavement Markings.

Traffic paint will be pretested and approved by the Research and Materials Engineer prior to delivery to the project. Samples of the batch from the manufacturer will be submitted directly to the Research and Materials Laboratory for testing and approval. An approval number will be issued to the manufacturer for use in identifying the batch of paint as being pretested and approved for the project. The delivery ticket and manufacturer's certification letter will include the following information:

- date,
- consignee and recipient name,
- purchase order number,
- type of paint and number of gallons shipped, and
- batch number and laboratory number for the approved batch.

Obtain and forward a copy of the manufacturer's certification letter to the Research and Materials Engineer. If the material is of questionable quality, contact the Research and Materials Engineer to sample the material at the job site. Epoxy, thermoplastic and intermixed glass bead materials that are used for pavement marking will be accepted based on the manufacturer's certified test results. Obtain and forward a copy of the manufacturer's certified test results to the Research and Materials Engineer. A sample of glass beads should be submitted to the Research and Materials Laboratory. Pay particular attention to the warranty requirements for epoxy material.

#### **604.2.2 Equipment Considerations**

Verify compliance of the required application, cleaning, heating and mixing, as applicable for the type of pavement marking material to be applied. Pay particular attention to the ability of the applicator to apply the correct thickness, width and length of material, with a clean cut-off. The applicator should be capable of traveling a constant speed while applying the marking material in the required alignment and pattern. The applicator also must be able to immediately deposit the proper quantity of glass beads on the material for reflectivity. Applicators should travel with the flow of traffic using properly equipped lead and shadow vehicles and traffic control devices.

#### **604.2.3 Application Restrictions**

Check for restrictions on weather, season, ambient temperature, relative humidity and hours of operation prior to application. Ensure the proper traffic control is in place to protect the markings. For application of hydrocarbon thermoplastic on a new asphalt surface, ensure that the asphalt surface has been in place a minimum of 20 days prior to application. For alkyd thermoplastic, ensure that the asphalt surface has been in place a minimum of 7 days prior to application.

### **604.3 INSPECTION DURING CONSTRUCTION**

#### **604.3.1 Surface Preparation**

Check to ensure that conflicting pavement markings are properly removed. Pay particular attention to specified removal requirements on concrete surfaces. Ensure that the surface is thoroughly cleaned of all dust, dirt, grease, oil and foreign matter just prior to application. The surface must be dry prior to application. A primer sealer may need to be applied, depending on the type of marking material and the surface it is being applied to. On new concrete surfaces, ensure that the curing compound is removed prior to application.

#### **604.3.2 Material Preparation**

Verify that the marking material is properly mixed, agitated and heated, as appropriate. Pay particular attention to time limit restrictions after mixing and heating. Ensure that the proper type and quantity of glass beads are immediately applied to the marking material.

**604.3.3 Application of Markings**

Verify that the correct color of marking material is placed at the correct location, pattern and alignment on the pavement surface. Pay particular attention to lateral distances, longitudinal spacing patterns and relationship to longitudinal joints. As applicable, verify the thickness of the marking material. Ensure compliance with the *MUTCD* and the Contract Plans and Specifications. Check the rate of application of marking and glass bead materials for compliance.

**604.4 POST-CONSTRUCTION CONSIDERATIONS**

Check line thickness, width, adhesion and cycle length for compliance. Verify that the final markings are free from waviness and that lateral deviations do not exceed specified tolerance. Greater deviation from allowable tolerance is sufficient cause for requiring the Contractor to remove and correct the markings. The Contractor is also required to remove and correct any symbol markings not meeting specified dimensional requirements. Observe the markings both during the day and at night for acceptability. Verify that overspray is properly cleaned. Enforce the provisions of the Contract with respect to any required rework. Ensure that all markings are sufficiently dry before opening to traffic. Final acceptance of permanent marking will occur after the 180 day warranty period.

