



**Procedures and Guidelines
for
Work Zone Traffic Control Design**

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INTRODUCTION

The *Work Zone Safety and Mobility Rule* (23 CFR 630 Subpart J), hereinafter referred to as *The Rule*, applies to all projects or work conducted by and for State and local governments in and around work zones on the South Carolina state highway system. *The Rule* requires implementation of processes and methods developed and designed to minimize and mitigate impacts generated by work zones. *The Rule* also requires management of the continuity and effectiveness of the transportation network including and surrounding the immediate work zone site and those adjacent areas which may or may not be contiguous to the work zone site but are impacted directly or non-directly by the presence of the work zone.

The South Carolina Department of Transportation (SCDOT) requires all maintenance of traffic methods, processes, procedures, staging, etc. utilized to conduct the work provide for minimization and mitigation of work zone impacts as required by *The Rule* and SCDOT Specifications. In accordance with *The Rule*, SCDOT developed the documents, *Rule on Work Zone Safety and Mobility: The Policy for South Carolina Department of Transportation* and *Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines*, to address the need for development, design and implementation of processes and methods for minimization and mitigation of impacts generated by work zones.

The ***Procedures and Guidelines For Work Zone Traffic Control Design*** manual complies with the requirements of *The Rule*, *Rule on Work Zone Safety and Mobility: The Policy for South Carolina Department of Transportation* and *Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines* and Part 6 of the *Manual on Uniform Traffic Control Devices (MUTCD)* and policies and procedures of the SCDOT. This manual specifies procedures and guidelines for development, design, implementation and/or maintenance of work zone traffic control installations and operations performed by an individual, firm, corporation or combination thereof undertaking the execution of the work in accordance with the terms of a contract with the South Carolina Department of Transportation or any entity contracting work within the rights-of-way of the South Carolina state highway system.

In addition to the requirements of this manual, all work zone traffic control installations and operations shall also comply with the latest editions of the following documents:

1. Rule on Work Zone Safety and Mobility: The Policy for South Carolina Department of Transportation
2. Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines
3. South Carolina Department of Transportation Engineering Directive Memorandum No. 19, Manual on Uniform Traffic Control Devices
4. South Carolina Department of Transportation Engineering Directive Memorandum No. 32, Hourly Restrictions for Lane Closures on Interstate and Primary Routes
5. South Carolina Flagger's Handbook

Also, all work zone traffic control installations and operations shall comply with the latest editions of the following documents in effect the date of the Letting of the project.

1. Standard Specifications for Highway Construction
2. SCDOT Standard Drawings (including all notes and requirements)
3. Special Provisions
4. Supplemental Specifications
5. Supplemental Technical Specifications
6. Approved Products List for Traffic Control Devices in Work Zones
7. SCDOT Qualified Products List
8. SCDOT Qualified Products Policies
9. SCDOT Construction and Traffic Control Policies

10. The Plans (including all notes and directions)
11. Documents included in the Contract that provided directions, provisions and specific requirements pertaining to the method and manner of performing the work, the quality and quantity of materials furnished and the measurement and payment for materials and work to satisfactorily complete the project

For all terms and definitions referenced in this manual, see **Division 100, Subsection 101** of the “*Standard Specifications for Highway Construction*”, latest edition, unless otherwise specified.

A designer must be aware of and keep in mind all regulations to ensure effectiveness and compliance of the Traffic Management Plan and its components thereof. Therefore, the reader will find many regulatory requirements from other specifications also included in this manual to assist and provide better insight to the foundations of these procedures and guidelines. From here forward, you will encounter those procedures and guidelines also utilized by SCDOT staff to design, develop and prepare all components of a Traffic Management Plan.

RULE ON WORK ZONE SAFETY AND MOBILITY

Implement *The Rule* in accordance with and as directed by *Rule on Work Zone Safety and Mobility: The Policy for South Carolina Department of Transportation* and *Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines*, the “*Standard Specifications for Highway Construction*”, latest edition, the *SCDOT Standard Drawings*, the supplemental specifications, the special provisions, the Plans and this manual.

TRANSPORTATION MANAGEMENT PLAN (TMP)

The Rule requires development of a set of coordinated strategies, hereinafter known as the *Transportation Management Plan (TMP)*, to manage the work zone impacts generated by a work zone for each project. A TMP will address the impacts within the work zone impact area which is hereby defined as the area including and surrounding the immediate project area and those adjacent areas of the transportation network which may or may not be contiguous to the project but are impacted directly or non-directly by the presence of the project. The level of detail, content and scope of the TMP will vary from project to project based upon the type, size, complexity and duration of the project and the anticipated work zone impacts generated by the project. A TMP is required for all Federal-aid highway projects.

See *Rule on Work Zone Safety and Mobility: The Policy for South Carolina Department of Transportation* and *Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines*, latest edition, for the development, design and implementation requirements for a TMP.

The coordinated strategies or components that compose a TMP are a Temporary Traffic Control plan (TTC), a Transportation Operations plan (TO) and a Public Information plan (PI). However, a TMP, dependent upon the classification and complexity of the project, may include all components or only the Temporary Traffic Control plan (TTC) or the Temporary Traffic Control plan (TTC) and either a Transportation Operations plan (TO) or a Public Information plan (PI). The Temporary Traffic Control plan (TTC) is a minimum requirement. The composition of components included in each TMP shall comply with the requirements specified by *Rule on Work Zone Safety and Mobility: The Policy for South Carolina Department of Transportation* and *Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines*.

Each of the components, the Temporary Traffic Control plan (TTC), the Transportation Operations plan (TO) and the Public Information plan (PI), shall comply with the requirements of the “*Standard Specifications for Highway Construction*”, latest edition, the Plans, the *SCDOT Standard Drawings*, the special provisions, the supplemental specifications, the manufacturer’s requirements and specifications and the *MUTCD*, latest edition.

The Temporary Traffic Control plan (TTC), the primary component of a TMP, addresses traffic control strategies and staging in the work zone and the work zone impact area.

The Transportation Operations plan (TO), a secondary component of a TMP, addresses the management of traffic operations in the work zone impact area.

The Public Information plan (PI), also a secondary component of a TMP, addresses communications with the public and entities impacted by the work zone.

The minimum number of components required for a TMP is dependent upon the project classification as follows:

Significant Projects: The TMP shall include a Temporary Traffic Control plan (TTC), a Transportation Operations plan (TO) and a Public Information plan (PI).

Intermediate Projects: The TMP will only require a Temporary Traffic Control plan (TTC). Inclusion of a Transportation Operations plan (TO) and a Public Information plan (PI) is optional; however, inclusion of these optional components may be beneficial and should be evaluated.

Basic Projects: The TMP will only require a Temporary Traffic Control plan (TTC). Inclusion of a Transportation Operations plan (TO) and a Public Information plan (PI) is optional; however, inclusion of these optional components may be beneficial and should be evaluated.

A TMP developed by an entity other than the SCDOT shall require review and approval by the SCDOT prior to implementation. Submit the TMP to the SCDOT for review as follows:

Standard Bid-Build – Standard bid build projects include the Transportation Plan (TMP) in the contract and the plans let to contract.

The Contractor may elect to implement the TMP developed by the Department and included in the project plans and documents; if so, submit notification to the RCE stating the Contractor's intent to do so prior to beginning work.

If the Contractor intends to utilize the TMP developed by the Department with revisions, submit the revised TMP, highlighting and making known all revisions, submit the revised TMP to the RCE no less than 30 days prior to initial implementation of the TMP and/or beginning work.

If the Contractor elects to develop and implement an alternate TMP in lieu of the TMP included in the project plans and documents, submit the alternate TMP to the RCE no less than 30 days prior to initial implementation of the TMP and/or beginning work. The alternate TMP shall include a staging narrative and plans drawings and all documents relative to the implementation, operation and maintenance of the TMP to encompass the duration of the project from the beginning to the end of the project.

Design-Build – Design-Build projects require the joint-venture entity to design and develop all components of the Transportation Management Plan (TMP).

Submit a draft of the TMP to encompass the duration of the project from the beginning of the project to the end of the project, including a staging narrative in accordance with all requirements of the design-build submittal process. The draft of the TMP shall also include a typical section of the roadway at all critical points for each stage or phase of work. Submit a final TMP for each stage or phase of work, including staging narrative and plans drawings, prior to beginning any work affiliated with and/or relative to that stage or phase of work.

TEMPORARY TRAFFIC CONTROL PLAN (TTC)

Provide a Temporary Traffic Control plan (TTC), the primary component of a TMP, for the maintenance and control of traffic during work conducted within the highway rights-of-way by a contractor, a subcontractor, a sub-subcontractor, a supplier or anyone working within the highway rights-of-way for each project. A Temporary Traffic Control plan (TTC) may range from simple to complex based upon the type, size, complexity and duration of the project and the anticipated work zone impacts generated by the project.

A Temporary Traffic Control plan (TTC) includes procedures and guidelines for minimizing negative impacts to the safety of highway workers and motorists while maximizing the efficiency of the passage of traffic through and/or around the project area. Also, the Temporary Traffic Control plan (TTC) should incorporate reasonable methods to minimize inconvenience to the traveling public. The Temporary Traffic Control plan (TTC) shall comply with the requirements of the “*Standard Specifications for Highway Construction*”, latest edition, the *SCDOT Standard Drawings*, the supplemental specifications, the manufacturer’s requirements and specifications and the *MUTCD*, latest edition.

A Temporary Traffic Control plan (TTC) includes provision, proper installation, maintenance, repair, replacement, relocation and removal of all traffic control devices, signing, channelizing devices and pavement markings used for regulating, warning or directing traffic.

When necessary, consider the necessity of off-road construction equipment or vehicles on portions of roadways open to the public to conduct the work. Encroachments upon roadways open to the public by off-road construction vehicles or equipment shall require the Department’s approval prior to beginning the work. Include details for the use of all construction equipment or vehicles on portions of the roadway that are open to the traveling public in accordance with the Temporary Traffic Control plan (TTC). Also, include details regarding locations utilized for ingress to and egress from the work area(s).

The Temporary Traffic Control plan (TTC) shall incorporate stages relative to the maintenance and control of traffic from the beginning to the end of the project. Each traffic stage represents the pattern of traffic in place throughout the limits of the project during a specific time frame in response to the work activities taking place during that time frame. Stage 1 shall represent the traffic pattern at the beginning of the project and each subsequent revision to the traffic pattern shall represent the subsequent traffic stage. The final traffic stage shall represent the traffic pattern in place during the application of the final pavement markings for the final traffic pattern resulting upon completion of the project.

Progression to a subsequent traffic stage from the previous traffic stage is the result of revision to a portion of or the entire traffic pattern in response to changes in the work activities.

Examples of Traffic Stage Progression:

Example 1 - Interstate Rehabilitation Project

The latter stages of an interstate rehabilitation project on an interstate highway.

Stage 5

The Hot Mixed Asphalt Surface Course – Type A is applied to the eastbound and westbound travel lanes of the interstate highway.

Stage 6

The Open Graded Friction Course is applied to the eastbound and westbound travel lanes of the interstate highway.

Example 2 - Full Depth Patching Operation –

During a full depth patching operation on a primary four lane divided highway with an earth median, at a select location the entire width of both eastbound travel lanes require a full depth patch.

Stage 1

Conduct the full depth patching operation in the eastbound right travel lane. Close the right travel lane to traffic and restrict all traffic to the left travel by means of a right lane closure during the implementation of the full depth patching operation in the right travel lane.

Stage 2

Conduct the full depth patching operation in the eastbound left travel lane. Close the left travel lane to traffic and restrict all traffic to the right travel by means of a left lane closure during the implementation of the full depth patching operation in the left travel lane.

A sub-stage or phase, i.e. Stage 2-A or Stage 2 - Phase A, is ONLY permitted when a traffic pattern is temporarily revised for a brief time period and then returned to its original pattern in place prior to the revision. Typically, the time duration of a sub-stage or phase should not exceed 72 hours unless otherwise approved or directed by the Department. The revised traffic patterns during a sub-stage or phase may be delineated and channelized through the installation of traffic control devices such as traffic cones, portable plastic drums, vertical panels, flexible delineator posts and barricades without the need for the application of pavement markings. The most common instance of a sub-stage or phase is a temporary road closure with a detour. Implementation of temporary work zone traffic control setups such as temporary lane closures that are routinely installed and removed each work shift are NOT considered sub-stages or phases.

An example of a sub-stage or phase is as follows:

Example 1 - Interstate Widening Project

During an intermediate stage of an interstate widening project, replacement of the pavement of an eastbound off-ramp at the gore area is required. This operation cannot be performed while maintaining traffic on the off-ramp.

Stage 4-A

While maintaining all other interstate highway traffic patterns of Stage 4, close the eastbound off-ramp to traffic to allow the replacement of the pavement. Detour the eastbound off-ramp traffic for a period of time not to exceed a selected time period less than 72 hours. Upon completion of the work and the selected time period, reopen the eastbound off-ramp to traffic, discontinue the detour and Stage 4-A comes to an end.

The number of traffic stages reflects the traffic patterns as determined by the methods of construction. The chosen methods of construction determine the duration of the project, not the number of traffic stages.

TRANSPORTATION OPERATIONS PLAN (TO)

Provide a Transportation Operations plan (TO), a secondary component of a TMP, when the work zone impacts may adversely affect efficient traffic operations within the work zone impact area in accordance with *The Policy for South Carolina Department of Transportation and Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines*. Provide a Transportation Operations Plan (TO) for each project classified as “Significant”. Provision of a Transportation Operations plan (TO) for projects classified as “Intermediate” and “Basic” is optional. However, the Department reserves the right to require a Transportation Operations plan (TO) on any project the Department determines a Transportation Operations plan (TO) may be beneficial to the traffic operations within the work zone impact area. When inclusion of a Transportation Operations plan (TO) is optional, the benefits of inclusion of this optional component into the TMP should be evaluated.

PUBLIC INFORMATION PLAN (PI)

Provide a Public Information plan (PI), a secondary component of a TMP, when the work zone impacts may be mitigated by positive informative communication efforts with the public and entities within the work zone impact area in accordance with *Rule on Work Zone Safety and Mobility: The Policy for South Carolina Department of Transportation and Rule on Work Zone Safety and Mobility: Implementation, Maintenance, and Safety Guidelines*. A Public Information plan (PI) for each project classified as “Significant”. Provision of a Public Information plan (PI) for projects classified as “Intermediate” and “Basic” is optional. However, the Department reserves the right to require a Public Information plan (PI) on any project the Department determines a Public Information plan (PI) may be beneficial to communications within the work zone impact area. When inclusion of a Public Information plan (PI) is optional, the benefits of inclusion of this optional component into the TMP should be evaluated.

ROADWAY CHARACTERISTICS

The characteristics of the roadway and the traffic conditions where the work is to be conducted determine the needs of the Transportation Management Plan (TMP). Design and develop all components of the TMP to comply with the roadway characteristics to better ensure the effectiveness of the TMP.

ROADWAY TYPES

Two-Lane Two-Way – A secondary or primary road with two opposing travel lanes. These roads occur in rural and urban areas. Most of these roads have pavement markings but low volume roads may not. The travel lanes of a two-lane two-way road are typically separated by double yellow center lines, with or without passing zones, or bi-directional yellow retroreflective pavement markers, however, some two-lane two-way roads may be separated by a paved or grassed earth median. The shoulder areas of these roads may be grassed earth, paved or have curb and gutter. Two-lane two-way roads may be low speed roads with posted speed limits of 35 mph or less, intermediate speed roads with posted speed limits of 40 mph to 50 mph or high speed roads with posted speed limits of 55 mph.

Multilane – A secondary or primary road with three or more travel lanes. These roads occur in rural and urban areas. The opposing travel lanes may be separated by double yellow center lines, paved medians, raised concrete islands, concrete median barrier walls and guardrails or grassed earth medians. The shoulder areas of these roads may be grassed earth, paved or have curb and gutter. Multilane roads may be low speed roads with posted speed limits of 35 mph or less, intermediate speed roads with posted speed limits of 40 mph to 50 mph or high speed roads with posted speed limits of 55 mph or greater.

Interstate – Interstate roads are free flowing access controlled freeways with four or more travel lanes. These roads occur in rural and urban areas. The opposing travel lanes may be separated by grassed earth medians or concrete median barrier walls. The immediate shoulder areas of these roadways are paved. Interstate roads are high speed roads with posted speed limits of 55 mph to 70 mph. Intersections with crossing routes are grade separated interchanges.

ROADWAY SPEED CLASSIFICATIONS

Low Speed – A low speed road has a posted speed limit of 35 MPH or less.

Intermediate Speed – An intermediate speed road has a posted speed limit of 40 MPH to 50 MPH.

High Speed – A high speed road has a posted speed limit of 55 MPH or greater.

TRAFFIC VOLUME CLASSIFICATIONS

Low Volume – A low-volume road has an average daily traffic volume (ADT) that does not exceed 400 vehicles per day as defined by the *MUTCD*, latest edition.

