

WORK ZONE TRAFFIC CONTROL PROCEDURES

WORK ZONE SETUP / REMOVAL

When installing a work zone, install the advance warning signs on all approaches prior to installing the traffic control devices. Perform removal of the traffic control devices and advance warning signs in the reverse sequence of installation. These methods will apply to all work zone traffic control procedures unless field conditions necessitate an alternate method. The following are typical installation scenarios.

Flagging Operations on Two-Lane Two-Way Roadways - Install the advance warning area (signs), the flagger station (flagger), the transition area (taper) and then the activity area (traffic control devices).

Lane Closures on Multilane Roadways - Install the advance warning area (signs), the transition area (taper) and then the activity area (traffic control devices).

Mobile Operations - When advance warning signs are used, install the advance warning signs prior to beginning the work.

FLAGGING OPERATIONS

A flagging operation is a stationary traffic control setup to temporarily control 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, an intermittent ramp closure or an intermittent encroachment of equipment onto a portion of the roadway. Conduct all flagging operations in accordance with this manual, the MUTCD and the SCDOT "Flagger's Handbook", latest edition.

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 directed by the District Engineering Administrator. Begin measurement of the time interval immediately upon the moment the Flagger rotates the Stop/Slow paddle to display the "Stop" condition to the approaching motorists. See *Table 8, Traffic Stopped Time Durations for Flagging Operations*.

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

If the work activities require traffic to be stopped for periods greater than 5 to 7 ½ minutes as stated above, consider conducting work activities during times of lowest traffic volumes such as during the hours of darkness, alternate work methods or complete road closure with detour installation.

Several of the key features relevant to flagging operations that each person responsible for the installation, maintenance and operation of flagging operations must be aware of are defined below:

Single Flagger Flagging Operation - A flagging operation controlled by one flagger. A “Single Flagger Flagging Operation” is restricted to low volume low speed to intermediate speed roadways during daytime hours ONLY. The “Work Activity Area” is restricted to a maximum distance of 200 feet. Station the flagger at a location no further than 200 feet from the first traffic control device in the Approach Taper and no further than 200 feet from the last traffic control device in the Downstream Taper furthest away from the Work Activity Area.

Multiple Flaggers Flagging Operation - A flagging operation controlled by two or more flaggers. Station the flagger controlling traffic operating in the travel lane closed to traffic, the Closed Lane Flagger, adjacent to the first traffic control device in the Approach Taper. Station the flagger controlling traffic in the travel lane that remains open to two-way traffic, the Open Lane Flagger, 100 feet beyond the last traffic control device in the Downstream Taper furthest away from the Work Activity Area.

Approach Taper - This is a one-lane two-way taper placed in the travel lane where the work activity takes place. This taper precedes the Buffer Space and the Work Activity Area. The length of this taper may vary from 50 feet to 100 feet. Install and maintain no less than five (5) traffic control devices equally spaced at 10-foot to 25-foot intervals as necessary to correspond with the length of the taper.

Downstream Taper - This taper, placed in the travel lane where the work activity is to take place, follows the Work Activity Area and serves as the termination area for the closure of the travel lane. The length of this taper may vary from 50 feet to 100 feet. Install and maintain no less than five (5) traffic control devices equally spaced at 10-foot to 25-foot intervals as necessary to correspond with the length of the taper.

Flagger Station - This is the specific location of the flagger.

Closed Lane Flagger - This flagger is stationed adjacent to the first traffic control device in the Approach Taper who controls the traffic that requires relocation from the travel lane being closed to traffic.

Open Lane Flagger - This flagger is stationed 100 feet beyond the last traffic control device in the Downstream Taper furthest away from the Work Activity Area who controls the traffic operating in the travel lane remaining open to traffic.

Side Road Flagger - This flagger is stationed on an intersecting Side Road and controls the side road traffic entering into the roadway where the Work Activity Area is located.

Buffer Space - This area is located between the downstream end of the Approach Taper and the nearest limits of the Work Activity Area and may provide some recovery space for an errant vehicle. The presence of personnel, tools, materials, equipment, work vehicles, etc. within the limits of the Buffer Space is PROHIBITED.

Work Activity Area - Personnel, materials, equipment, work vehicles, etc. are present within this area to conduct the work.