**604.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS**

Measurement for payment for permanent pavement markings will be determined either by unit length of line type or each type of symbol applied and accepted. Document measurements in the Daily Work Report. Payment will be based on the Contract unit price. Retain all field notes and copies of all manufacturer's certifications.



## **Section 605**

### **Permanent Raised Pavement Markers**

#### **605.1 DESCRIPTION OF WORK**

When permanent raised pavement markers are specified in the Contract, the Contractor will be responsible for furnishing, preparing the surface, applying adhesive and retroreflective pavement markers of the type, color and dimensions and at the locations designated on the Contract Plans and Specifications. During the work, the Contractor also will be responsible for the temporary traffic control and protection of the markers during construction. The Resident Construction Engineer and Roadway Inspectors will be responsible for ensuring that the work and materials comply with the requirements of the *MUTCD* and the Contract Plans and Specifications.

#### **605.2 PRECONSTRUCTION CONSIDERATIONS**

Raised pavement markers must be tested and approved prior to use. The Resident Construction Engineer can check if a particular Lot of pavement markers has been previously tested by searching Matlab on the Department's Intranet site for the appropriate lot number. If pavement markers have been tested, no additional tests are needed. Otherwise, obtain and forward samples to the Research and Materials Laboratory for testing. A minimum of 25 markers of each type to be placed, selected at random from each shipment or Lot, will constitute a representative sample. Obtain and forward with the samples a copy of the manufacturer's certified test results. Ensure that the manufacturer's application recommendations are followed. Ensure that the adhesive material is supplied from a source listed on SCDOT Approval Sheet 42. Obtain from the Contractor and forward to the Research and Materials Engineer the manufacturer's certification letter stating that the material complies with specified requirements. Sampling of adhesive will not be necessary.

#### **605.3 INSPECTION DURING CONSTRUCTION**

Verify compliance of any application restrictions, including season, temperature and weather. Ensure that lane line raised pavement markers, edgeline markers, centerline markers and entrance and exit ramp markers are located as shown on the Contract Plans, including *Standard Drawings*. Verify that the markers are properly bonded to the pavement surface using either the epoxy or asphalt adhesive, as specified.

#### **605.4 POST-CONSTRUCTION CONSIDERATIONS**

Delay final inspection and acceptance of the permanent raised pavement markers for a period of 180 days after the last date of marker placement. Inspect the markers both during the day and at night for acceptance. Enforce the provisions of the Contract with respect to repairs and replacement.

**605.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS**

Measurement for payment for permanent raised pavement markers will be based on each type of unit installed and accepted. Document measurements in the Daily Work Report. Payment will be made based on the Contract unit price. Retain all field notes and copies of all manufacturer's certifications.

**Section 606  
Reserved**



## **Section 607**

# **Permanent Terminal Impact Attenuator**

### **607.1 DESCRIPTION OF WORK**

An impact attenuator is installed to control the deceleration of an impacting errant vehicle and to dissipate its kinetic energy. When struck from the front, the unit will bring the errant vehicle to a safe and controlled stop. When struck from the side, the unit will redirect the errant vehicle. The Contractor will be responsible for furnishing, assembling and installing the device at the specified location to protect the approaching terminal end of a concrete barrier wall or other similar fixed-object hazard. The installation will be governed by the documentation and drawings of the manufacturer of the SCDOT-approved system. SCDOT approval of such systems is primarily based on whether or not the system is NCHRP Report 350 compliant for the unit's intended application. The Resident Construction Engineer and Roadway Inspectors will be responsible for ensuring the unit is installed in compliance with the requirements of the Contract Plans and Specifications and the manufacturer's recommendations.