Intermediate Volume – An intermediate volume road has an average daily traffic volume (ADT) that ranges from greater than 400 to 10,000 vehicles per day.

High Volume – A high volume road has an average daily traffic volume (ADT) that exceeds 10,000 vehicles per day.

DURATION OF WORK

Work duration is a major factor in determining the number and types of traffic control devices used in temporary traffic control work zones. The various work durations are defined below. Also, the type of channelizing devices that may be required for each work duration scenario is provided.

Long-Term Stationary – Work operations that occupy a location more than 3 days. These work operations extend into the hours of darkness, therefore, channelizing devices designated for use during the hours of darkness are required.

Intermediate-Term Stationary – Work operations that occupy a location from 12 hours to 3 days. The shortest work period of 12 hours will extend into the hours of darkness during the shorter days of the year; therefore, channelizing devices designated for use during hours of darkness are required.

Short-Term Stationary – Work operations that occupy a location from 1 to 12 hours. During daytime work periods that will not extend into the hours of darkness, channelizing devices designated for daytime hours are acceptable. However, daytime work operations with longer work periods during the shorter days of the year may encroach into the hours of darkness, therefore, under these conditions channelizing devices designated for use during the hours of darkness are required. **Short-Term Stationary** work operations that occur during the hours of darkness shall require channelizing devices designated for use during the hours of darkness.

Short Duration – Work operations that occupy a location up to 1 hour. Due to the short time duration of the work, channelizing devices may be used but are not required during **Short Duration** work operations. However, if channelizing devices are utilized, ensure the devices comply with all retroreflectivity requirements regarding the time of day these devices are being used. Supplement each work vehicle operating in the work zone with amber or yellow colored high intensity rotating or strobe type flashing auxiliary warning light devices. Warning signs, truck mounted arrow panels, truck mounted changeable message signs and truck mounted attenuators may also be required to supplement these vehicles.

Mobile Operations – Work operations that move continuously at speeds of 3 mph or greater at all times without any stops. Use of channelizing devices is acceptable but not required during mobile work operations. Supplement the equipment and each work vehicle with amber or yellow colored high intensity rotating or strobe type flashing auxiliary warning light devices. Also, the equipment and work vehicles may require supplementation with warning signs, truck mounted arrow panels, truck mounted changeable message signs and truck mounted attenuators in accordance with the *SCDOT Standard Drawings* and/or when directed by the Engineer.

TEMPORARY TRAFFIC CONTROL ZONE

A temporary traffic control zone is an area of a highway where the normal roadway conditions are impacted due to the presence of a work zone. The work zone may include signs, channelizing devices, work vehicles, pedestrian workers, equipment and materials. It extends from the first warning sign, truck mounted changeable message sign or amber or yellow colored high intensity rotating or strobe type flashing auxiliary warning light device on a vehicle to the "End Road Work" sign, the last temporary traffic control device or last work vehicle encountered by a motorist passing through the zone.

COMPONENTS

Advance Warning Area -

The advance warning area is the section of roadway where motorists are informed about a forthcoming work zone. The advance warning area of a stationary work zone usually includes a series of advance warning signs.

During mobile operations, the advance warning area may consist of a vehicle with an amber or yellow colored high intensity rotating or strobe type flashing auxiliary warning light device or a truck mounted changeable message sign and/or a work or shadow vehicle supplemented with a flat sheet advance warning sign.

Transition Area -

The transition area is the section of roadway where motorists are redirected out of their normal travel path. The transition area of a stationary work zone usually includes a merging taper, a shifting taper or a one-lane two-way traffic taper.

During mobile operations, advance warning regarding the presence of a mobile work area is provided to motorists through the operation of amber or yellow colored high intensity rotating or strobe type flashing auxiliary warning light devices, truck mounted advance warning arrow panels, truck mounted changeable message signs or flat sheet advance warning signs. However, the motorist shall maintain responsibility to determine when to alter or redirect their travel path during mobile operations.

Activity Area -

The activity area is the section of roadway where the work activity takes place. This area consists of the work area, the travel way for traffic and the buffer space.

The work area is the portion of the roadway closed to motorists and reserved for workers, equipment and material. This area is typically delineated and separated from the travel way by a series of traffic control devices or longitudinal barriers.

The travel way is the portion of the roadway which motorists are directed or routed onto for passage through the activity area.

The buffer space is a longitudinal area between the downstream end of the transition area and the work area that may provide some recovery space for an errant vehicle. Design the buffer space to remain absent of personnel, tools, equipment, materials, work vehicles, etc. The presence of personnel, tools, equipment, materials, work vehicles, etc., within the limits of the buffer space is PROHIBITED.

Termination Area -

The termination area is the section of roadway where motorists return to the normal travel path. The termination area extends from the downstream end of the activity area to the last traffic control device or “End Road Work” sign or last work vehicle encountered by a motorist.

TAPERS

Tapers may be used in transition and termination areas. The length of a taper may require field adjustments due to field conditions such as hills, curves, intersecting roads, etc. A taper within a transition area provides notice to motorists the subsequent area is closed to travel and redirects the motorists onto an alternate travel path. A taper within a termination area provides notice to motorists the area closed to travel has ended and may provide guidance to motorists to return to their original travel path. A taper placed on a shoulder area provides notice to motorists the subsequent shoulder area is closed and encroachment onto that portion of the shoulder is not allowed.

Tapers are developed through utilization of a series of traffic control devices. Taper lengths are determined by the legal posted regulatory speed limit of the roadway prior to beginning the work, see *Table 1, Formulas for Determining Taper Lengths*.

Table 1 Formulas for Determining Taper Lengths

Speed (S)	Taper Length (L) in Feet
40 mph or Less	$L = WS^2 / 60$
45 mph or more	$L = WS$

Where: L = taper length in feet
W = width of offset in feet
S = posted speed limit prior to work starting

There are various types of tapers which include merging tapers, shifting tapers, shoulder tapers, one-lane two-way traffic tapers and downstream tapers. For determination of taper lengths according to the type of taper, see *Table 2, Taper Types and Taper Length Criteria*.

A merging taper precedes the closure of a travel lane or travel path and requires motorists to merge into a common road space with motorists from an adjacent travel lane. The minimum length of a merging taper is no less than 1.0 L.

A shifting taper precedes a change in the roadway alignment and requires motorists to negotiate a lateral shift in their normal travel path. The minimum length of a shifting taper is 0.5 L according to the *MUTCD*, latest edition; however, SCDOT practice is to use a minimum length of 1.0 L.

A shoulder taper precedes a shoulder work area. The shoulder taper precedes a shoulder work area and provides notification to motorists that encroachment upon the subsequent shoulder area is not permitted. The minimum length of a shoulder taper is no less than 0.33 L.

A one-lane two-way taper precedes a work area controlled by a flagging operation that requires motorists from opposing directions on a two-lane two-way roadway to share a common travel lane as directed by the flagger(s). The length of a one-lane two-way taper is 50 feet to 100 feet.

A downstream taper follows the activity area to provide a visual cue to the motorist that access to their original travel path is available. The length of a downstream taper is 50 feet to 100 feet. Installation of a downstream taper is optional.

Table 2 Taper Types and Taper Length Criteria

Type of Taper	Taper Length
Merging Taper	at least 1.0 L
Shifting Taper	at least 0.5 L <i>(SCDOT Practice is to use 1.0 L unless otherwise directed by this manual)</i>
Shoulder Taper	at least 0.33 L
One-Lane, Two-Way Traffic Taper	50 feet minimum, 100 feet maximum
Downstream Taper	50 feet minimum, 100 feet maximum

Note: Use Table 1 to calculate L.

TRAFFIC CONTROL DEVICES

SIGNS

Temporary traffic control work zone signs include regulatory, warning and guide signs utilized to provide regulations, warnings and guidance information to road users impacted by the presence of a work zone within the highway rights-of-way. Henceforth, for general purposes when specific references are not required, all temporary traffic control work zone signs will be referred to as advance warning signs.

Mount the advance warning signs on either ground mounted u-channel or square steel tube posts, approved temporary sign supports or Type III barricades. **Do not mount advance warning signs on Type II barricades.** The mounting height of an advance warning sign, dependent upon the type of sign support the sign is attached to, is measured from the either the ground or the near edge of the adjacent travel lane or sidewalk when a sidewalk is present to the bottom edge of the sign. The mounting height of a sign attached to a ground mounted u-channel or square steel tube post is measured from the bottom edge of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present. The mounting height of a sign attached to an approved temporary sign support or Type III barricade is measured from the bottom edge of the sign to the ground or surface on which the sign support is located.

The mounting height of a primary regulatory or advance warning sign erected on a ground mounted u-channel or square steel tube post is no less than 7 feet or no greater than 8 feet from the bottom edge of the sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present. The minimum mounting height of a secondary sign mounted on the same assembly is 6 feet from the bottom edge of the secondary sign to the grade elevation of the near edge of the adjacent travel lane or sidewalk when a sidewalk is present unless otherwise specified. The secondary sign shall not overlap or encroach upon the face of the primary sign.

The minimum mounting height for guide signs, including detour sign assemblies with multiple sign panels, erected on ground mounted u-channel or square steel tube posts should be no less than 5 feet from the grade elevation of the near edge of the adjacent travel lane to the bottom of the route sign or the detour sign panel (M4-9) unless otherwise directed by the Department.

The minimum mounting height of advance warning signs erected on portable sign supports is 5 feet from the bottom edge of the sign to the ground or surface on which the sign support is located.

Mount temporary "Exit" signs (E5-1) (M1025-00) located within temporary gore areas during lane closures on multi-lane roadways at a minimum height of 7 feet from the bottom edge of the sign to the surface on which the sign support is placed in accordance with the requirements of the MUTCD. The minimum 7-foot mounting height for a temporary "Exit" sign applies to installation on both ground embedded and portable sign supports.

When sufficient shoulder space is available, install signs mounted on ground supports no less than 2 feet from the near edge of an adjacent paved shoulder or the face of a curb or if no paved shoulder exists, 6 feet to 12 feet from the near edge of an adjacent travel lane to the nearest edge of the sign.

When mounting signs on multiple ground embedded sign supports, each post shall be of the same type. Do not combine and install both ground embedded u-channel and square steel tube posts within the same sign assembly. Also, do not combine a sign support / ground support post combination and a direct driven post on the same sign assembly installation that contains two or more sign supports.

Regarding sign support / ground support post combination installations, ensure that post lengths, stub heights and breakaway assemblies comply with the manufacturer's requirements and specifications. Use

approved breakaway assemblies found on the *Approved Products List For Traffic Control Devices in Work Zones*.

Fabricate advance warning signs mounted on portable sign supports or Type III barricades from an approved roll-up retroreflective fabric material or an approved rigid aluminum laminated composite substrate. **Advance warning signs fabricated with 0.080 inch or 0.100 inch thick aluminum sign blanks are PROHIBITED for use with portable sign supports or Type III barricades.** Refer to the *Approved Products List For Traffic Control Devices in Work Zones* for approved roll-up retroreflective fabric sign materials and approved rigid aluminum laminated composite sign substrates.

Fabricate rigid advance warning signs mounted on ground mounted u-channel or square steel tube posts from an approved sign substrate material constructed of aluminum or an approved aluminum laminated composite material. Use aluminum sign blanks that meet SCDOT specifications or sign blanks fabricated from approved aluminum laminated composite materials included on the *Approved Products List For Traffic Control Devices in Work Zones*.

Reflectorize orange advance warning signs and any orange areas of a multi-colored advance warning sign with fluorescent orange colored microprismatic retroreflective sheeting. Reflectorize white advance warning signs and any white areas of multi-colored advance warning signs with white colored microprismatic retroreflective sheeting.

When advance warning signs mounted on portable sign supports are not in use, remove and relocate the portable sign supports to a location beyond 15 feet from the near edge line of a primary or secondary travel lane and beyond 30 feet from the near edge line of an interstate travel lane. On primary and secondary routes, when the 15 foot clear distance or rights-of-way is unavailable, store the portable sign supports at the greatest possible distance from the near edge of the adjacent travel lane. **Do not simply redirect a sign when not in use.** Ensure that all portable sign supports lie flat with the legs in a retracted position when not in use.

When advance warning signs mounted on ground mounted u-channel or square steel tube posts are not in use, cover the signs in their entirety with an opaque material or remove them from the work area when not in use. Cover the signs in their entirety to prevent any visualization of any portion of the sign by the motorist. Use weather resistant materials to cover signs to prevent any exposure of a covered sign due to adverse weather conditions or long periods.

When covering signs with opaque materials, do not attach a covering material to the face of the sign with tape or a similar product or any method that may leave a residue on the retroreflective sheeting. The residue from tape or similar products, as well as many methods utilized to remove such residue, will damage the retroreflectivity of the sign and render the sign ineffective, especially during the hours of darkness.

When the permanent construction advance warning sign installations are not directly addressed by the *SCDOT Standard Drawings*, install typical 3 advance warning sign array installations at spacing intervals based on the posted regulatory speed limit of the roadway prior to beginning any work, see *Table 3*.

Table 3 Advance Warning Sign Placement Intervals

ADVANCE WARNING SIGN PLACEMENT INTERVALS	
URBAN / RURAL (LOW SPEED) ≤ 35 MPH	200 / 200 / 200 Feet
URBAN / RURAL (INTERMEDIATE SPEED) 40 - 50 MPH	350 / 350 / 350 Feet
RURAL (HIGH SPEED) ≥ 55 MPH	500 / 500 / 500 Feet
INTERSTATE	1000 / 1500 / 2600 Feet

CHANNELIZING DEVICES

Channelizing devices provide warning to motorists of hazards in work zones. These devices channelize vehicular and pedestrian traffic away from hazards. Also, these devices provide guidance to motorists by delineating the travel path intended for use by motorists. SCDOT approved channelizing devices are 36" standard traffic cones, 42" oversized traffic cones, portable plastic drums and barricades. **The following paragraphs provide descriptions of these traffic control devices and how these devices may be used. When determining the specific applications of these devices, consider the *SCDOT Standard Drawings* and any specific requirements of the work activity.**

36" Standard Traffic Cones -

The 36" standard traffic cones may be utilized to delineate travel lanes and to channelize traffic through the tangent section or activity area of lane closures, during daytime shoulder closures and to mark specific hazards. When utilized in lane closures, replace the 36" standard traffic cones with 42" oversized cones or portable plastic drums when a daytime operation extends into the nighttime hours. The 36" standard traffic cones may only be used during the hours of darkness during emergencies. Only reflectorized 36" standard traffic cones are acceptable for emergency use during nighttime hours.

Maintain 36" standard traffic cones in good condition. Replace and do not use 36" standard traffic cones that have completed their functional service life.

42" Oversized Traffic Cones -

The 42" oversized traffic cones may be utilized to delineate travel lanes and to channelize traffic through the tangent section or activity area of lane closures, during daytime shoulder closures and to mark specific hazards. Also, the 42" oversized traffic cones may be utilized during flagging operations on two-lane two-way roadways. Reflectorize the 42" oversized traffic cones with Type III flexible microprismatic retroreflective sheeting unless otherwise directed by the Department. Use 42" oversized traffic cones in place of 36" standard traffic cones in lane closures during the hours of darkness.

The 42" oversized traffic cones are acceptable for use during flagging operations on two-lane two-way roadways, lane closures on multilane roadways, daytime shoulder closures and to mark specific hazards. **The 42" oversized traffic cones are unacceptable for delineation of a pavement edge; portable plastic drums are required for delineation of a pavement edge.**

Maintain 42" oversized traffic cones in good condition. Replace and do not use 42" oversized traffic cones that have completed their functional service life.

Portable Plastic Drums -

Portable plastic drums may be utilized to delineate travel lanes, channelize traffic through the tangent section or activity area of a lane closure, delineate shoulder closures, delineate the pavement edge of a roadway and delineate excavations and structures. Reflectorize portable plastic drums with Type III flexible microprismatic retroreflective sheeting unless otherwise directed by the Department. Portable plastic drums are the preferred traffic control device for channelization and delineation of a travel way during the hours of darkness.

Maintain portable plastic drums in good condition. Replace and do not use portable plastic drums that have completed their functional service life.

Barricades -

Use Type II barricades to develop taper sections and channelize traffic into lane closures, delineate travel lanes and delineate excavations and structures.

Use Type III barricades to close a roadway to traffic and to prevent traffic from entering a work area.

Reflectorize all barricades with Type IX or XI Microprismatic retroreflective sheeting unless otherwise directed by the Department.

Type II barricades shall have alternating diagonal orange and white stripes sloping downward at a 45 degree angle in the direction traffic is to pass.