Limits of the Work Activity Area - This is the boundary of the Work Activity Area first encountered, from either direction, by motorists passing by the Work Activity Area in the adjacent travel lane open to traffic and controlled by the flaggers.

Approach Lane - Traffic approaches an intersection or a specific location in this travel lane.

Departure Lane - Traffic departs from an intersection or a specific location in this travel lane.

Mainline Approach - This is an approach to the Work Activity Area on the roadway where the Work Activity Area is located.

Side Road(s) - A road that intersects the roadway on which the Work Activity Area is located.

Limits of the Intersection (Physical Area of an Intersection) - The limits of or physical area within an intersection is defined by the location of stop bars when present. When stop bars are absent, the limits of or physical area within an intersection is defined by the location points where the corner radii between adjacent roadway approaches tie to the edge of pavement or the edge of travel lane adjacent to the edge of pavement of each roadway approach.

Always ensure the Flagger Station provides sufficient stopping sight distance for approaching traffic. For the stopping sight distance as determined by the **posted regulatory speed limit** of the roadway, see *Table 11, Stopping Sight Distance*.

Lane closures for flagging operations are restricted to a maximum distance of 2 miles unless otherwise approved by the District Engineering Administrator. Minimize the distance of the lane closure to only the area(s) where the work activities are to take place. However, an increased distance in addition to the actual Work Activity Area, not to exceed the 2 mile maximum length, may be included in the lane closure to provide adequate stopping sight distance of the Flagger Station to approaching motorists.

Conduct the work in such a manner so as not to encroach onto the adjacent travel lane open to traffic. Install, maintain and adjust the traffic control devices as necessary to ensure proper delineation of the work area.

In the event work that requires flagging operations is being conducted at two different locations at the same time, separate the two locations by no less than 2 miles from the last traffic control device in the Downstream Taper of the first lane closure to the first traffic control device in the Approach Taper of the second lane closure encountered by a motorist.

Equip each flagger with a 24" x 24" Stop/Slow paddle with 8 inch high letters mounted on a rigid handle with a minimum length of 7 feet. Do not use flags except during emergency situations.

Maintain two-way radio communications between all flaggers.

Nighttime Flagging Operations

Each flagger shall wear safety apparel in compliance with the requirements of *ANSI / ISEA 107 Standard Performance for Class 3 Exposure*, latest revision, when conducting nighttime flagging operations.

Illuminate each Flagger Station with any combination of portable lights, standard electric lights, existing street lights, etc. that will provide a minimum illumination level of 108 lux or 10 foot candles when conducting nighttime flagging operations.

Supplement each array of advance warning signs on each Mainline Approach with a trailer mounted changeable message sign. These changeable message signs are not required on the Side Roads intersecting the roadway where the Work Activity Area is located. Also, these changeable message signs are not required during daytime flagging operations. Install the changeable message signs in advance of the "Road Work Ahead" sign (W20-1-48-A) on each Mainline Approach in accordance with the spacing intervals based on the posted regulatory speed limit of the roadway prior to beginning any work. See *Table 3, Advance Warning Sign Placement Intervals for Typical 3 Advance Warning Sign Array*. The messages should be "Prepare To Stop", "Flagger Ahead". **A truck mounted changeable message sign is not an acceptable alternative to a trailer mounted changeable message sign during nighttime flagging operations.**

Utilize portable plastic drums or 42" oversized traffic cones during nighttime flagging operations. In the event that portable plastic drums or 42" oversized traffic cones are not utilized in a daytime flagging operation and the flagging operation extends into the nighttime hours, replace all 28" or 36" standard traffic cones with either portable plastic drums or 42" oversized traffic cones.

Reflectorize all portable plastic drums and all traffic cones with Type III or greater flexible microprismatic retroreflective sheeting unless otherwise directed by the SCDOT.

Buffer Space

The minimum distance requirements for the Buffer Space are based upon the legal posted regulatory speed limit of the roadway prior to beginning the work. See *Table 9, Minimum Distance Requirements for a Buffer Space in a Flagging Operation*.

Table 9 Minimum Distance Requirements for a Buffer Space in a Flagging Operation

SPEED LIMIT	DISTANCES
LOW SPEED 35 MPH or LESS	200 Feet
INTERMEDIATE SPEED 40 - 50 MPH	300 Feet
HIGH SPEED 55 MPH	400 Feet

The lengths of a Buffer Space indicated in *Table 9* are for normal conditions. Adjustments to increase the length of a Buffer Space may be necessary due to vertical and horizontal curves that may obstruct sight distance, driveways, intersecting roadways, etc. when approved by the SCDOT.