### **607.2 PRECONSTRUCTION CONSIDERATIONS**

Ensure the impact attenuator is of the type specified in the Contract. Verify the proper submittal of the required installation manual. Inspect the Shop Plans and detailed specifications from the manufacturer. Verify that the Shop Plans and specifications include performance criteria, installation drawings and instructions that completely describe the installation of the attenuator system. Inspect all parts and materials to ensure conformance with specifications. Verify the cartridges are of the type specified for the intended application and that they are new. Damaged cartridges exhibiting pulled staples, wrinkles in the plastic container package or exposed internal material should be replaced immediately. Verify that the nose assembly and required signs are of the proper type and color and have the required type of reflective sheeting.

### **607.3 INSPECTION DURING CONSTRUCTION**

Verify that all obstructions are cleared from the surrounding and approach areas for the specified length. Verify that the approach grade is smooth and flat and conforms to the roadway grade, as specified. Pay attention to superelevated areas. Where installed in two-way traffic situations, verify the proper installation of the transition panel and that the installation minimizes impact or snagging from the rear. Verify that the transition panel does not impede the movement of fender panels. Ensure that the top of the foundation is at the same grade elevation as the adjacent travel lane or paved shoulder. Verify that the foundation is constructed to be compatible with the anchor system and that the anchor system conforms to specified requirements. Ensure that the grout used for the anchor system is of the proper type and installed as specified.

**607.4 POST-CONSTRUCTION CONSIDERATIONS**

Inspect the impact attenuator, including all parts and materials, immediately after installation to ensure compliance with all specifications. Maintenance of the unit will require immediate attention, as specified in the Contract Specifications, if struck by a vehicle.

**607.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS**

Measurement for payment for permanent terminal impact attenuators will be based on each unit installed and accepted. Document measurements in the Daily Work Report. Payment will be made based on the Contract unit price. Retain all field notes and manufacturer's documentation.

## **Section 608**

### **Permanent Signing**

#### **608.1 DESCRIPTION OF WORK**

When permanent signing is specified, the Contractor will be responsible for furnishing sign blank, reflective sheeting, sign fabrication and furnishing sign posts as required by the Contract Plans and Specifications. The Resident Construction Engineer and Roadway Inspectors will be responsible for ensuring compliance of the sign materials and fabrication.

#### **608.2 PRECONSTRUCTION CONSIDERATIONS**

##### **608.2.1 Aluminum Sign Blanks**

Obtain the manufacturer's Mill Test Reports and material certifications from the Contractor and forward a copy to the Research and Materials Laboratory. Failure to provide Mill Test Reports and materials certifications is grounds for rejecting the material. Check the size, holes, corner radii and type of material for compliance.

##### **608.2.2 Reflective Sheeting**

Reflective sheeting for highway signing must be supplied from a supplier listed on SCDOT Approval Sheet 20. For sheeting types see the latest Engineering Directive Memorandum Number 4 – Reflective Sheeting for Signs.

Obtain from the Contractor the manufacturer's certificate of compliance. Pay particular attention to the requirements of performance warranties. Check for proper application and splicing of sheeting and the overall quality of the fabricated sign.

##### **608.2.3 Sign Posts**

Obtain from the Contractor the manufacturer's Mill Test Reports and material certifications for the sign posts furnished for the project. Failure to provide Mill Test Reports and materials certifications is grounds for rejecting the material. Verify the metal type, galvanization, dimensions, weight of post, lengths and compliance with yielding or breakaway system criteria, as applicable.

#### **608.3 INSPECTION DURING CONSTRUCTION**

When permanent highway signing is installed, verify compliance with respect to the type, color, size, message, placement location, lateral offset, mounting height, orientation and reflectorization. Pay particular attention to the installation details and assembly of breakaway sign supports.

**608.4 POST-CONSTRUCTION CONSIDERATIONS**

The Resident Construction Engineer in consultation with Traffic Engineering will be responsible for the final acceptance of all highway signing materials.

**608.5 DOCUMENTATION AND PAYMENT CONSIDERATIONS**

Measurement and payment for permanent signing will be based on bid items as specified in the contract. Retain all Mill Test Reports and copies of all manufacturer's certifications.