Type III barricades shall have alternating diagonal orange and white stripes sloping downward at a 45 degree angle. At locations where the barricades extend entirely across a roadway, the stripes should slope downward in the direction toward which motorists must turn or pass. At locations where both right and left turns are provided, the stripes should slope downward in both directions from the center of the barricade or from the center of the assembly of barricades. At locations where the roadway is closed to traffic and no turns are intended, the stripes should slope downward toward the center of the barricade or the center of the assembly of barricades.

Type III barricades may be supplemented with advance warning signs. Only advance warning signs fabricated from either an approved roll-up retroreflective fabric material or an approved rigid aluminum laminated composite substrate are acceptable for mounting on or attachment to a Type III barricade. Do not attach a sign fabricated from any other type of sign substrate to a Type III barricade. Refer to the *Approved Products List For Traffic Control Devices in Work Zones* for approved roll-up retroreflective fabric sign materials and approved rigid aluminum laminated composite sign substrates.

Maintain barricades in good condition. Replace and do not use barricades that have completed their functional service life.

Installations of the traffic control channelizing devices illustrated on the *SCDOT Standard Drawings* are for normal conditions. Adjustments may be required due to horizontal and/or vertical alignments or other sight distance restrictions.

Maximize the effective and positive impact of a traffic control channelizing device by installing the device in a location and in an application suitable to the device. Always consider roadway type, roadway classification, light conditions (day vs. night), traffic speeds, traffic volumes, potential sight distance restrictions, etc., when determining which traffic control channelizing device is best suited for a traffic control setup. Unless otherwise directed by a work zone traffic control plan or the *SCDOT Standard Drawings*, utilize the specified traffic control channelizing devices within lane closures and shoulder closures as directed, see *Table 4*.

Table 4 Traffic Control Channelizing Device Applications

TRAFFIC CONTROL CHANNELIZING DEVICE APPLICATIONS							
LANE CLOSURE				SHOULDER CLOSURE			
PRIMARY & SECONDARY		INTERSTATE		PRIMARY & SECONDARY		INTERSTATE	
DAY	NIGHT	DAY	NIGHT	DAY	NIGHT	DAY	NIGHT
36" Cones	-----	36" Cones	-----	36" Cones	-----	36" Cones	-----
42" Cones	42" Cones	42" Cones	42" Cones	42" Cones	-----	42" Cones	-----
Drums	Drums	Drums	Drums	Drums	Drums	Drums	Drums

WARNING LIGHTS

Supplemental Warning Lights for Traffic Control Devices -

Type A, Type B, Type C and Type D warning lights are yellow or amber, portable, lens directed and enclosed. Types A and B lights operate in a flashing mode and Types C and D lights operate in a steady burn mode.

All warning lights shall meet the requirements of the *MUTCD*, latest edition. The weight of these lights shall not exceed 3.3 pounds in accordance with the requirements of *NCHRP Report 350* or the *AASHTO Manual for Assessing Safety Hardware (MASH)*.

Mount all warning lights on signs or channelizing devices in a manner that, if hit by an errant vehicle, the light will not be likely to penetrate the windshield of the errant vehicle.

The minimum mounting height of a warning light is 30 inches from the bottom of the lens of the light to the travel lane surface when placed in a roadway or to the grade elevation of the near edge of the adjacent travel lane when placed adjacent to a roadway.

When utilizing a warning light with a detachable battery pack, place the battery pack on the ground.

Use Types A, B, C and D warning lights as supplemental traffic control devices for signs and barricades.

Auxiliary Warning Lights for Vehicles and Equipment -

Supplement all construction and/or construction-related vehicles and equipment that operate in a stationary or mobile work zone within or adjacent to a roadway within the highway rights-of-way with AMBER or YELLOW colored high intensity rotating or strobe type flashing auxiliary warning light devices. Auxiliary warning lights of a color other than AMBER or YELLOW are unacceptable and prohibited. Utilize, install, operate and maintain a single or multiple lighting devices as necessary to provide visibility to approaching motorists.

All auxiliary warning light models shall meet *Society of Automotive Engineers (SAE)* Class I standards and SAE Standard J575 relative to *Tests for Motor Vehicle Lighting Devices and Components* and these specifications.

The amber/yellow color of the dome/lens of an auxiliary warning light device shall meet SAE Standard J578 for amber/yellow color specifications.

Auxiliary warning lights with parabolic reflectors that rotate shall rotate around a halogen lamp at a rate to produce 175 flashes per minute. The parabolic reflector shall produce a minimum 80,000 candle power and a minimum 54,000 candela through an SAE Standard J846 approved amber dome.

Equip strobe type flashing auxiliary warning light devices with photosensitive circuit controls to adjust the lighting intensity in response to changes in ambient light conditions such as from day to night. These lights shall have a double-flash capability rated at 80 double flashes per minute and produce a minimum 24 joules of flash energy at the highest power level setting.

Acceptable auxiliary warning light models shall provide sufficient light output to be clearly recognizable at a minimum distance of 1750 feet.

Mount all auxiliary warning light devices intended to function as the auxiliary warning light system or as an element thereof on vehicles and equipment at locations no less than 3 feet above the ground and in conspicuous locations to provide visibility to approaching motorists.

Auxiliary warning light devices and/or models that mount in the locations of the standard vehicle lighting system are unacceptable as the specified auxiliary warning light system due to restrictive simultaneous visibility capabilities from multiple sight angles. However, auxiliary warning light devices that mount in the standard vehicle lighting system locations are acceptable as supplements to the specified lighting devices mounted in locations that do meet the minimum height requirements and provide simultaneous visibility capabilities from multiple sight angles.

Standard vehicle hazard warning lights are only permitted as supplements to the specified auxiliary warning light devices.

TRAILER MOUNTED TRAFFIC CONTROL DEVICES

ADVANCE WARNING ARROW PANELS

Use trailer mounted advance warning arrow panels to provide additional advance warning and directional information to assist motorists through a work zone. Make certain to provide these warning devices for advance directional information in lane closures. All trailer mounted advance warning arrow panels shall comply with department specifications.

All trailer mounted advance warning arrow panels shall be a Type C. All advance warning arrow panels shall meet the minimum size, legibility distance and minimum number of elements, see *Table 5*.

Table 5 Advance Warning Arrow Panels (Trailer Mounted)

Arrow Panel Type	Minimum Size	Minimum Legibility Distance	Minimum Number Of Elements
C	96" x 48"	1 Mile	15

A trailer mounted advance warning arrow panel shall have a minimum mounting height of 7 feet from the bottom of the sign panel to the surface on which the unit is placed when raised into its operating position.

The trailer mounted advance warning arrow panel is a supplemental traffic control device. Use of a trailer mounted arrow panel as a singular entity is PROHIBITED.

Do not use a trailer mounted advance warning arrow panel operating in a Flashing Arrow Mode or a Sequential Chevron Mode as a part of a flagging operation to direct vehicles into lanes used by opposing traffic.

Use the Flashing Arrow Modes, the Sequential Chevron Modes or the Caution Mode. Do not display Sequential Stem Arrow Modes due to staged and slow development of the intended message by these message modes.

The Caution Mode requires a pattern of 4 lamps with 1 lamp in each corner flashing simultaneously (referred to as the "4 Corners" pattern). Ensure the "4 Corners" pattern does not indicate direction or resemble any other mode. Do not use trailer mounted advance warning arrow panels incapable of producing the "4 Corners" pattern. Do not display a "bar," "alternating diamond(s)," or any other symbol other than the required "4 Corners" pattern during the Caution Mode.

CHANGEABLE MESSAGE SIGNS

Use trailer mounted changeable message signs to provide additional advance warning and directional information to assist motorists through a work zone. Consider utilizing these warning devices for advance information to assist motorists on high volume high speed roadways or on any job site that advance information is beneficial to motorists. All trailer mounted changeable message signs shall comply with department specifications.

The trailer mounted changeable message sign shall have a minimum mounting height of 7 feet from the bottom of the sign panel to the surface on which the unit is placed when raised into its operating position.

When a trailer mounted changeable message sign is non-operational for more than 72 hours, remove the sign from the roadway unless otherwise directed by the Department.

Use pre-programmed messages in accordance with the *SCDOT Standard Drawings* when the trailer mounted changeable message signs are used as part of the traffic control setup for lane closures. Display only those messages pertinent to the traffic control situation and traffic conditions. Do not use messages on a changeable message sign that duplicate the legends on the advance warning signs. **Display all messages with a minimum character height of 18 inches.**

On primary and secondary routes, place the trailer mounted changeable message sign on the shoulder of the roadway not less than 6 feet from the edge of the sign to the near edge of the adjacent travel lane when space is available. When the 6 foot space or right-of-way is unavailable, place the trailer mounted changeable message sign at the greatest possible distance up to 6 feet from the near edge of the adjacent travel lane.

On primary and secondary routes, when a trailer mounted changeable message sign is placed within the limits of a paved shoulder or remains in place adjacent to a travel lane when inoperative regardless of shoulder type, supplement the trailer mounted changeable message sign location with not less than 5 portable plastic drums placed between the sign and the adjacent travel lane for delineation of the sign location. This requirement for delineation of the sign location applies at all times under the aforementioned conditions during which the sign is within 15 feet of the near edge of a travel lane open to traffic. Use of 36" standard traffic cones or 42" oversized traffic cones as substitutes for the portable plastic drums in this application is unacceptable.

On interstate routes, place the trailer mounted changeable message sign on the shoulder of the roadway not less than 6 feet from the edge of the sign to the near edge of the adjacent travel lane. Supplement the sign location with no less than 5 portable plastic drums placed between the sign and the adjacent travel lane for delineation of the sign location. Install and maintain the drums not closer than 3 feet from the near edge of the adjacent travel lane. The requirement for delineation of the sign location applies at all times during which the sign is within 30 feet of the near edge of a travel lane open to traffic. Use of 36" standard traffic cones or 42" oversized traffic cones as substitutes for the portable plastic drums in this application is unacceptable.

TRUCK MOUNTED TRAFFIC CONTROL DEVICES

ADVANCE WARNING ARROW PANELS

Use truck mounted advance warning arrow panels to provide additional advance warning and directional information to assist motorists through a work zone during but not limited to lane closures, shoulder closures, and mobile operations. All truck mounted advance warning arrow panels shall comply with department specifications.

All truck mounted advance warning arrow panels shall be a Type C. All advance warning arrow panels shall meet the minimum size, legibility distance and minimum number of elements, see *Table 6*.

Table 6 Advance Warning Arrow Panels (Truck Mounted)

Arrow Panel Type	Minimum Size	Minimum Legibility Distance	Minimum Number Of Elements
C	96" x 48"	1 Mile	15

A truck mounted advance warning arrow panel shall have a minimum mounting height of 7 feet from the bottom of the sign panel to the surface on which the truck is operating when the arrow panel is in its operating position.

Do not use a truck mounted advance warning arrow panel operating in a Flashing Arrow Mode or a Sequential Chevron Mode as a part of a flagging operation to direct vehicles into lanes used by opposing traffic. A truck mounted advance warning arrow panel shall operate in the "4 Corners" caution mode ONLY when utilized in conjunction with a flagging operation.

Use the Flashing Arrow Modes, the Sequential Chevron Modes or the Caution Mode. Do not display Sequential Stem Arrow Modes due to staged and slow development of the intended message by these message modes.

The Caution Mode requires a pattern of 4 lamps with 1 lamp in each corner flashing simultaneously (referred to as the "4 Corners" pattern). Ensure the "4 Corners" pattern does not indicate direction or resemble any other mode. Do not use truck mounted advance warning arrow panels incapable of producing the "4 Corners" pattern. Do not display a "bar," "alternating diamond(s)" or any other symbol other than the required "4 Corners" pattern during the Caution Mode.

CHANGEABLE MESSAGE SIGNS

Use truck mounted changeable message signs to provide additional advance warning and directional information to assist motorists through a work zone. Consider utilizing these warning devices for advance information to assist motorists on high volume high speed roadways or on any job site that advance information is beneficial to motorists. All truck mounted changeable message signs shall comply with department specifications.

The truck mounted changeable message sign shall have a minimum mounting height of 7 feet from the bottom of the sign panel to the surface on which the truck is operating when the changeable message sign is in its operating position.

The display panel shall have full matrix capability and provide two message lines with the capability to display 7 characters per line with a character height of 18 inches. **Display all messages with a minimum character height of 18 inches.**

When traffic queues develop during lane closures on multilane roadways, a truck mounted changeable message sign may be utilized to provide advance notice to motorists that the motorists are approaching a traffic queue and should be prepared to stop. When used in association with a traffic queue, place the truck mounted changeable message sign on the shoulder of the roadway. On high speed roadways, maintain the truck mounted changeable message sign no less than 2000 feet in advance of the traffic queue at all times. Do not place a truck mounted changeable message sign on the shoulder of a roadway without an operator. The truck mounted changeable message sign shall have the capability to display the message, "PREPARE TO STOP", with a minimum character height of 18 inches.

During mobile operations on multilane roadways, a truck mounted changeable message sign may be used to provide advance notice to motorists that the motorists are approaching a work operation operating in the travel lane. When used in association with a mobile operation, the truck mounted changeable message sign should flash alternately to read "RIGHT LANE", "CLOSED AHEAD" during operations in the right travel lane or "LEFT LANE", "CLOSED AHEAD" during operations in the left travel lane. Place and operate the truck mounted changeable message sign on the roadway shoulder unless the shoulders are too narrow to accommodate vehicles, the shoulders are structurally inadequate or curb and gutter is present. When site conditions require the truck mounted changeable message sign to operate within the travel lane, the changeable message sign shall display a flashing arrow. The flashing arrow display on a truck mounted changeable message sign is permissible only when the changeable message sign must operate in a travel lane. Do not display the flashing arrow on a truck mounted changeable message sign when the changeable message sign operates on the shoulder.

Use pre-programmed messages in accordance with the *SCDOT Standard Drawings* when the truck mounted changeable message signs are used as part of the traffic control setup. Display only those messages pertinent to the traffic control situation and traffic conditions. Do not use messages on a truck mounted changeable message sign that duplicate the legends on the advance warning signs.

TRUCK MOUNTED ATTENUATORS

Truck mounted attenuators approved for use by the SCDOT include two (2) types of truck mounted attenuators, the conventional direct truck mounted units mounted directly to a truck and the trailer towed units towed behind a truck.

Use truck mounted attenuators to provide separation between approaching vehicular traffic and a work zone. These devices are especially effective in areas where pedestrian workers are conducting work activities within the limits of a travel lane. Utilize these devices in lane closures, shoulder closures, mobile operations and similar scenarios. These devices may be mounted directly to a truck or on a trailer. All truck mounted attenuators shall comply with department specifications.

All approved truck mounted attenuators are classified as *NCHRP Report 350* or the *AASHTO Manual for Assessing Safety Hardware (MASH)* Test Level 2 or Test Level 3. Determine if a Test Level 2 or Test Level 3 truck mounted attenuator is suitable to a specific roadway based upon the legal posted regulatory speed limit of the specified roadway prior to the presence of a work zone or a temporary speed limit within a work zone.

Test level 2 truck mounted attenuators are approved for roadways with legal posted regulatory speed limits of 45 mph or less. Do not utilize test level 2 truck mounted attenuators on Interstate highways or roadways with posted regulatory speed limits of 50 mph or greater.

Test level 3 truck mounted attenuators are approved for roadways with legal posted regulatory speed limits of 50 mph or greater. Test level 3 truck mounted attenuators are acceptable for use on all roadways.

Always provide a clear zone in front of a truck mounted attenuator for potential roll ahead during an impact from an errant vehicle. Always provide a clear zone of approximately 100 feet to the front of the vehicle unless otherwise directed by the Department. Also, do not position pedestrian workers or equipment in the immediate area in front of the vehicle due to the potential for the unit to roll forward during an impact. Do not place the truck mounted attenuator in advance of a stationary hazard such as a temporary concrete barrier wall that may restrict the roll ahead and impede the unit's capacity to function properly.

A direct truck mounted truck mounted attenuator is mounted and attached to brackets or similar devices connected to the frame of a truck. Attach each direct truck mounted truck mounted attenuator to the rear of a truck with a minimum gross vehicular weight (GVW) of 15,000 pounds (actual weight) unless otherwise directed within the "Remarks" column of the *Approved Products List For Traffic Control Devices in Work Zones* in regard to any specific requirements for the device in question. If the addition of supplemental weight to the vehicle as ballast is necessary, contain the material within a structure constructed of steel. Construct this steel structure to have a minimum of four sides and a bottom to contain the ballast material in its entirety. A top is optional. Bolt this structure to the frame of the truck. Utilize a sufficient number of fasteners for attachment of the steel structure to the frame of the truck to ensure the structure will not part from the frame of the truck during an impact upon the attached truck mounted attenuator. Utilize either dry loose sand or steel reinforced concrete for ballast material within the steel structure to achieve the necessary weight. The ballast material shall remain contained within the confines of the steel structure and shall not protrude from the steel structure in any manner.