When using a truck mounted attenuator (TMA), the length of the Buffer Space is measured from the downstream end of the Approach Taper to the back of the TMA. When not using a TMA, the length of the Buffer Space is measured from the downstream end of the Approach Taper to the beginning of the Work Activity Area.

The presence of personnel, tools, materials, equipment, work vehicles, etc. within the limits of the Buffer Space is PROHIBITED.

Signs and Traffic Control Devices

Install and maintain the proper array of advance warning signs for each Mainline Approach of a flagging operation prior to initiation of the operation and remove or cover all signs immediately upon termination of the operation.

Measure all advance warning sign locations for each Mainline Approach from the location of the adjacent Flagger Station.

Install the advance warning signs at spacing intervals based on the posted regulatory speed limit of the roadway prior to beginning any work. See *Table 3, Advance Warning Sign Placement Intervals for a Typical 3 Advance Warning Sign Array*. The advance warning sign placement intervals indicated in *Table 3*, are for normal conditions. Adjustments to these distance intervals may be necessary due to existing signs, driveways, intersecting roadways, horizontal and/or vertical roadway alignments or other sight distance restrictions.

Always maintain the Flagger Station within 500 feet of the "Flagger" (W20-7-48) symbol sign of the array of advance warning signs.

Install advance warning signs mounted on portable sign supports no less than 4 feet from the near edge of the sign to the near edge of an adjacent travel lane on roadways with grass shoulders and no less than 6 feet from the near edge of the sign to the near edge of an adjacent travel lane on roadways with paved shoulders. When curb & gutter is present, install the sign no less than 2 feet from the near edge of the sign to the face of the curb.

During flagging operations, the minimum mounting height of ALL signs mounted 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.

When necessary to relocate the Flagger Station while actively maintaining the flagging operation, install an additional array of advance warning signs in advance of and relative to the location of the new Flagger Station immediately prior to relocating the flagger. Remove the array of advance warning signs in advance of the previous Flagger Station immediately upon completion of the relocation of the flagger to the new Flagger Station.

Utilize portable plastic drums or 42" oversized traffic cones during nighttime flagging operations. In the event that portable plastic drums or 42" oversized traffic cones are not utilized in a daytime flagging operation and the flagging operation extends into the nighttime hours, replace all 28" or 36" standard traffic cones with either portable plastic drums or 42" oversized traffic cones. Reflectorize all portable plastic drums and all traffic cones with Type III or greater flexible microprismatic retroreflective sheeting unless otherwise directed by the SCDOT.

Delineate the tangent area of the lane closure with the necessary traffic control devices to provide delineation of and to minimize encroachment by motorists into the closed travel lane. On roadways with posted regulatory speed limits of 35 MPH or less, install the traffic control devices at spacing intervals of 25 feet. On roadways with posted regulatory speed limits of 40 MPH or greater, install the traffic control devices at spacing intervals of 50 feet. These spacing intervals for the traffic control devices are based upon the posted regulatory speed limit of the roadway prior to beginning any work. See *Table 10, Traffic Control Device Spacing Intervals for Flagging Operations*.

Table 10 Traffic Control Device Spacing Intervals for Flagging Operations

SPEED LIMIT	SPACING INTERVALS
35 MPH or LESS	25 Feet
40 - 55 MPH	50 Feet

Advance Warning Arrow Panel

An advance warning arrow panel shall operate in the "Four Corners" caution mode when located within or between the limits of the advance warning sign arrays specific to a flagging operation. Operation of an advance warning arrow panel in an arrow, chevron or any other type of caution mode other than the "Four Corners" caution mode when located within or between the limits of the advance warning sign arrays as specified hereinbefore is PROHIBITED.

Truck Mounted Attenuator

A truck mounted attenuator is recommended but not required. However, when utilizing a truck mounted attenuator, locate the truck mounted attenuator approximately 100 feet in advance of the "Work Activity Area".

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 28" or 36" standard traffic cones are acceptable traffic control devices for daytime lane closure setups and 42" oversized traffic cones or portable plastic drums are the required traffic control devices for nighttime lane closure setups. **Standard traffic cones utilized during daytime lane closures on interstate roadways shall have a minimum height of 36 inches.**

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. Replace the standard traffic cones with 42" oversized traffic cones or portable plastic drums.