A trailer towed truck mounted attenuator is a trailer type attenuator towed from behind and attached to the frame of a truck via a standard pintle hook / hitch. Attach each trailer towed truck mounted attenuator to the rear of a truck with a minimum gross vehicular weight (GVW) of 10,000 pounds (actual weight) unless otherwise directed within the "Remarks" column of the *Approved Products List For Traffic Control Devices in Work Zones* in regard to any specific requirements for the device in question. If the addition of supplemental weight to the vehicle as ballast is necessary, contain the material within a structure constructed of steel. Construct this steel structure to have a minimum of four sides and a bottom to contain the ballast material in its entirety. A top is optional. Bolt this structure to the frame of the truck. Utilize a sufficient number of

fasteners for attachment of the steel structure to the frame of the truck to ensure the structure will not part from the frame of the truck during an impact upon the attached truck mounted attenuator. Utilize either dry loose sand or steel reinforced concrete for ballast material within the steel structure to achieve the necessary weight. The ballast material shall remain contained within the confines of the steel structure and shall not protrude from the steel structure in any manner.

WORK VEHICLES

When work vehicles and/or equipment operate within travel lanes open to traffic, the work vehicles shall travel in the same direction of roadway traffic.

When work vehicles operate within a closed travel lane or a closed shoulder area, they may travel in either direction as necessary. However, when operating within a closed travel lane or a closed shoulder area during the hours of darkness, the work vehicles should minimize travel in the opposite direction of roadway traffic due to visibility limitations of motorists due to darkness and the unpredictable reactions startled motorists may have from seeing opposing headlights in an area where opposing traffic is not anticipated by motorists.

On primary and secondary routes, the Contractor shall have flaggers available to control all construction vehicles entering or crossing the travel lanes of secondary and primary routes. The RCE shall determine the necessity of these flaggers for control of these construction vehicles. The RCE shall consider sight distance, vertical and horizontal curves of the roadway, prevailing speeds of traffic, frequency of construction vehicles entering or crossing the roadway, and other site conditions that may impact the safety of the workers and motorists when determining the necessity of these flaggers. These flaggers will not stop roadway traffic, cause roadway traffic to change lanes or affect roadway traffic in any manner. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

When working within the rights-of-way of access-controlled roadways such as Interstate highways, the Contractor's vehicles may only change direction of travel at interchanges. These vehicles are prohibited from crossing the roadway from right side to median or vice versa. The Contractor's vehicles may not disrupt the normal flow of roadway traffic or enter the travel lane of the roadway until a sufficient gap is present.

When working within the rights-of-way of access-controlled roadways with posted regulatory speed limits of 55 MPH or greater and average daily traffic volumes {ADT} of 10,000 vehicles per day or greater, i.e. Interstate highways, all construction and work vehicles possessing any one or more of the vehicular characteristics listed below are only permitted to enter and exit a right or left shoulder work area during the presence of active lane closures unless otherwise directed by the RCE. These vehicles are not permitted to enter or exit these work areas without the presence of active lane closures unless otherwise directed by the RCE. Shoulder closures are unacceptable and insufficient methods for control of traffic at ingress / egress areas for these vehicles. The restrictive vehicular characteristics include the following:

- Over six (6) tires
- Tandem rear axles
- A base curb weight greater than 8000 lbs.
- A gross vehicular weight greater than 12000 lbs.
- A trailer in tow except under the following conditions:
 - Trailers transporting traffic control devices relative to the installation of lane closures, shoulder closures or other traffic control operations approved by the RCE (including but not limited to standard and 42" oversized traffic cones, portable plastic drums, signs, portable sign supports, u-channel and square steel tube sign posts)
 - Trailer mounted traffic control devices (including but not limited to advance warning arrow panels, changeable message signs, temporary traffic signals, highway advisory radios, work zone intelligent transportation systems and trailer towed truck mounted attenuators)

DAYTIME AND NIGHTTIME WORK

The conditions of daytime and nighttime are defined in accordance with the level of natural light provided by the sun measured by a light meter. The terms "Daytime," "Hours of Daylight," or any similar term refers to a level of illumination greater than or equal to 54 Lx or 5 fc. The terms "Nighttime," "Hours of Darkness" or any similar term refers to a level of illumination less than 54 Lx or 5 fc.

In areas where work is being performed during the hours of darkness, furnish, place and maintain lighting facilities capable of providing light of sufficient intensity to facilitate good workmanship and proper inspection at all times. Arrange the lighting so that it does not produce glare or diminish the motorist's visibility; primarily those motorists driving in the direction opposing the direction the lighting is being targeted toward. Perform ride-through inspection when installing lighting facilities to evaluate the impacts to motorists' visibility.

Illuminate the work area by any combination of portable lights, standard electric lights, existing streetlights, etc., that provides the necessary illumination. See *Table 7*.

Table 7 **Work Area Illumination Requirements**

Area of Illumination	Work Activity	Minimum Illumination Level Lx (fc)
General	Cleaning, Sweeping, Tacking, Painting, etc.	54 (5)
Tasks Around Equipment (50 foot Ahead / Behind)	Milling, Paving, Rolling, etc.	108 (10)

WORK ZONE TRAFFIC CONTROL PROCEDURES

FLAGGING OPERATIONS

A flagging operation is a temporary control of the flow of traffic when two opposing directions of traffic must share a common travel lane on a two-lane two-way roadway. A flagging operation may be necessary during a lane closure on a two-lane two-way roadway or an intermittent ramp closure. Utilize flagging operations to direct traffic around work activities within a closed portion of the roadway and maintain a continuous traffic flow, therefore, stopped traffic shall not be required to stop for time durations greater than those listed below unless otherwise approved by the Department. See *Table 8*.

Table 8 Traffic Stopped Time Durations for Flagging Operations

LENGTH OF CLOSURE	MAXIMUM TIME DURATION FOR STOPPED TRAFFIC
1 MILE or LESS	5 Minutes
1 to 2 MILES	7 ½ Minutes

Conduct all flagging operations in accordance with the *SCDOT Standard Drawings*, the *MUTCD*, latest edition and the *SCDOT "Flagger's Handbook"*, latest edition.

Erect all signs relative to a flagging operation before initiation of the operation and immediately remove or cover the signs upon termination of the operation.

During flagging operations, station the flagger controlling traffic operating in the travel lane closed to traffic adjacent to the first traffic control device in the approach taper. Station the flagger controlling traffic operating in the travel lane that remains open to two-way traffic 100 feet in advance of the first traffic control device in the downstream taper.

Equip all flaggers with a Stop/Slow paddle. Do not use flags except during emergency situations.

Maintain the proper array of advance warning signs in place for each approach at all times that a flagging operation is in place and active. When necessary to relocate the flagger station while actively maintaining the flagging operation, install an additional array of advance warning signs at the new location for the flagger station and complete the relocation of the flagger station prior to removing the existing array of advance warning signs. Always maintain the flagger station within 500 feet or less of the "Flagger" (W20-7-48) symbol sign of the array of advance warning signs.

During nighttime flagging operations, supplement each array of advance warning signs with a trailer mounted changeable message sign for each approach. These changeable message signs are not required during daytime flagging operations. Install the changeable message signs 500 feet in advance of the "Road Work Ahead" sign (W20-1-48-A) on each approach. Display the messages, "PREPARE TO STOP", "FLAGGER AHEAD", on the changeable message signs.

During nighttime flagging operations, ensure that flaggers wear safety apparel that meet ANSI/ISEA 107, *Standard Performance for Class 3 Risk Exposure*, latest revision and SCDOT requirements.

During nighttime flagging operations, illuminate each flagger station with any combination of portable lights, standard electric lights, existing street lights, etc., that provide a minimum illumination level of 108 Lx or 10 fc.

LANE CLOSURES

A typical lane closure is an installation of a specific array of traffic control devices to temporarily reduce the number of travel lanes on a multilane roadway through channelization and relocation of traffic from the closed travel lane into the remaining adjacent travel lane(s) open to traffic. The traffic control devices function to channelize the traffic and provide delineation of the separation of the travel lane(s) closed to traffic and the travel path open to traffic.

Traffic control setups differ for daytime and nighttime lane closures. Do not use daytime lane closure setups during the hours of darkness. Install nighttime lane closure setups when lane closures are required during the hours of darkness or required to remain in place during both daytime and the hours of darkness. Observe all time restrictions for lane closures as required by the Department.

The 36" standard traffic cones are acceptable traffic control devices for daytime lane closure setups and 42" oversized cones or portable plastic drums are required traffic control devices for nighttime lane closure setups.

Convert a daytime lane closure setup to a nighttime lane closure setup whenever circumstances prohibit removal of a daytime lane closure before entering nighttime conditions. If 36" standard traffic cones are being utilized during a daytime lane closure and due to unforeseen circumstances the closure must be extended into the nighttime hours, replace the 36" standard traffic cones with 42" oversized traffic cones or portable plastic drums.

Install and operate a trailer mounted advance warning arrow panel within the taper of a single lane closure on a low speed multilane roadway in accordance with the *SCDOT Standard Drawings*. Place the advance warning arrow panel on the roadway shoulder at the beginning of the taper. However, where the shoulders are narrow or site conditions restrict the use of the shoulder areas, place the advance warning arrow panel behind the channelizing devices of the taper as close as practical to the beginning of the taper. The preferred location for placement of the trailer mounted advance warning arrow panel is as close as practical to the start of the taper.

Install and operate two trailer mounted advance warning arrow panels within the taper of a single lane closure on an intermediate to high speed multilane roadway in accordance with the *SCDOT Standard Drawings*. Place one advance warning arrow panel on the roadway shoulder at the beginning of the taper and a second within the closure at the downstream end of the taper. However, where the shoulders are narrow or site conditions restrict the use of the shoulder areas, place the first advance warning arrow panel behind the channelizing devices of the taper as close as practical to the beginning of the taper. The preferred location for placement of the first trailer mounted advance warning arrow panel is as close as practical to the start of the taper.

Install and operate two trailer mounted advance warning arrow panels within each taper of dual lane closure on low, intermediate and high speed roadways in accordance with the *SCDOT Standard Drawings*. Place one advance warning arrow panel at the beginning of each taper and a second advance warning arrow panel within the closure at the downstream end of each taper. Guidelines for placement of the trailer mounted advance warning arrow panels within the tapers of single lane closures also apply to the placement of these devices in the tapers of dual lane closures.

Truck mounted advance warning arrow panels operating within the activity area of a lane closure shall operate in the Caution Mode anytime the truck is advanced beyond 250 feet from the downstream end of the transition area (taper) of a lane closure.

On an interstate roadway, when a traffic queue develops, provide a truck with a truck mounted changeable message sign or a static sign to convey advance notice to motorists that the motorists are approaching a traffic queue and should be prepared to stop. Place this truck on the shoulder of the roadway

and maintain the truck no less than 2000 feet in advance of the traffic queue at all times. Placement of this truck on the shoulder of the roadway without an operator is PROHIBITED. A truck mounted changeable message sign shall display the message, "PREPARE TO STOP", with a minimum character height of 18 inches and comply with all SCDOT specifications. If utilizing the static sign, the static sign shall be shall be a 48-inch x 48-inch "Be Prepared To Stop" sign (W3-4-48) with a rigid sign substratum reflectorized with either Type VIII, Type IX or Type XI microprismatic fluorescent orange retroreflective sheeting with a sign legend composed of 8 inch black Series "C" letters. Supplement the static sign with two amber high intensity rotating, flashing, oscillating or strobe lights.

On low speed primary roadways, if work is being conducted at two different locations at the same time in the same travel lane, separate the two locations by not less than 1 mile from the end of the first lane closure to the beginning of the taper of the second lane closure. On all other roadways, if work is being conducted at two different locations at the same time in the same travel lane, separate the two locations by not less than 2 miles from the end of the first lane closure to the beginning of the taper of the second lane closure.

On low speed primary roadways, when work is being conducted at two different locations in different travel lanes at the same time, separate the two locations by not less than 2 miles from the end of the first lane closure to the beginning of the taper of the second lane closure. On all other roadways, when work is being conducted at two different locations in different travel lanes at the same time, separate the two locations by not less than 4 miles from the end of the first lane closure to the beginning of the taper of the second lane closure.

Restrict the length of a lane closure to a maximum distance of 2 miles unless otherwise specified.

Do not install lane closures on high volume roadways with high volume commuter traffic during peak traffic periods unless otherwise specified.

SHOULDER CLOSURES

A shoulder closure is an installation of a specific array of advance warning signs and traffic control devices to temporarily close the shoulder area of a roadway to vehicular and pedestrian traffic. When the work activity is conducted within 15 feet or less of the near edge of the adjacent travel lane, advance warning signs and traffic control devices are required for a shoulder closure. When the work activity is conducted beyond 15 feet from the near edge of the adjacent travel lane, only advance warning signs are required for a shoulder closure.

Observe all hourly and holiday restrictions designated for lane closures for shoulder closures. Hourly and holiday restrictions designated for lane closures for any specific roadway location shall also apply to the installation and maintenance of shoulder closures within the same specific roadway location for work activities performed within 15 feet of the near edge of an adjacent travel lane.

On primary and secondary roadways, the shoulder area within 1 foot or less of the near edge of an adjacent travel lane is restricted and conducting work within the limits of this restricted area under a shoulder closure is prohibited. Install and maintain lane closures for all work that may require the presence of personnel, tools, equipment, materials, vehicles, etc., within the restricted area of within 1 foot of the near edge of an adjacent travel lane.

On interstate highways, the limits of a paved shoulder or within 10 feet of the near edge of an adjacent travel lane is restricted and conducting work within the limits of this restricted area under a shoulder closure is prohibited. Install and maintain lane closures for all work that may require the presence of personnel, tools, equipment, materials, vehicles, etc., within the restricted area of the limits of a paved shoulder or within 10 feet of the near edge of an adjacent travel lane.

When performing work activities behind a positive protection such as guardrail or temporary concrete barrier wall, the restrictions regarding the presence of personnel, tools, equipment, materials, vehicles, etc., within the restricted areas as defined above may be waived. However, waiver of the restrictions regarding the restricted areas shall require approval by the RCE prior to beginning any work activities with the restricted areas.

On primary and secondary roadways, shoulder closures are required for work zones that may include the presence of personnel, tools, equipment, materials, vehicles, etc., beyond one foot but within 30 feet of the near edge of an adjacent travel lane.

On primary and secondary roadways, install shoulder closures as follows:

CASE I: Install advance warning signs and traffic control devices to provide a 250 foot taper in advance of the closed shoulder area and to delineate the closed shoulder area when the shoulder area within 15 feet but not closer than 1 foot from the near edge of the adjacent travel lane is occupied by a work zone. A truck mounted attenuator is required.

CASE II: Only advance warning signs are required whenever the shoulder area beyond 15 feet but within 30 feet of the near edge of the adjacent travel lane is occupied by a work zone.

On interstate roadways, shoulder closures are required for work zones that may include the presence of personnel, tools, equipment, materials, vehicles, etc., beyond 10 feet but within 30 feet of the near edge of an adjacent travel lane.

On interstate roadways, install standard shoulder closures as follows:

CASE I: Install advance warning signs and traffic control devices to provide a 300 foot taper in advance of the closed shoulder area and to delineate the closed shoulder area when the shoulder area within 15 feet but not closer than 10 feet from the near edge of the adjacent travel lane is occupied by a work zone. A truck mounted attenuator is required.

CASE II: Only advance warning signs are required whenever the shoulder area beyond 15 feet but within 30 feet of the near edge of the adjacent travel lane is occupied by a work zone.

When a grassed median area within 30 feet of a travel lane is occupied by a short term stationary or longer term work zone, close the adjacent shoulder(s) according to the "CASE I" and "CASE II" requirements as directed above. If the median area work activities are within 30 feet of both adjacent travel lanes, close both shoulders as necessary.

On primary and secondary roadways, 36" standard traffic cones, 42" oversized cones and portable plastic drums are acceptable traffic control devices for daytime shoulder closure setups. Portable plastic drums are the required traffic control devices for nighttime shoulder closures.

On interstate roadways, 36" standard traffic cones, 42" oversized cones and portable plastic drums are acceptable traffic control devices for daytime shoulder closure setups. Portable plastic drums are the required traffic control devices for nighttime shoulder closures.

On all roadways, if work is being conducted simultaneously at two (2) different locations under "CASE I" shoulder closures, separate the two (2) locations by no less than 1 mile from the end of the first "CASE I" closure that a motorist will encounter to the beginning of the taper of the second "CASE I" closure. A minimum separation distance of $\frac{1}{2}$ mile is required between shoulder closures when one or both shoulder closures are a "CASE II" shoulder closure.

MOBILE OPERATIONS

Mobile operations are planned work activities conducted with vehicle trains consisting of work vehicles and shadow vehicles operating collectively to perform specific work activities and operations while continuously moving at speeds of 3 mph or greater at all times without any stops. The minimal traffic flow impacts generated by these operations involve brief traffic flow speed reductions and travel path diversions. Conduct work operations that cannot be performed at speeds of 3 mph or greater under standard stationary lane closures.