On low speed roadways, install and operate a trailer mounted advance warning arrow panel within the taper of a single lane closure. 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. Placement of the advance warning arrow panel at the start of the taper is preferred.

On intermediate to high speed primary and secondary roadways, installation and operation of two trailer mounted advance warning arrow panels within the taper of a single lane closure is recommended for improved visibility by the motorists. However, no less than one advance warning arrow panel within the taper of a single lane closure is required. When operating a single advance warning arrow panel, place the arrow panel on the roadway shoulder at the beginning of the taper. On roadways where the shoulders may be 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. Placement of the advance warning arrow panel at the start of the taper is preferred. When utilizing two advance warning arrow panels within the taper of a single lane closure, place one arrow panel on the roadway shoulder at the beginning of the taper and a second arrow panel 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. Placement of the first advance warning arrow panel at the start of the taper is preferred.

On interstate roadways, install and operate two trailer mounted advance warning arrow panels within the taper of a single lane closure. 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.

Install and operate two trailer mounted advance warning arrow panels within each taper of a dual lane closure on low, intermediate and high speed primary and secondary roadways. 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. However, where the shoulders are narrow or site conditions restrict the use of the shoulder areas adjacent to the beginning of the first taper of a dual lane closure, place the first advance warning arrow panel behind the channelizing devices of the first taper as close as practical to the beginning of the first taper. Placement of the first advance warning arrow panel at the start of the first taper of a dual lane closure is preferred.

Install and operate two trailer mounted advance warning arrow panels within each taper of a dual lane closure on interstate roadways. 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.

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 (150 feet where indicated on Low Speed roadways) 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 a 48-inch x 48-inch "Be Prepared To Stop" sign (W3-4-48) with a rigid sign substrate 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.

Determine if the required separation distance between lane closures is adequate by measuring from the end of the last traffic control device of the first closure that a motorist will encounter to the first traffic control device at the beginning of the taper of the second closure.

Restrict the length of a lane closure to a maximum distance of 2 miles unless otherwise directed by the District Engineering Administrator.

Do not install lane closures on high volume roadways with high volume commuter traffic during peak traffic periods unless otherwise directed by the District Engineering Administrator.

SHOULDER CLOSURES

A standard 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 standard 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 standard shoulder closure.

On primary and secondary roadways, standard shoulder closures may be necessary for work zones that may require 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 as prescribed by this manual.

On primary and secondary roadways, install standard 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 optional.

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, standard shoulder closures may be necessary for work zones that may require 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 as prescribed by this manual. The presence of personnel, tools, equipment, materials, vehicles, etc. within 10 feet or less of the near edge of an adjacent travel lane of an interstate roadway require closure of the adjacent travel lane except during specified maintenance performance activities with specific work zone traffic control setups provided for and prescribed by this manual.

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 optional.

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.

Advance warning arrow panels supplementing truck mounted attenuators when the truck mounted attenuators are utilized should function in the “4 Corners” Caution mode, however, when pedestrian workers are present within 15 feet of the near edge of the adjacent travel lane, operate the advance warning arrow panel in the appropriate Flashing Arrow mode.

When a grassed median area within 30 feet of a travel lane is occupied by a short term stationary or longer 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, 28” or 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.

MOBILIZED SHOULDER OPERATIONS

Mobilized shoulder operations are roadway shoulder area work zones with no more than one (1) single equipment unit that progress along the roadway at a slow pace and may require the equipment to encroach upon a travel lane or a paved shoulder to various degrees. The single equipment unit must be accompanied by a shadow vehicle when the stopping sight distance interval between the single equipment unit and an approaching motorist is unavailable based upon the posted regulatory speed limit of the roadway.

Consider mobilized shoulder operations for work activities that progress at speeds less than 3 mph, do not comply with the requirements for intermittent mobile operations and do not fully warrant closure of the adjacent travel lane.

Work activities that require more than one (1) single equipment unit, not including a shadow vehicle when one is necessary, do NOT comply with the requirements for mobilized shoulder operations. Therefore, conduct work activities that require more than one (1) single equipment unit under lane closures.