Roadway characteristics such as type, speed classification and volume classification shall impact the traffic control requirements for continuous mobile operations.

The distance intervals between the vehicles as indicated in the *SCDOT Standard Drawings* may require adjustments to compensate for sight distance obstructions created by hills and curves and any other conditions that may obstruct the sight distance between the vehicles. However, adjustments to the distance intervals between the vehicles should be maintained within the range of variable distance intervals indicated on the *SCDOT Standard Drawings*.

Maintain two-way radio communication between all vehicles in the vehicle train operating in a mobile operation.

Supplement all vehicles and equipment operating in the vehicle train with AMBER or YELLOW colored high intensity rotating or strobe type flashing auxiliary warning light devices. Utilize, install, operate and maintain a single or multiple lighting devices as necessary to provide visibility to approaching motorists. Supplement these vehicles with advance warning arrow panels and truck mounted attenuators as prescribed by the *SCDOT Standard Drawings*.

Supplement all construction and/or construction-related vehicles and equipment that operate in a stationary or mobile work zone within or adjacent to a roadway within the highway rights-of-way with AMBER or YELLOW colored high intensity rotating or strobe type flashing auxiliary warning light devices. Utilize, install, operate and maintain a single or multiple lighting devices as necessary to provide visibility to approaching motorists.

Install, operate and maintain all advance warning arrow panels, truck mounted attenuators and truck mounted changeable message signs as required by the standard specifications, the manufacturer's specifications and the *SCDOT Standard Drawings*.

DETOURS

A detour is a relocation of traffic from a roadway closed to traffic onto alternate routes. In many scenarios the detoured traffic is returned to the closed roadway beyond the section of roadway closed to traffic.

Conduct, maintain and install all roadway detours and the detour signing in accordance with SCDOT requirements, the *SCDOT Standard Drawings* and the *MUTCD*, latest edition.

Select roads for a detour route that have a structure and geometry to safely sustain the type and amount of detoured traffic. Ensure the detour route has adequate sight distances at intersections, no bridges with posted weight limitations, travel lanes with adequate lane widths to accommodate the detoured traffic, adequate pavement markings and a good pavement surface. Also, during the detour route selection process consider factors such as school locations, emergency services access, areas of reduced speed limits, intersection geometry and traffic control at intersections impacted by the detour.

Monitor the detour during the operation so that any deficiencies that may arise can be addressed and corrected.

PACING OPERATIONS

A pacing operation is a temporary control of the traffic flow through a defined area without creating a complete cessation of the traffic flow. Use a specified array of traffic control devices, law enforcement officers and law enforcement vehicles to conduct a pacing operation. Pacing operations are only permitted on access controlled roadways such as interstate routes.

Assistance from the South Carolina Highway Patrol is required when a pacing operation is implemented.

The Highway Patrol troopers will intercept traffic in advance of the project site at a distance sufficient to provide a work period of 20 minutes or less. Close all on-ramps within the affected area in advance of the project site until the queue of controlled traffic has passed. Station a uniformed law enforcement officer at the point of closure on each ramp. Uniformed law enforcement officers are the only acceptable individuals permitted to enforce these ramp and intersecting roadway closures.

Arrange all equipment and crews to conduct and complete the necessary work tasks prior to the arrival of the controlled traffic flow. Conduct the necessary work in a time period no longer than 20 minutes. Upon completion of the 20 minute time period, allow the controlled traffic flow to clear the area after each event and resume normal traffic flow for the location prior to initiating a subsequent pacing operation. Make all reasonable efforts to expedite the work and minimize interference with traffic.

Utilize pacing operations at times of the lowest traffic volumes. The hourly restrictions for lane closures at the subject location also apply to pacing operations. Do not conduct pacing operations during holidays, holiday weekends or special events unless otherwise directed by the District Engineering Administrator.

In the event a traffic queue should develop when conducting pacing operations, provide a truck with a truck mounted changeable message sign or a static sign to convey advance notice to motorists that the motorists are approaching a traffic queue and should be prepared to stop. Place this truck on the shoulder of the roadway and maintain the truck no less than 2000 feet in advance of the traffic queue at all times. Placement of this truck on the shoulder of the roadway without an operator is PROHIBITED. A truck mounted changeable message sign shall display the message, "PREPARE TO STOP", with a minimum character height of 18 inches and comply with all SCDOT specifications. If utilizing the static sign, the static sign shall be shall be a 48-inch x 48-inch "Be Prepared To Stop" sign (W3-4-48) with a rigid sign substratum reflectorized with either Type VIII, Type IX or Type XI microprismatic fluorescent orange retroreflective sheeting with a sign legend composed of 8 inch black Series "C" letters. Supplement the static sign with two amber high intensity rotating, flashing, oscillating or strobe lights.

The Contractor shall provide notice to the RCE no less than 2 weeks prior to conducting any major traffic interruption such as a pacing operation.

SEPARATION of ADJACENT TRAVEL LANES / TRAFFIC SPLIT

On interstate and multilane primary and secondary roadways, a separation of traffic in adjacent travel lanes or a traffic split of adjacent travel lanes may be an acceptable option depending upon the site conditions, construction requirements and project objectives.

The Department will consider separation of adjacent travel lanes through placement of barrier wall, earth median or other type of physical feature between the travel lanes ONLY after extensive evaluations of all routine work zone traffic control staging options have determined the routine options inadequate for the construction requirements.

The Department reserves the right to deny any proposal to separate traffic. The Department may deny the proposal based upon but not limited to traffic queue generation, length and duration of any resulting traffic queues, traffic delays, network impacts, emergency response impacts and safety issues.

Proposal Requirements -

Submit all proposals to separate adjacent travel lanes to the Department for review. These submittals shall include the following:

TYPICAL SECTIONS FOR EACH TRAFFIC CONTROL STAGE:

The traffic control typical sections will illustrate the travel lane configurations and lane widths, shoulder configurations and shoulder widths, temporary concrete barrier wall placement, traffic control devices placement, existing pavement, pavement under construction, temporary pavement and grade elevation differences between and adjacent to travel lanes if any exist during each traffic control stage or phase. Include all distance information between each adjacent feature in these typical sections as well as the width of each feature (i.e. width of temporary concrete barrier and distance interval between temporary concrete barrier wall and near edge of adjacent travel lane). These typical sections will include both directions and the median area.

STAGING PLANS:

The staging plans will include plan sheets illustrating all travel lane, shoulder, temporary concrete barrier wall, median area and work area configurations and locations. These plans will also include the traffic separation / traffic split. Include and label all signs, traffic control devices, pavement markings, lane widths, shoulder widths and spacing intervals between traffic control devices as well as any temporary pavement that may be necessary. Provide station numbers to designate sign locations, beginning / ending locations of each taper, beginning / ending locations of each line of traffic control devices and beginning / ending locations of each line of temporary concrete barrier wall. Provide these staging plans for each traffic control stage during which the traffic separation / traffic split is in operation.

TRAFFIC SEPARATON /

TRAFFIC SPLIT PLANS: The TRAFFIC SEPARATION / TRAFFIC SPLIT PLANS are a subsection of the STAGING PLANS noted above. These plans will illustrate and include all travel lane, shoulder and temporary concrete barrier wall configurations and locations. Include and label all signs, traffic control devices, pavement markings, lane widths, shoulder widths and spacing intervals between traffic control devices. Provide station numbers to designate sign locations, beginning / ending locations of each taper, beginning / ending locations of each line of traffic control devices and beginning / ending locations of each line of temporary concrete barrier wall. Provide these plans for each traffic control stage during which the traffic separation / traffic split is in operation.

These plans shall illustrate a location selected for the traffic separation / traffic split that will provide visibility of the site of physical separation of the travel lanes, hereupon referred to as the Point of Bifurcation, to approaching motorists. The Department will consider locations that do not provide adequate visibility of this site to approaching motorists unacceptable (i.e. locating the traffic separation / traffic split beyond the crest of a vertical curve (hill)). See *Table 9*.

**VOLUME CAPACITY
MITIGATION**

OPTIONS:

When necessary to equalize volumes between the separated travel lanes, design and include crossovers. Each crossover will allow traffic to relocate in one (1) direction ONLY to permit avoidance of or access to an impending or subsequent interchange. The Department PROHIBITS the use of “weave” lanes in these locations.

**ENGINEERING
STUDIES:**

These engineering studies will determine, analyze and evaluate traffic impacts such as traffic queues, traffic queue lengths and duration of the traffic queues as well as delay resulting from the traffic separation / traffic split. Analyze and evaluate the impacts upon mainline traffic from the interaction with traffic entering and exiting the mainline traffic flow at interchanges and any impacts relative to the number of interchanges and locations within the project limits as well as impacts from or to interchanges adjacent to the project limits. Also, analyze and evaluate any impacts generated by the combinations of mainline and ramp volumes relative to the number of interchanges and length of the overall traffic separation / traffic split.

Determine the maximum acceptable length of the traffic separation / traffic split up to 10 miles based upon mainline and interchange ramp volumes and the interactions of the mainline and ramp volumes base upon Department guidelines for acceptable traffic impacts.

Analyze, evaluate and consider impacts upon local and state emergency response resources.

Upon completion of the evaluation and analysis of the traffic impacts the work zone will likely generate, report the findings to the Department. The results of this evaluation and analysis SHALL NOT obligate the Department to accept or approve the proposed traffic separation / traffic split.

When utilizing computer software to analyze the traffic impacts generated by the work zone, the Department requires the submittal of the work zone traffic impacts analysis include an analysis of the existing traffic conditions of the roadway prior to beginning the work. The analysis of the existing traffic conditions prior to beginning the work will serve as a baseline for comparison to the work zone traffic impacts analysis. Utilize the same computer software for the evaluation and analysis of both conditions.

Restrictions -

Site conditions of the roadway, horizontal and vertical curves, in advance of the Point of Bifurcation of the travel lanes shall provide roadway profiles to permit approaching motorists opportunity to see the location of the Point of Bifurcation at those distances specified in the following table:

Table 9 Decision Sight Distance for Avoidance Maneuver

Speed	Distance
35 MPH	800
40 MPH	900
45 MPH	1000
50 MPH	1100
55 MPH	1200
60 MPH	1300
65 MPH	1400
70 MPH	1500

Use the posted regulatory speed limit of the roadway PRIOR to beginning work to determine the necessary Decision Sight Distance for Avoidance Maneuver.

In the event the Department considers separation of adjacent travel lanes / traffic split an acceptable course of action, the Department restricts this separation event to **NO MORE THAN ONE (1)** separation event per direction of travel at any one time unless otherwise approved. However, if the Department approves multiple separation of adjacent travel lanes / traffic split events, separate these separation events by **NO LESS THAN SIX (6) MILES** from the Point of Reunification of the separate travel lanes of the first event to the Point of Bifurcation of the travel lanes of the second separation event encountered by motorists. The Point of Reunification is the location point the separated travel lanes return to a configuration with the travel lanes located immediately adjacent to each other that will allow motorists to freely change travel lanes at will.

A separation of adjacent travel lanes / traffic split should not exceed a **LENGTH OF 10 MILES** unless otherwise approved by the Department. Measure the length of the traffic separation from the Point of Bifurcation of the travel lanes to the Point of Reunification.

During a separation of adjacent travel lanes / traffic split, **PLANNED** lane closures to conduct work activities within either of the separated / split travel lanes shall require approval by the Department. **PLANNED** lane closures that require direction of traffic to alternate routes to alleviate traffic queues are unacceptable.

When determining the length of a separation of adjacent travel lanes / traffic split, consider the traffic impacts such as but not limited to traffic queues, traffic queue lengths and durations, traffic delay, overall project length, number of interchanges, interchange locations, mainline traffic volumes, ramp traffic volumes, peak hour traffic volumes and seasonal variations in traffic volumes. Also, consider impacts upon local and state emergency response resources.

For a written description of the design requirements of the separation of adjacent travel lanes / traffic split, see **Design Criteria** below, however, for illustrative drawings, see **Appendix A**.

Design Criteria -

Design criteria for the Approach Area and Taper / Transition Area for the traffic separation / traffic split of adjacent travel lanes shall include the following:

- 1) **Approach Area** - Install ground mounted Advance Lane Designation signs, span wire suspended overhead Lane Assignment signs and center line pavement markings in the Approach Area.
 - A. **Advance Lane Designation Signs** - Install these signs on approved ground mount breakaway sign supports. Install the Left Lane Designation sign in the left shoulder area and the Right Lane Designation sign in the right shoulder area.
Install the Advance Lane Designation signs no less than 3350 feet in advance of the Point of Bifurcation. Evaluate potential sight distance restrictions resulting from physical features at the site.
 - B. **Lane Assignment Signs** - Attach these signs on spanwire supports compliant with SCDOT requirements and specifications. A minimum of two (2) installations of the Lane Assignment signs is required.
Install Lane Assignment sign Installation No. 1 no less than 2000 feet downstream of the Advance Lane Designation signs and approximately 1350 feet in advance of the Point of Bifurcation.
Install Lane Assignment sign Installation No. 2 no less than 1000 feet downstream of Lane Assignment sign Installation No. 1 and approximately 350 feet in advance of the Point of Bifurcation.
 - C. **Center Line Pavement Markings** - End the white lane lines / begin a 12 inch white solid (center) line no less than 250 feet in advance of the Point of Bifurcation of the right and left travel lanes. Supplement this 12 inch white solid (center) line with 4" x 4" temporary clear raised pavement markers installed on each side of the line at spacing intervals of 10 feet.

- 2) **Taper / Transition Area** - Design all tapers within the Taper / Transition Area in accordance with the legal posted regulatory speed limit of the roadway prior to beginning the work. These tapers for relocating traffic are Shifting Tapers and will have a MINIMUM distance of 0.5 L where L=WS, see below. This distance may be longer.

L = taper length in feet

W - width of offset in feet

S - posted regulatory speed limit prior to beginning work

Offset the beginning and ending points of the edge lines relative to each travel lane in the Taper / Transition Area by 10 feet. These offsets will provide increased maneuverability for motorists at the Point of Bifurcation and the End Point of the Transition Area by increasing the lane width at these locations and throughout the length of the Taper / Transition Area.

A. Pavement Markings -

- a) **Edge Lines (Inside Edge Lines)** - End the 12 inch white solid (center) line / begin two (2) 6 inch white solid (center) lines at the Point of Bifurcation of the right and left travel lanes.

- 1) **Right Travel Lane** - Install a 6 inch white solid line to the left edge of the right travel lane from the Point of Bifurcation for a distance of 500 feet. At the 500 foot distance location, end the 6 inch white solid edge line / begin a 6 inch yellow solid edge line. This 6 inch yellow solid edge line will continue through the remaining distance of the Taper / Transition Area to connect to the 6 inch yellow solid left edge line of the relocated right travel lane 10 feet in advance of the End Point of the Transition Area.

Supplement the 6 inch white solid line with 4" x 4" temporary clear raised pavement markers installed at spacing intervals of 10 feet.

Supplement the 6 inch yellow solid line with 4" x 4" temporary yellow raised pavement markers installed at spacing intervals of 10 feet.

- 2) **Left Travel Lane** - Install a 6 inch white solid line to the right edge of the left travel lane from the Point of Bifurcation for the entire distance of the Taper / Transition Area to connect to the 6 inch white solid right edge line of the relocated left travel lane at the End Point of the Transition Area.

Supplement this 6 inch white solid line with 4" x 4" temporary clear raised pavement markers installed at spacing intervals of 10 feet.

- b) **Edge Lines (Outside Edge Lines)** -

- 1) **Right Travel Lane** - Continue a 6 inch white solid line on the right edge of this travel lane from the Approach Area throughout complete length of the Taper / Transition Area. Install this 6 inch white solid line from 10 feet downstream from the Point of Bifurcation to connect to the 6 inch white solid right edge line of the relocated right travel lane at the End Point of the Transition Area.

- 2) **Left Travel Lane** - Continue a 6 inch yellow solid edge line on the left edge of this travel lane from the Approach Area throughout complete length of the Taper / Transition Area. Install this 6 inch yellow solid line from 10 feet in advance of the Point of Bifurcation to connect to the 6 inch yellow solid left edge line of the relocated left travel lane 10 feet in advance of the End Point of the Transition Area.

B. Traffic Control Devices -

a) Inside Edge Lines (Right and Left Travel Lanes) -

1) Center Line(s) / Inside Edge Lines

(From the Point of Bifurcation to 150 feet downstream of the Point of Bifurcation) -

Do not install traffic control devices for supplementation of the Inside Edge Lines of the travel lanes in this area. (The only supplemental devices in this 150-foot long area will be the 4" x 4" temporary clear raised pavement markers installed adjacent to each edge line at spacing intervals of 10 feet.)

2) Center Line(s) / Inside Edge Lines

(From 150 feet downstream of the Point of Bifurcation to 450 feet downstream of the Point of Bifurcation) -

Install a single (1) line of 42" white temporary flexible delineator posts centered between the diverging 6 inch white solid center / inside edge lines at spacing intervals of 10 feet for the 300 foot distance.

3) Center Line(s) / Inside Edge Lines

(From 450 feet downstream of the Point of Bifurcation to the location the separation distance between the diverging Inside Edge Lines becomes 10 feet) -

Install 42" temporary flexible delineator posts adjacent to each edge line at spacing intervals of 10 feet. The color of each post and the relative retroreflective sheeting shall match the color of the adjacent edge line.

4) Center Line(s) / Inside Edge Lines

(From the location the separation distance between the diverging Inside Edge Lines becomes 10 feet to the End Point of the Transition Area) -

Install vertical panels adjacent to each edge line at spacing intervals of 25 feet.

b) Outside Edge Lines (Right and Left Travel Lanes) -

1) Right Travel Lane (Right Edge Line) -

From 10 feet downstream of the Point of Bifurcation to the point of encountering the temporary concrete barrier wall or the End Point of the Transition Area, whichever comes first, supplement this 6 inch white solid line with portable plastic drums installed at spacing intervals of 25 feet.

2) Left Travel Lane (Left Edge Line) -

From 10 feet in advance of the Point of Bifurcation to 10 feet in advance of the End Point of the Transition Area, supplement the 6 inch yellow solid line with vertical panels installed at spacing intervals of 50 feet.

3) Work Activity Area - Maintain no less than 200 feet of Buffer Space between 10 feet downstream of the End Point of the Transition Area and the beginning of the work area.

WORK ZONE TRAFFIC CONTROL DESIGN STANDARDS

PLANS DEVELOPMENT / CONSTRUCTION PHASES

1. Design and develop a Transportation Management Plan (TMP) for inclusion in all projects. The level of detail, content and scope of the TMP will vary from project to project based upon the type, size, complexity and duration of the project and the anticipated work zone impacts generated by the project. A TMP is required for all Federal-aid highway projects.
2. Specify and incorporate the Department's hourly restrictions for prohibition of lane closures on interstate, primary and secondary routes to minimize traffic delay resulting from lane closures, shoulder closures, temporary road closures, flagging operations or any reduction of highway capacity. See Engineering Directive Memorandum No. 32, "Hourly Restrictions for Lane Closures on Interstate and Primary Routes". The hourly restrictions utilized for prohibition of lane closures shall also apply to CASE I shoulder closures unless otherwise directed by the Department.
3. Specify maintenance of traffic strategies such as flagging operations, lane closures, shoulder closures, road closures with detours, pacing operations, etc.
4. Specify advance warning, regulatory, guidance and information signing plans in the Temporary Traffic Control plan (TTC) component of the TMP.
5. Maintain the legal posted regulatory and advisory speed limits of all roadways, including but not limited to interstate mainlines, multilane and two-lane two-way primary and secondary roads, collector-distributor facilities, ramps, etc., prior to the presence of a work zone or an unforeseen roadway hazard unless otherwise directed by the Department. Design and develop the Temporary Traffic Control plan (TTC), including but not limited to tapers, tangent and curve sections, reverse curves, etc. based upon the legal posted regulatory speed limit of the roadway prior to beginning the work. The Department will evaluate proposed temporary speed limit reductions submitted to the Department for review when temporary roadway alignments, roadway geometry and other factors such as rights-of-way limitations facilitate a design incorporating a speed limit reduction. However, the Department reserves the right to reject and/or require modifications to all proposed temporary speed limit reductions. Do not design the Temporary Traffic Control plan (TTC) based upon temporary reduced speed limits unless extensive evaluations and review have determined a Temporary Traffic Control plan (TTC) design incorporating the legal posted regulatory speed limit of the roadway prior to beginning the work is unfeasible and inadequate for construction requirements.
6. When designing and developing a Temporary Traffic Control plan (TTC) regarding intersections and interchanges, maintain all traffic movements, including but not limited to through, left and right turn movements and on-ramp and off-ramp movements, for the duration of the project unless otherwise approved by the Department. Reduction or removal of turn lanes at intersections and interchanges shall require approval by the Department. Design all aspects of the Temporary Traffic Control plan (TTC) to consider lane widths, shoulder widths, clear zones, curves and reverse curves, lane shifts, taper lengths, lane drops, stopping sight distance, buffer areas, placement of traffic control devices, etc. and to comply with the legal posted speed limit of the roadway prior to initiation of the project or beginning the work or the implementation of a reduced speed limit due to a previous road defect.
7. Restrict the maximum length of lane closures to 2 miles unless otherwise approved by the Department.

8. Consider project specific traffic queue thresholds when feasible. All traffic queue thresholds shall require approval by the Department.
9. When necessary to reduce an existing multiple lane roadway with an earth median to a temporary two-lane two-way facility without an earth median, design and develop the Temporary Traffic Control plan (TTC) to include installation of temporary concrete barrier wall for a positive separation of the two-lane two-way traffic. Omitting utilization of a positive separation of traffic with minimal deflection such as temporary concrete barrier wall when reducing an existing multiple lane roadway with an earth median to a temporary two-lane two-way facility is PROHIBITED.
10. During a separation of adjacent travel lanes / traffic split, closure of a travel lane within either of the separated / split travel lanes to conduct work activities shall require approval by the Department. A lane closure is defined as a channelization and relocation of traffic from the closed travel lane into the remaining adjacent travel lane(s) open to traffic. A detour is defined as a relocation of traffic from a roadway closed to traffic onto alternate routes and in many scenarios includes return of the relocated traffic to the closed roadway beyond the section of roadway closed to traffic. During a separation of adjacent travel lanes / traffic split, closure of a travel lane that requires redirection of traffic from the closed travel lane onto an alternative route is a detour and is considered unacceptable except during emergencies ONLY.
11. On low to intermediate speed primary and secondary routes with original travel lane widths of 11 feet or greater prior to beginning the work, the travel lane widths may be temporarily reduced by no more than 1 foot if deemed necessary unless otherwise approved by the Department.
12. On high speed primary and secondary routes, maintain minimum temporary travel lane widths of no less than 11 feet unless otherwise approved by the Department.
13. On interstate routes for mainline travel lanes, maintain minimum temporary travel lane widths of no less than 11 feet; maximum temporary travel lane widths no greater than 14 feet.
14. Specify minimum travel lane widths of 11 feet plus 2-foot shoulders adjacent to longitudinal barriers.
15. Specify a minimum roadway width of 26 feet on two-lane bridges during bridge staging unless otherwise approved by the Department. On all bridges, maintain minimum lane widths of 11 feet with 2 foot shoulders on each side of the travel way.
16. Minimize shoulder width reductions. On roadways with paved shoulders, maintain a minimum total width of paved shoulder area no less than 5 feet wide with a minimum 3-foot / 2-foot split between each paved shoulder; provide a minimum width of 2 feet of paved shoulder on one side of the travel way with a minimum width of 3 feet of paved shoulder on the other side of the travel way. On bridge structures, maintain a minimum total width of shoulder area no less than 4 feet wide with a 2-foot / 2-foot split between each shoulder; provide no less than 2 feet of shoulder width on each side of the travel way.
17. Consider upgrading and/or widening shoulders if considered feasible to facilitate traffic movement.

18. During concrete paving operations for roadway travel lanes, provide clear zones no less than 3 feet wide immediately adjacent to and on each side of the lane(s) being paved for a concrete slipform type paving machine to encroach upon. Proposed reduction of the minimum 3 foot clear zone SHALL require submittal of the proposed paving process to the State Pavement Design Engineer for review. If approved by the State Pavement Design Engineer, provide written notification of the approval and the Temporary Traffic Control plan incorporating the reduced clear zone to the State Traffic Design Engineer for review.
19. During most work operations, grade elevation differences of 2 inches or less are considered acceptable to exist between and/or adjacent to travel lanes open to traffic unless otherwise directed by the Department.
20. During surface planing and milling operations, grade elevation differences greater than 1 inch in areas with pavements composed of hot mixed asphalt (HMA) base courses, intermediate courses or surface courses and Portland cement concrete are prohibited unless otherwise directed by the Department.
21. During surface planing and milling operations for removal of Open-Graded Friction courses ONLY, a grade elevation difference of 1 ½ inches between adjacent travel lanes opened to traffic may exist unless otherwise directed by the Department.
22. In areas not protected by the presence of longitudinal barrier wall(s) or guardrail, grade elevation differences or drop-offs greater than 2 inches adjacent to traffic or a travel lane open to traffic are prohibited during times when the Contractor is not present and actively conducting work activities directly related to and in the immediate vicinity of the grade elevation difference. Eliminate grade elevation differences or drop-offs greater than those specified as acceptable prior to the end of each workday by placement of an approved material next to a travel lane open to traffic at a 6:1 slope or implementation of other acceptable procedures for elimination of a grade elevation difference as approved by the Department. Observe all restrictions regarding grade elevation differences, lane closures and shoulder closures through development of a functional construction schedule.
23. Grade elevation differences and drop-offs 18 inches or greater or any grade elevation differences and drop-offs that cannot be eliminated with placement of a 6:1 slope prior to the end of each workday or any grade elevation differences limited to a finite and specific location are considered excavations. Minimize the presence of open excavations within the clear zone on all roadways. Open excavations in areas where the adjacent travel lane open to traffic is separated from the open excavation by the presence of guardrail or concrete barrier wall or similar device are acceptable unless otherwise directed by the Department. An excavation may remain open during those times the Contractor is present and actively conducting work activities directly related to and in the immediate vicinity of the excavation, however, the requirement for a shoulder closure or lane closure will be dependent upon the distance of the work activities from the near edge of the adjacent travel lane. Also, provide protective covers, metal plates capable of sustaining vehicular traffic, for excavations (i.e. catch basins) considered susceptible to contact with errant vehicles.
24. Structures are those items that protrude above the adjacent and/or surrounding surface area. Some structures may support vehicular traffic. Some structures may pose as an obstacle and potential hazard to vehicular traffic.

25. On roadways with posted speed limits of 45 mph or less, delineate each excavation and/or structure within 15 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.
26. On roadways with posted speed limits of 50 mph or greater, delineate each excavation and/or structure within 30 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.
27. On interstate highways, excavations and structures are prohibited within 10 feet or less of the near edge of an adjacent travel lane without the presence of guardrail or concrete barrier wall or a similar device to separate the feature from the adjacent travel lane.
28. When placing temporary concrete barrier wall on a bridge deck to provide a temporary railing, anchor the barrier wall to the bridge deck to minimize the potential for displacement of the barrier wall that could render the barrier wall ineffective. Anchor the barrier wall to the bridge deck when there is 8 feet or less of bridge deck area between the face of the barrier wall nearest the edge of the bridge deck and the edge of the bridge deck. However, anchorage of the barrier wall is not required when the barrier wall is in a location with more than 8 feet of bridge deck area between the face of the barrier wall nearest the edge of the bridge deck and the edge of the bridge deck unless site specific conditions warrant otherwise.
29. When "bolt through the deck method" anchorage of temporary concrete barrier walls on a bridge deck with a deck thickness less than 14 inches is required, ensure the location of wall will allow for the "bolt through the deck method". The presence of bridge beams and similar features in these areas may prevent proper access to permit the "bolt through the deck method" as specified in the *SCDOT Standard Drawings*.
30. When establishment of detour routes are necessary, select roads with structure and geometry capable of safely sustaining the type and amount of detour traffic intended for the detour routes. Ensure the detour routes have adequate sight distance at intersections, no bridges with posted weight limitations, adequate travel lane widths to accommodate the detoured traffic and adequate pavement surface and pavement markings. Also, consider factors such as school locations, emergency service access, areas of reduced speed limits, intersection geometry and traffic control at intersections. When feasible, specify improvements to the detour routes.
31. Utilize the type and quantity of temporary pavement markings to ensure proper functionality of the temporary pavement markings throughout the duration of the project. At a minimum, provide a sufficient quantity of temporary pavement markings to ensure application of the pavement markings to the entire pavement marking scheme at the beginning of the project and at the beginning of each traffic control stage or phase. Based on time duration of each stage or phase, reapplication of the temporary pavement markings may be required prior to completion of a construction stage or phase. When utilizing the standard temporary pavement marking, waterborne fast dry paint (15 mils), provide sufficient quantities of temporary pavement markings for reapplication at time intervals not greater than 90 days during any single stage or phase due to wear resulting from traffic and construction activities.
32. On high volume high speed roadways such as interstate highways, apply more durable pavement markings such as temporary thermoplastic on an asphalt pavement course or temporary epoxy on a concrete pavement course during traffic control stages or phases that will last 4 to 6 months or longer.
33. Utilize temporary raised pavement markers unless otherwise directed by the Department. At a minimum, provide a sufficient quantity of temporary raised pavement markers to ensure

application of the temporary raised pavement markers to the entire pavement marking scheme at the beginning of the project and at the beginning of each traffic control stage or phase. Based on time duration of each stage or phase, reapplication of the temporary raised pavement markers may be required prior to completion of a construction stage or phase.

34. When traffic congestion is a concern, specify alternate routes for through traffic when alternate routes are available and are viable alternatives. When feasible, specify improvements to alternate routes to include but not limited to installation of signing, temporary traffic signals, application of new pavement markings and raised pavement markers and roadway surface repair or resurfacing prior to beginning the work.
35. Coordinate with local and regional transportation planning organizations, local government authorities, law enforcement, emergency services, businesses, schools, regional associations and utilities impacted by the work.
36. Coordinate with law enforcement regarding enforcement of all traffic laws within the project site and to provide assistance with pacing operations and temporary road closures.
37. Plan to utilize work zone intelligent transportation systems (WZITS) technologies to provide motorists with current information regarding traffic delays, lane closures and alternate routing that may improve the efficiency of traffic movement(s) through work zones on high volume high speed roadways and Significant projects.
38. Consider roadside assistance services within project limits on high volume high speed roadways.
39. Consider wrecker services within project limits on high volume high speed roadways with limited shoulder areas for disabled vehicles to utilize.
40. Utilize various media outlets for distribution of information. Consider social media as well. Plan and organize methods to ensure provisions of accurate and timely updates of travel conditions and work activities.

WORK SITE FEATURES / FIELD CONDITIONS

Grade Elevation Differences / Drop-offs, Excavations & Structures

Work site and field conditions will impact the work zone requirements. Those conditions referenced in this section are grade elevation differences / drop-offs, excavations and structures.

GRADE ELEVATION DIFFERENCES / DROP-OFFS

Grade elevation differences / drop-offs are differences of elevation less than 18 inches. Differences of elevation of 18 inches and greater are considered excavations.

Grade elevation differences / drop-offs, from here on referred to as grade elevation differences, typically occur longitudinally along the roadway between or adjacent to travel lanes, adjacent to the edge of pavement or within the shoulder area in close proximity of a roadway.

The Department stipulates various processes, procedures and methods for dealing with grade elevation differences. Acceptable grade elevation differences may exist adjacent to a travel lane open to traffic and unacceptable grade elevation differences require closure of the adjacent travel lane for as long as the unacceptable grade elevation difference remains. Not only does the extent of the grade elevation difference impact the requirements for dealing with the condition, but also the specific work activity.

Basic Field Requirements -

On multilane facilities, minimize acceptable grade elevation differences between and/or adjacent to travel lanes open to traffic to no more than one (1) in the same direction unless otherwise directed by the RCE.

Acceptable grade elevation differences may remain in place for a time period up to but not greater than 72 hours from the time the work creates the grade elevation difference in any specific location unless otherwise directed by the RCE. Begin procedures to eliminate an acceptable grade elevation difference within 72 hours or less of creation of the grade elevation difference in any specific location unless otherwise approved by the RCE.

The presence of an acceptable grade elevation difference between or adjacent to the travel lanes of an interstate highway shall not encroach upon holiday periods unless otherwise approved by the RCE. Eliminate all grade elevation differences between or adjacent to the travel lanes of an interstate highway prior to entering a restricted holiday time period unless otherwise approved by the RCE.

Observe all restrictions regarding grade elevation differences, including lane closure and shoulder closure hourly prohibition restrictions, by maintaining an approved construction schedule. The Contractor shall obtain the RCE's approval of the schedule for all paving, surface planing, milling, grading or any similar operations that will generate a grade elevation difference before beginning the work.

Paving Operations -

Grade elevation differences shall not exceed 2 inches between and/or adjacent to travel lanes open to traffic during paving operations unless otherwise directed by the Department. Consider grade elevation differences of 2 inches or less created by paving operations between and/or adjacent to travel lanes open to traffic acceptable and subject to all restrictions regarding acceptable grade elevation differences.