On two-lane two-way roadways, mobilized shoulder operations are unacceptable when the work activities require more than one (1) single equipment unit, not including a shadow vehicle when one is necessary, to conduct the work activities. Conduct these work activities under flagging operations.

Due to the mobility of these operations, the traffic control requirements are usually limited to the installation of advance warning sign assemblies for each approach that may be impacted by the work activities. Relocate the advance warning sign assemblies as necessary as the work zone is advanced along the roadway.

Utilize advance warning signs relative to the type of work activity being conducted. The various types of advance warning sign assemblies that may be utilized shall include the "Mowing" sign (W21-9-48) supplemented with the supplemental sign "Next 3 Miles" (W7-3a-42) for grass mowing operations. When pedestrian workers are present, the "Worker" sign (W21-1-48) is required. The "Worker" sign (W21-1-48) may be installed in addition to those signs relative to work activities that may not require pedestrian workers. For example, the "Worker" sign (W21-1-48) may be installed in addition to the "Mowing" sign (W21-9-48) when appropriate.

PRIMARY AND SECONDARY ROADWAYS -

Pedestrian Workers –

Pedestrian workers should remain beyond 1 foot of the near edge of an adjacent travel lane. However, when encroachment to within 1 foot of the near edge of the adjacent travel lane or upon the adjacent travel lane up to but no more than 2 feet by a pedestrian worker is necessary to conduct the work activities, do so in strict accordance with the requirements specified by this manual and those drawings that specifically designate acceptable locations for pedestrian workers.

On low speed roadways, speeds of 35 mph or less, pedestrian workers may encroach from the shoulder area to within 1 foot of the near edge of the adjacent travel lane or onto the adjacent travel lane up to but no more than 2 feet when the work activity area is channelized with traffic control devices as specified by Drawing Nos. 515-01-C and 515-01-D for shoulder closures. A shadow vehicle is required. Consider utilizing a truck mounted attenuator on low speed roadways with intermediate to high traffic volumes.

On low speed roadways, speeds of 35 mph or less, when work activities require pedestrian workers to encroach upon the adjacent travel lane more than 2 feet, close the travel lane to traffic. When closure of the adjacent travel lane is necessary, utilize flagging operations on two-lane two-way roadways and standard lane closures on multilane roadways.

On intermediate to high speed two-lane two-way roadways, speeds of 40 mph to 55 mph, when pedestrian workers must encroach to within 1 foot of the near edge of the adjacent travel lane or upon the adjacent travel lane, close the travel lane to traffic. Utilize flagging operations for these lane closures.

On intermediate to high speed multilane roadways, speeds of 40 mph to 60 mph, when pedestrian workers must encroach upon the adjacent travel lane up to but no more than 2 feet, provide and operate a shadow vehicle supplemented with an advance warning arrow panel and a truck mounted attenuator in the adjacent travel lane to provide separation between the location of the pedestrian workers and approaching traffic. The advance warning arrow panel shall display a flashing arrow.

Equipment / Vehicles -

All travel lanes may remain open to traffic when work vehicles or equipment encroach upon an adjacent travel lane up to but not more than 2 feet.

Brief encroachments by a single equipment unit or a work vehicle into an adjacent travel more than 2 feet are acceptable when necessary to bypass an obstacle such as a sign or utility pole.

On two-lane two-way roadways, mobilized shoulder operations are unacceptable when the work activities require more than one (1) single equipment unit, not including a shadow vehicle when one is necessary, to conduct the work activities. Conduct these work activities under flagging operations.

On multilane roadways, mobilized shoulder operations are unacceptable when the work activities require more than one (1) single equipment unit, not including a shadow vehicle when one is necessary, to conduct the work activities. Conduct these work activities under lane closures.

INTERSTATE ROADWAYS -

Equipment and pedestrians are permitted to encroach onto a paved shoulder up to but not more than 2 feet under a traffic control setup for a mobilized shoulder operation. Brief periodic encroachments more than 2 feet by equipment are permissible when the equipment is bypassing structures such as guardrail locations or bridge structures.

A work vehicle shall accompany pedestrian workers when the pedestrian workers are within 30 feet or less of an adjacent travel lane. The accompanying work vehicle shall remain within 100 feet of the work location of the pedestrian workers at all times.

Pedestrian workers may encroach onto a paved shoulder up to 2 feet. A pedestrian worker is PROHIBITED from encroaching onto a paved shoulder more than 2 feet under a traffic control setup for a mobilized shoulder operation.

Standard shoulder closures are required when the work activities require equipment, personnel or vehicles to encroach onto a paved shoulder more than 2 feet to perform the work except during brief periodic encroachments necessary for equipment to bypass structures such as guardrail locations and bridge structures. Due to the mobility of these roadway shoulder area work zones and the brevity of the encroachments of more than 2 feet upon a paved shoulder, the requirements for lane closures when personnel, tools, equipment, materials, vehicles, etc., are present on a paved shoulder within 10 feet of the near edge of an adjacent travel lane are waived for work activities typically conducted under mobilized shoulder operations as prescribed by this manual.

MOBILE OPERATIONS

INTERMITTENT MOBILE OPERATIONS -

An intermittent mobile operation is a mobile operation that moves at speeds less than 3 mph or involves frequent short stops. The minimal traffic flow impacts generated by these operations involve brief traffic flow speed reductions and slight travel path diversions.

Intermittent mobile operations may be performed by a single work vehicle or a vehicle train. A single work vehicle may be a car or truck type vehicle or a single piece of equipment. A vehicle train operating under the requirements of an intermittent mobile operation typically includes no more than 2 (two) vehicles to include either 1 (one) work vehicle or 1 (one) piece of equipment and a shadow vehicle. However, additional shadow vehicles may be utilized when deemed necessary by the RME or the RME's designated representative.

Work activities that require intermittent mobile operations during the hours of darkness should be minimized and avoided when possible. However, in the case of an emergency when nighttime intermittent mobile operations are required and a lane closure is not feasible, a minimum work zone traffic control setup should include a shadow vehicle(s) supplemented with a truck mounted attenuator.

Consideration for utilizing a shadow vehicle is based upon the availability of adequate stopping sight distance. A shadow vehicle should accompany the work vehicle when the distance interval between the location point at which an approaching prudent driver is first able to recognize the presence of the work vehicle and the location of the work vehicle is less than the numerical figure indicated for the sufficient stopping sight distance. **When a shadow vehicle is utilized, position the shadow vehicle to maintain adequate stopping sight distance between the shadow vehicle and approaching motorists. Field adjustments to the location of the shadow vehicle may be necessary to ensure the shadow vehicle is not positioned in a location that may create a hazardous situation due to limited stopping sight distance in regard to a prudent driver being able to recognize the presence of the shadow vehicle.**

On low volume low speed roadways, a shadow vehicle may be optional provided the work vehicles and/or equipment is equipped with amber or yellow colored high intensity rotating, flashing, oscillating or strobe auxiliary warning lights.

On low volume intermediate to high speed roadways and all intermediate and high volume roadways, the necessity of a shadow vehicle is determined by the availability of the stopping sight distance. When adequate stopping sight distance is available, a shadow vehicle is not required.

A minimum number of two (2) persons in the work vehicle is recommended so that one person may act as spotter while the other person performs the work.

Roadway characteristics such as type, speed classification and volume classification shall determine the traffic control requirements for intermittent mobile operations. The following restrictions shall apply to all intermittent mobile operations.

Primary and Secondary Routes

- A. The work vehicle and shadow vehicle shall utilize the shoulder areas as much as practical when stopped.
- B. The maximum time duration of a stop is 15 minutes if the work vehicle and/or a shadow vehicle must encroach upon a travel lane more than 2 feet.
- C. The maximum time duration of a stop is 30 minutes if the work vehicle and/or a shadow vehicle remain in the shoulder area in their entirety or encroaches upon a travel lane no more than 2 feet.

Interstate Routes

- A. Encroachment upon a travel lane by the work vehicle and a shadow vehicle is only permitted in those areas with shoulder areas inadequate to accommodate vehicles in their entirety due to the presence of a concrete median barrier wall or a bridge parapet wall. **Any encroachment upon an interstate travel lane without a shadow vehicle is PROHIBITED.**
- B. The maximum time duration of a stop is 5 minutes, unless otherwise directed by this manual, if the work vehicle and/or a shadow vehicle must encroach upon an adjacent travel lane due to a shoulder area inadequate to accommodate a vehicle in its entirety due to the presence of a concrete median barrier wall or a bridge parapet wall.
- C. The maximum time duration of a stop is 30 minutes if the work vehicle and/or a shadow vehicle remain in the shoulder areas in their entirety with no encroachment upon an adjacent travel lane.