Surface Planing and Milling Operations -

Grade elevation differences between and/or adjacent to travel lanes open to traffic during surface planing and milling operations shall comply with the following requirements:

Asphalt Base Course, Intermediate Course, Surface Course and Portland Cement Concrete -

Grade elevation differences shall not exceed 1 inch between and/or adjacent to travel lanes open to traffic on roadways with pavements composed of asphalt base courses, intermediate courses or surface courses and Portland cement concrete during surface planing and milling operations unless otherwise approved by the RCE.

Open-Graded Friction Course -

During removal of Open-Graded Friction courses ONLY, consider grade elevation differences of 1½ inches or less existing between and/or adjacent to travel lanes open to traffic acceptable unless otherwise directed by the Department. The 1½ inch grade elevation difference restriction ONLY applies to milling or surface planing operations for the removal of an Open-Grade Friction Course; the 1-inch restriction applies to all other pavements.

Beveling Pavement Edges (ALL Pavements) -

Grade elevation differences may extend up to 3 inches when the Contractor uses a beveling process approved by the RCE to eliminate the 90 degree vertical pavement edge generated by surface planing and milling operations. The beveling process SHALL replace the 90 degree vertical pavement edge with a 1:1 or flatter slope (no greater than 45 degrees).

The Contractor SHALL coordinate with the RCE for a proposed beveling process prior to conducting any work that will exceed the grade elevation difference restrictions regarding each pavement type as specified.

The Department will consider and evaluate proposals for a beveling process during surface planing and milling operations ONLY.

The Contractor SHALL conduct a Field Test of the proposed beveling process. Conduct the Field Test as directed by the RCE. The RCE will determine acceptability and approval of the proposed beveling process based upon evaluation of the Field Test.

SPECIAL NOTE:

Proposal to implement a beveling process during the design and plan development process does NOT ensure acceptance of the procedure by the RCE. ONLY successful field testing of the beveling process will aid the acceptance and approval process.

Grading Operations -

The Department prohibits grade elevation differences greater than 2 inches between the edge of pavement of a travel lane open to traffic and the earth shoulder immediately adjacent to the pavement edge during times when the Contractor is not present and actively conducting work activities directly related to and in the immediate vicinity of the grade elevation difference.

Eliminate all grade elevation differences greater than those specified by the Department as acceptable prior to the end of each workday / work shift unless otherwise directed by the RCE. Procedures for elimination of a grade elevation difference immediately adjacent to the edge of pavement of a travel lane open to traffic, including placement of an approved material next to the pavement edge at a 6:1 slope, shall comply with all Department specifications and shall require approval by the RCE prior to conducting work that will generate a grade elevation difference.

Grade Elevation Differences / Drop-offs per Road Types -

Road types and specific locations of grade elevation differences / drop-offs determine the acceptable options for dealing with the conditions as follows:

Two-Lane Two-Way Multilane Primary and Secondary Routes -

Travel Lanes -

For all requirements regarding grade elevation differences specific to the travel lanes of primary and secondary routes, see the sections above entitled, **Paving Operations** and **Surface Planing and Milling Operations**.

Shoulders -

Earth Shoulders –

Typically, the earth shoulder is immediately adjacent to a travel lane. However, in those areas with a supplemental additional 2 feet of pavement to create a 2-foot paved shoulder for safety purposes, this section will also apply to the earth shoulder immediately adjacent to the 2-foot wide paved shoulder. The requirements of this section, **Earth Shoulders**, shall apply to specified areas of the shoulders as follows:

- within 6 feet of an adjacent travel lane open to traffic in a shoulder area wider than 6 feet
- between the beginning of the front slope of an adjacent ditch and the near edge of a travel lane where the near edge of the front slope of the adjacent ditch is within 6 feet or less of the near edge of the travel lane.

Eliminate any grade elevation difference greater than 2 inches adjacent to the edge of pavement by excavating the earth or by placing a material approved the RCE next to the travel lane open to traffic to a 6:1 or flatter slope unless otherwise directed by the Department prior to the end of each workday / work shift. Adjustments to these requirements may be necessary due to field conditions when approved by the RCE.

An acceptable grade elevation difference of 2 inches or less may exist within the earth shoulder area adjacent to a travel lane open to traffic without the presence of a standard lane closure or shoulder closure.

When a grade elevation difference greater than 2 inches is present within the earth shoulder areas, as specified above, the adjacent travel lane may remain open to traffic

provided the area is supplemented with a standard shoulder closer maintained in compliance with the *SCDOT Standard Drawings* and the Contractor is present and actively conducting work activities directly related to and in the immediate vicinity of the grade elevation difference. The Department prohibits a grade elevation difference greater than 2" adjacent to or within 6 feet of a travel lane open to traffic unless otherwise directed by the RCE.

A temporary grade elevation difference of 3 inches or less may exist immediately adjacent to the edge of pavement in strict accordance with the supplemental specification "Correcting Low Shoulder Conditions" dated August 1, 2014 during standard roadway resurfacing work or similar types of work on primary and secondary roadways ONLY, i.e. Federal-Aid Resurfacing projects. This temporary 3-inch grade elevation difference is unacceptable for all other types of work unless specifically approved by the Director of Traffic Engineering.

During any work operations, i.e. grading operations, that may create a grade elevation difference greater than 2 inches within 6 feet of an adjacent travel lane, provide for the safe movement of traffic by excavating the earth or by placing a material approved the RCE next to the travel lane open to traffic to a 6:1 or flatter slope unless otherwise directed by the Department prior to the end of each workday / work shift.

Paved Shoulders –

The paved shoulder specified here is a paved shoulder wider than the 2-foot wide paved shoulder installed for safety. The requirements of this section, **Paved Shoulders**, shall apply to those specific locations of the shoulder area as follows:

- within the surface area of the paved shoulder and/or within 10 feet or less of the adjacent travel lane when a paved shoulder wider than the 2-foot wide paved shoulder installed for safety is present
- between the pavement edge of a paved shoulder and the near edge of the front slope of an adjacent ditch when the near edge of the front slope of the adjacent ditch is within 10 feet or less of the near edge of the travel lane.

Eliminate any grade elevation difference greater than 2 inches adjacent to the edge of pavement of a paved shoulder by excavating the earth or by placing a material approved the RCE next to the edge of pavement to a 6:1 or flatter slope unless otherwise directed by the Department prior to the end of each workday / work shift. Adjustments to these requirements may be necessary due to field conditions when approved by the RCE.

An acceptable grade elevation difference of 2 inches or less may exist adjacent to the pavement edge of a paved shoulder area without the presence of a standard lane closure or shoulder closure.

When a grade elevation difference greater than 2 inches is present adjacent to the pavement edge of a paved shoulder, the adjacent travel lane may remain open to traffic provided the shoulder area is closed to traffic with a standard shoulder closer maintained in compliance with the *SCDOT Standard Drawings*.

Interstate Routes -

Travel Lanes -

For all requirements regarding grade elevation differences specific to the travel lanes of interstate routes, see the sections above entitled, **Paving Operations** and **Surface Planing and Milling Operations**.

Right Shoulder -

During paving operations and grading operations, an acceptable grade elevation difference of 2 inches or less may exist within or adjacent to the right paved shoulder without the presence of a standard lane closure or shoulder closure. Consider grade elevation differences of 2 inches or less created by paving operations and grading operations acceptable to exist within the right shoulder area adjacent to a travel lane open to traffic.

During paving operations within a right paved shoulder 10 feet wide or less, grade elevation differences greater than 2 inches but less than or equal to 3 inches may exist within the paved shoulder under the following scenarios and relative requirements unless otherwise approved by the RCE:

- Close the right shoulder with a standard shoulder closure maintained in compliance with all shoulder closure prohibition restrictions and the *SCDOT Standard Drawings*.
 - ❖ Begin procedures to eliminate the grade elevation difference within 72 hours or less of creation of the grade elevation difference and in accordance with all specifications and as approved by the RCE. However, the shoulder closure prohibition restrictions shall take precedence over the 72 hour restriction thereby reducing the 72 hours to a period of time compliant with the shoulder closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with all specifications and as approved by the RCE.

During surface planing and milling operations, an acceptable grade elevation difference of 1 inch or less may exist within a right paved shoulder with a pavement composed of an asphalt base course, an intermediate course or a surface course or a Portland cement concrete without the presence of a standard lane closure or shoulder closure. Consider these grade elevation differences of 1 inch or less created by surface planing and milling operations acceptable to exist within the right paved shoulder area adjacent to a travel lane open to traffic.

During surface planing and milling operations for removal of Open-Graded Friction courses ONLY, an acceptable grade elevation difference of 1½ inches or less may exist within a right paved shoulder without the presence of a standard lane closure or shoulder closure. Consider these grade elevation differences of 1½ inches or less created by surface planing and milling operations for removal of Open-Graded Friction courses ONLY acceptable within the right paved shoulder area adjacent to a travel lane open to traffic.

During surface planing and milling operations within a right paved shoulder 10 feet wide or less, grade elevation differences with a 90 degree vertical edge created by the work may exceed the 1 inch and 1½ inches restrictions relative to the pavement types as specified above but less than or equal to 3 inches within the paved shoulder under the following scenarios and relative requirements unless otherwise approved by the RCE:

- Close the right shoulder with a standard shoulder closure maintained in compliance with all shoulder closure prohibition restrictions and the *SCDOT Standard Drawings*.
 - ❖ Begin procedures to eliminate the grade elevation difference within 72 hours or less of creation of the grade elevation difference and in accordance with all specifications and as approved by the RCE. However, the shoulder closure prohibition restrictions shall take precedence over the 72 hour restriction thereby reducing the 72 hours to a period of time compliant with the shoulder closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with all specifications and as approved by the RCE.

During surface planing and milling operations within a right paved shoulder 10 feet wide or less, grade elevation differences may extend up to 3 inches when the Contractor uses a beveling process approved by the RCE to eliminate the 90 degree vertical pavement edge generated by surface planing and milling operations. The beveling process SHALL replace the 90 degree vertical pavement edge with a 1:1 or flatter slope (no greater than 45 degrees). For all requirements regarding the beveling process, see the section above entitled, **Beveling Pavement Edges (ALL Pavements)**.

A grade elevation difference greater than 3 inches may exist within a right paved shoulder 10 feet wide or less in accordance with either of the following scenarios and relative requirements:

- Close the adjacent travel lane with a standard lane closure maintained in compliance with all lane closure prohibition restrictions and the *SCDOT Standard Drawings*.
 - ❖ Begin procedures to eliminate the grade elevation difference within 72 hours or less of creation of the grade elevation difference and in accordance with all specifications and as approved by the RCE. However, lane closure prohibition restrictions shall take precedence over the 72 hour restriction thereby reducing the 72 hours to a period of time compliant with the lane closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with all specifications and as approved by the RCE.

A grade elevation difference greater than 3 inches is permitted beyond 10 feet but within 15 feet of the near edge of an adjacent travel lane open to traffic in areas without w-beam or thrie-beam semi-rigid guardrail in accordance with either of the following scenarios and relative requirements:

- Delineate the shoulder area with portable plastic drums installed at intervals of 50 feet adjacent to and for the entire length or area where this grade elevation difference exists. Install these portable plastic drums immediately adjacent to the grade elevation difference to minimize impact upon the shoulder and traffic in the adjacent travel lane. Install the advance warning sign array required for a Case I shoulder closure. A truck mounted attenuator is not required for this installation. The RCE may waive the shoulder closure prohibition restrictions in this scenario.
 - ❖ Eliminate the grade elevation difference within 14 days of creation of the grade elevation difference and in accordance with all specifications and as approved by the RCE. However, when RCE elects to maintain the shoulder closure prohibition restrictions, the shoulder closure prohibition restrictions shall take precedence over the 14 day restriction thereby reducing the 14 days to a period of time compliant with the shoulder closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with all specifications and as approved by the RCE.

Assess and treat those grade elevation differences greater than 3 inches beyond 15 feet but within 30 feet of the near edge of an adjacent travel lane open to traffic in areas without w-beam or thrie-beam semi-rigid guardrail on a case by case basis as determined by the RCE. See the section entitled **Excavations** for all requirements regarding grade elevation differences and drop-offs of 18 inches or greater.

Left Shoulder / Median -

During paving operations and grading operations, an acceptable grade elevation difference of 2 inches or less may exist within or adjacent to a left paved and/or earth shoulder without the presence of a standard lane closure or shoulder closure. Consider these grade elevation differences of 2 inches or less created by paving operations and grading operations acceptable and may exist within the left shoulder area adjacent to a travel lane open to traffic.

During paving operations within a left paved shoulder 10 feet wide or less, grade elevation differences greater than 2 inches but less than or equal to 3 inches may exist within the paved shoulder under the following scenarios and relative requirements unless otherwise approved by the RCE:

- Close the left shoulder with a standard shoulder closure maintained in compliance with all shoulder closure prohibition restrictions and the *SCDOT Standard Drawings*.
 - ❖ Begin procedures to eliminate the grade elevation difference within 72 hours or less of creation of the grade elevation difference and in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE. However, the shoulder closure prohibition restrictions shall take precedence over the 72 hour restriction thereby reducing the 72 hours to a period of time compliant with the shoulder closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from the traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE.

During surface planing and milling operations, an acceptable grade elevation difference of 1 inch or less may exist within a left paved shoulder with a pavement composed of an asphalt base course, an intermediate course or a surface course or a Portland cement concrete without the presence of a standard lane closure or shoulder closure. Consider these grade elevation differences of 1 inch or less created by surface planing and milling operations acceptable and may exist within the left paved shoulder area adjacent to a travel lane open to traffic.

During surface planing and milling operations for removal of Open-Graded Friction courses ONLY, an acceptable grade elevation difference of 1½ inches or less may exist within a left paved shoulder without the presence of a standard lane closure or shoulder closure. Consider grade elevation differences of 1½ inches or less created by surface planing and milling operations for removal of Open-Graded Friction courses ONLY acceptable and may exist within the left paved shoulder area adjacent to a travel lane open to traffic.

During surface planing and milling operations within a left paved shoulder 10 feet wide or less, grade elevation differences with a 90 degree vertical edge created by the work may exceed the 1 inch and 1½ inches restrictions relative to the pavement types as specified above but less than or equal to 3 inches within the paved shoulder under the following scenarios and relative requirements unless otherwise approved by the RCE:

- Close the left shoulder with a standard shoulder closure maintained in compliance with all shoulder closure prohibition restrictions and the *SCDOT Standard Drawings*.
 - ❖ Begin procedures to eliminate the grade elevation difference within 72 hours or less of creation of the grade elevation difference and in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE. However, the shoulder closure prohibition restrictions shall take precedence over the 72 hour restriction thereby reducing the 72 hours to a period of time compliant with the shoulder closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from the traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE.

During surface planing and milling operations within a left paved shoulder 10 feet wide or less, grade elevation differences may extend up to 3 inches when the Contractor uses a beveling process approved by the RCE to eliminate the 90 degree vertical pavement edge generated by surface planing and milling operations. The beveling process SHALL replace the 90 degree vertical pavement edge with a 1:1 or flatter slope (no greater than 45 degrees). For all requirements regarding the beveling process, see the section above entitled, **Beveling Pavement Edges (ALL Pavements)**.

A grade elevation difference greater than 3 inches may exist within or adjacent to a left paved and/or earth shoulder and/or within 10 feet of the adjacent travel lane (including the opposing travel lane) in accordance with either of the following scenarios and relative requirements:

- Close the adjacent travel lane (including the opposing travel lane when within 10 feet of the grade elevation difference) with a standard lane closure maintained in compliance with all lane closure prohibition restrictions and the *SCDOT Standard Drawings*.
 - ❖ Begin procedures to eliminate the grade elevation difference within 72 hours or less of creation of the grade elevation difference and in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE. However, lane closure prohibition restrictions shall take precedence over the 72 hour restriction thereby reducing the 72 hours to a period of time compliant with the lane closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from the traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE.

During any work operations, i.e. grading operations, that may create a grade elevation difference greater than 2 inches adjacent to the edge of pavement of the left paved shoulder, provide for the safe movement of traffic by excavating the earth or by placing a material approved the RCE next to the pavement edge of the left paved shoulder to a 6:1 or flatter slope unless otherwise directed by the Department prior to the end of each workday / work shift. In the event the contractor is unable or elects not to place a 6:1 or flatter slope adjacent to the edge of pavement of the left paved shoulder, then the contractor shall comply with either of the following scenarios and relative requirements:

- Close the adjacent travel lane (including the opposing travel lane when within 10 feet of the grade elevation difference) with a standard lane closure maintained in compliance with all lane closure prohibition restrictions and the *SCDOT Standard Drawings*.
 - ❖ Begin procedures to eliminate the grade elevation difference within 72 hours or less of creation of the grade elevation difference and in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE. However, lane closure prohibition restrictions shall take precedence over the 72 hour restriction thereby reducing the 72 hours to a period of time compliant with the lane closure prohibition restrictions.
- Install temporary concrete barrier wall in accordance with the *SCDOT Standard Drawings* to provide a positive protection of the grade elevation difference from the traffic in the adjacent travel lane.
 - ❖ Eliminate the grade elevation difference in accordance with the requirements of these specifications, the special provisions, the Plans and the RCE.

Left Shoulder / Median with Cable Barrier -

A grade elevation difference greater than 2 inches is PROHIBITED between a cable barrier and an adjacent travel lane open to traffic. In the event a grade elevation greater than 2 inches must exist between the cable barrier and an adjacent travel lane, comply with the following scenarios and relative requirements:

- the cable barrier is within 15 feet or less of the near edge of the adjacent travel lane;
 - ❖ close the adjacent travel lane to traffic with a standard lane closure installed and maintained in compliance with the *SCDOT Standard Drawings*
- the cable barrier is within 30 feet but not less than 15 feet of the near edge of the adjacent travel lane;
 - ❖ close the adjacent shoulder to traffic with a standard shoulder closure installed and maintained in compliance with the *SCDOT Standard Drawings*.

EXCAVATIONS

Excavations are grade elevation differences and drop-offs 18 inches or greater or any grade elevation differences and drop-offs created by paving operations, surface planing and milling operations or grading operations that cannot be eliminated with placement of pavement or a 6:1 slope prior to the end of each workday / work shift. Typically, these features are limited to a finite and specific location.

Basic Field Requirements -

Minimize the presence of open excavations within the clear zone on all roadways. In locations where the presence of guardrail or concrete barrier wall or similar device separates an open excavation from an adjacent travel lane is acceptable unless otherwise determined by the RCE. An excavation may remain open during those times the Contractor is present and actively conducting work activities directly related to and in the immediate vicinity of an excavation.

The contractor shall provide protective covers, metal plates capable of sustaining vehicular traffic, for excavations (i.e. catch basins) the RCE may determine to be susceptible to contact with errant vehicles.

The requirement for a shoulder closure or lane closure is dependent upon the type of roadway and the distance of the excavation from the near edge of the adjacent travel lane and as directed by the RCE.

Excavations per Road Types -

Primary and Secondary Two-Lane Two-Way Roadways -

Shoulders -

On roadways with posted speed limits of 45 mph or less, delineate each excavation within 15 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

On roadways with posted speed limits of 50 mph or greater, delineate each excavation within 30 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

Primary and Secondary Multilane Roadways -

Right Shoulders -

On roadways with posted speed limits of 45 mph or less, delineate each excavation within 15 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

On roadways with posted speed limits of 50 mph or greater, delineate each excavation within 30 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

Left Shoulders -

Earth Median -

On roadways with posted speed limits of 45 mph or less, delineate each excavation within 15 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

On roadways with posted speed limits of 50 mph or greater, delineate each excavation within 30 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

Consider the clear zone of an opposing travel lane. All requirements regarding the clear zone also apply to the opposing travel lane when the excavation occurs within the clear zone of the opposing travel lane.

Paved Median -

Close the median area to traffic where an open excavation and work activities relative to the excavation are present and as directed by the RCE.

Interstate Routes -

Do not construct excavations within 10 feet or less of the near edge of an adjacent travel lane without the presence of guardrail or concrete barrier wall or similar device present to separate the excavation from the adjacent travel lane unless otherwise directed by the Department.

Right Shoulders -

Delineate each excavation beyond 10 feet but within 30 feet of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

Left Shoulders -

Delineate each excavation beyond 10 feet but within 30 feet of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the excavation from the adjacent travel lane.

Consider the clear zone of an opposing travel lane. All requirements regarding the clear zone also apply to the opposing travel lane when the excavation occurs within the clear zone of the opposing travel lane.

STRUCTURES

Structures, as specified in **Subsection 101.3.72 Structure** of the Standard Specifications, latest edition, are items that exist within or protrude above the adjacent and/or surrounding surface area that may support vehicular traffic and may pose as an obstacle to vehicular traffic. In areas where guardrail or concrete barrier wall or a similar device separates the structure from the adjacent travel lane, the structure does not require delineation unless otherwise determined necessary by the RCE.

Basic Field Requirements -

The requirement for a shoulder closure or lane closure is dependent upon the type of roadway and the distance of the excavation from the near edge of the adjacent travel lane and as directed by the RCE.

Structures per Road Types -

Primary and Secondary Two-Lane Two-Way Roadways -

Shoulders -

On roadways with posted speed limits of 45 mph or less, delineate each structure within 15 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the structure from the adjacent travel lane.

Primary and Secondary Multilane Roadways -

Right Shoulders -

On roadways with posted speed limits of 45 mph or less, delineate each structure within 15 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the structure from the adjacent travel lane.

On roadways with posted speed limits of 50 mph or greater, delineate each structure within 30 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the structure from the adjacent travel lane.

Left Shoulders -

Earth Median -

On roadways with posted speed limits of 45 mph or less, delineate each structure within 15 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the structure from the adjacent travel lane.

On roadways with posted speed limits of 50 mph or greater, delineate each structure within 30 feet or less of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the structure from the adjacent travel lane.

Consider the clear zone of an opposing travel lane. All requirements regarding the clear zone also apply to the opposing travel lane when the structure occurs within the clear zone of the opposing travel lane.

Paved Median -

Close the median area to traffic where a structure and work activities relative to the structure are present without the presence guardrail or concrete barrier wall or similar device to separate the structure from the adjacent travel lane.

Interstate Routes -

Do not construct structures within 10 feet or less of the near edge of an adjacent travel lane without the presence of guardrail or concrete barrier wall or similar device present to separate the structure from the adjacent travel lane unless otherwise directed by the Department.

Right Shoulders -

Delineate each structure beyond 10 feet but within 30 feet of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the structure from the adjacent travel lane.

Left Shoulders -

Delineate each structure beyond 10 feet but within 30 feet of the near edge of an adjacent travel lane with two or more 3-foot Type II barricades or four or more portable plastic drums in areas where no guardrail or concrete barrier wall or similar device is present to separate the structure from the adjacent travel lane.

Consider the clear zone of an opposing travel lane. All requirements regarding the clear zone also apply to the opposing travel lane when the structure occurs within the clear zone of the opposing travel lane.

ACCESS AREAS - INGRESS / EGRESS - MEDIAN WORK AREAS

Median work areas supplemented with temporary concrete barrier wall will require access areas specific to providing ingress to and egress from the work area. Construct, install, maintain and operate these access areas in accordance with Standard Drawing No. 605-425-00.

All construction vehicles designated and restricted to enter or exit a median or shoulder work area during the presence of active lane closures ONLY, SHALL continue to comply with those restrictions when utilizing these access areas. The Department will NOT consider construction of temporary pavement or utilization of permanent pavement areas as an "acceleration / deceleration lane" at these access areas to mitigate the requirement for active lane closures.

In addition to the requirements of Standard Drawing No. 605-425-00, construct and install access areas to median work areas in compliance with the following requirements and guidelines:

The primary requirements for each access area are as follows:

- 1) each access area shall provide ingress to and/or egress from a median work area to only one (1) direction of travel of the roadway
- 2) separate multiple access areas to the same direction of roadway travel by no less than one (1) mile where travel of construction vehicles and equipment within a median work area is not restricted
- 3) the location of each access area shall have no less than 1100 feet of stopping sight distance for approaching motorists measured from the beginning of the access area first encountered by an approaching motorist.

Individual access areas servicing different directions of roadway travel require separation. Locate, construct and install these access areas as follows:

- 1) the open areas, those areas without any traffic control devices or temporary concrete barrier wall through which the vehicles actually travel, of these access areas SHALL NOT overlap in any manner (the open areas SHALL NOT occupy the same Station number locations)
- 2) separate the open areas by no less than 500 feet (measure the minimum 500 foot interval between the openings from the downstream termini of each opening {end of barrier wall with a portable terminal impact attenuator})
- 3) these requirements regarding separation of open areas do NOT override the requirements for a one (1) mile separation between access areas servicing the same direction of travel.

Field conditions may restrict travel of construction vehicles and equipment. Such field conditions may include but are not limited to the presence of structures such as bridge columns / footings and roadway interchanges or water features such as creeks and rivers thereby generating multiple work sites detached from one another. Due to these restrictive field conditions, travel of construction vehicles from one work site to an adjacent work site is not possible without exiting the median work area and using the adjacent travel lane open to traffic. The Department may consider a reduction of the minimum one (1) mile separation relative to multiple work sites; however, the Department SHALL ONLY consider this reduction under the following conditions:

- 1) brevity of the work sites do not permit the one (1) mile separation between adjacent work sites
- 2) field conditions do not allow for the one (1) mile separation between ingress / egress areas of multiple work sites
- 3) field conditions limit the areas feasible for construction of ingress / egress areas that do not negatively impact traffic operations of the adjacent travel lane(s)
- 4) the contractor's activities or construction methods did NOT generate or create the restrictive field conditions that produced the multiple work sites

APPENDIX A

SEPARATION of ADJACENT TRAVEL LANES / TRAFFIC SPLIT

REFERENCES

WORK ZONE TRAFFIC CONTROL ENGINEER



SIGNATURE

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1		
0	B-01-16	JCS
#	DATE	CHK
		DESCRIPTION
		NEW DRAWING



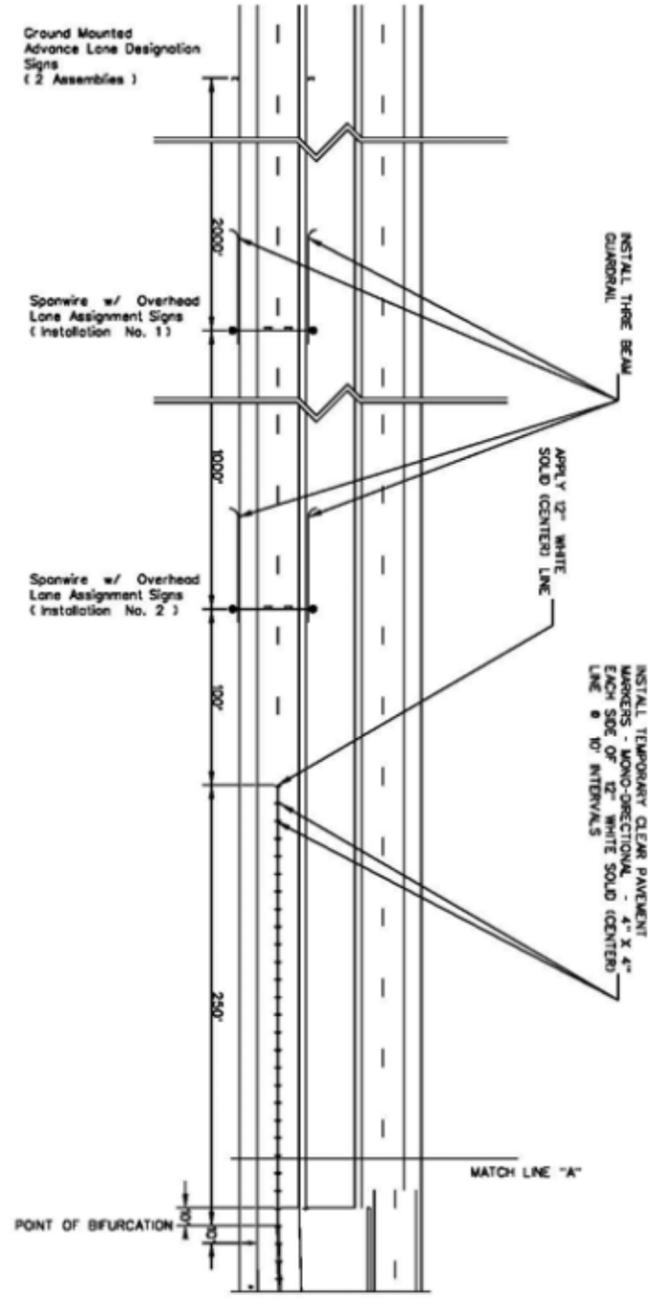
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
ROOM 405
COLUMBIA, SC 29201

STANDARD DRAWING

TRAFFIC SPLIT
SEPARATION OF
ADJACENT TRAVEL
LANES
APPROACH AREA

EFFECTIVE LETTING DATE

THIS DRAWING IS NOT TO SCALE



REFERENCES

WORK ZONE TRAFFIC CONTROL ENGINEER



SIGNATURE

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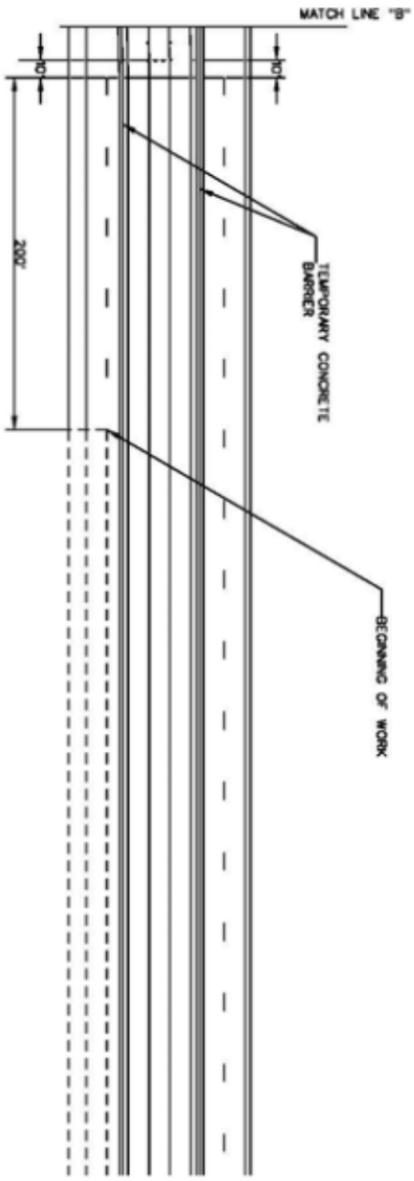
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
 DESIGN STANDARDS OFFICE
 955 PARK STREET
 ROOM 405
 COLUMBIA, SC 29201

STANDARD DRAWING

TRAFFIC SPLIT
 SEPARATION OF
 ADJACENT TRAVEL
 LANES
 WORK ACTIVITY
 AREA

EFFECTIVE LETTING DATE

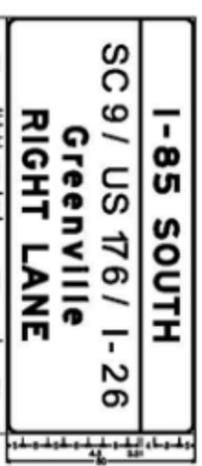
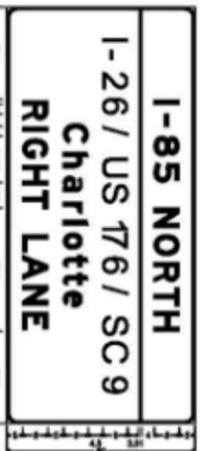
THIS DRAWING IS NOT TO SCALE



REFERENCES

GROUND MOUNTED ADVANCE LANE DESIGNATION SIGNS

1. FABRICATE ALL GROUND MOUNTED ADVANCE LANE DESIGNATION SIGNS IN COMPLIANCE WITH SECTION 651 OF THE STANDARD SPECIFICATIONS UNLESS OTHERWISE DIRECTED BY THE DEPARTMENT.
2. REFLECTORIZE ALL GROUND MOUNTED ADVANCE LANE DESIGNATION SIGNS WITH TYPE II MICROPRISMATIC RETROREFLECTIVE SHEETING.



WORK ZONE TRAFFIC CONTROL ENGINEER



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1	B-01-16	NEW DRAWING
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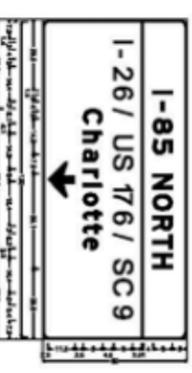
SOUTH CAROLINA DEPARTMENT OF TRANSPORTATION
DESIGN STANDARDS OFFICE
955 PARK STREET
COLUMBIA, SC 29201

STANDARD DRAWING
TRAFFIC SPLIT
SEPARATION OF ADJACENT TRAVEL LANES
ADVANCE LANE DESIGNATION / LANE ASSIGNMENT SIGNS

EFFECTIVE LETTING DATE

SPANWIRE SUSPENDED OVERHEAD LANE ASSIGNMENT SIGNS

1. FABRICATE ALL SPANWIRE SUSPENDED OVERHEAD LANE ASSIGNMENT SIGNS FROM ALUMINUM LAMINATED COMPOSITE MATERIAL SUBSTITUTES WITH THICKNESSES IN COMPLIANCE WITH THE STANDARD SPECIFICATIONS.
2. REFLECTORIZE ALL SPANWIRE SUSPENDED OVERHEAD LANE ASSIGNMENT SIGNS WITH TYPE XI MICROPRISMATIC RETROREFLECTIVE SHEETING.



THIS DRAWING IS NOT TO SCALE