STOPPING SIGHT DISTANCE -

The stopping sight distance interval for any specific location is determined by the **posted regulatory speed limit** of the roadway. For the stopping sight distance as determined by the **posted regulatory speed limit** of the roadway, see *Table 11, Stopping Sight Distance*.

Stopping Sight Distance: **The length of roadway necessary for a typical vehicle to stop before reaching a stationary object in its path.**

Table 11 **Stopping Sight Distance**

STOPPING SIGHT DISTANCE		
POSTED REGULATORY SPEED LIMIT	DISTANCE PASSENGER CAR	DISTANCE TRUCK
35 mph or less	250 feet	350 feet
40 mph To 55 mph	500 feet	750 feet
60 mph To 70 mph	750 feet	1100 feet

Roadway characteristics shall determine the vehicle train requirements for an intermittent mobile operation. Evaluate the potential sight distance restrictions, such as vertical and horizontal curves, and the posted regulatory speed limits prior to deployment of a work detail to determine the minimum vehicle train requirements.

VEHICLE TRAIN REQUIREMENTS -

Single Work Vehicle: A single work vehicle is permitted in locations where the stopping sight distance interval between the work vehicle and an approaching motorist is available based upon the posted regulatory speed limit of the specific location.

When a sufficient stopping sight distance interval is not available, a shadow vehicle is required. See "Vehicle Train" below to determine the required distance intervals between the shadow vehicle and the work vehicle.

Shadow Vehicle: Low Volume / Low Speed Roadways -

Shadow vehicles may be **OPTIONAL** provided the work vehicle / equipment is equipped with **AMBER** or **YELLOW** colored high intensity rotating, flashing, oscillating or strobe auxiliary warning lights.

Low Volume / Intermediate to High Speed Roadways -
Intermediate Volume to High Volume / Low Speed to High Speed Roadways -

A vehicle train consisting of a work vehicle and a shadow vehicle is required in locations the stopping sight distance interval between the work vehicle and an approaching motorist is unavailable based upon the posted regulatory speed limit of the specific location.

Primary and Secondary Routes -

The distance interval from the shadow vehicle to the work vehicle may vary from a minimum 50 feet up to but not more than the stopping sight distance interval based upon the posted regulatory speed limit of the specific location.

Interstate Routes -

The distance interval from the shadow vehicle to the work vehicle may vary from 100 feet up to but not more than 750 feet based upon the posted regulatory speed limit of the specific location.

On low volume low speed roadways, intermittent mobile operations may be conducted with one person in the work vehicle. However, a minimum number of 2 persons in the work vehicle is recommended so that one person may act as a spotter while the other person performs the work. **Shadow vehicles are optional for these operations provided the work vehicles and/or equipment is equipped with AMBER or Yellow colored high intensity rotating, flashing, oscillating or strobe auxiliary warning lights.**

On low volume intermediate speed to high speed roadways, intermittent mobile operations may be conducted with one person in the work vehicle. However, a minimum number of 2 persons in the work vehicle is recommended so that one person may act as a spotter while the other person performs the work. **Evaluate the potential sight distance restrictions and posted regulatory speed limits of these roadways prior to deployment of the work detail to determine the minimum vehicle train requirements.**

On intermediate volume low speed to high speed roadways, intermittent mobile operations should be conducted with no less than 2 persons in the work vehicle. One person should act as a spotter while the other person performs the work. **Evaluate the potential sight distance restrictions and posted regulatory speed limits of these roadways prior to deployment of the work detail to determine the minimum vehicle train requirements.**

On high volume low speed to high speed roadways, intermittent mobile operations should be conducted with no less than 2 persons in the work vehicle. One person should act as a spotter while the other person performs the work. **Evaluate the potential sight distance restrictions and posted regulatory speed limits of these roadways prior to deployment of the work detail to determine the minimum vehicle train requirements.**

Maintain two-way radio communication between all vehicles when more than 1 vehicle is utilized.

Supplement the work vehicles and the shadow vehicles with amber colored auxiliary warning lights. The auxiliary warning lights shall be high intensity rotating, flashing, oscillating or strobe lights. Standard vehicle hazard warning lights are only permitted as a supplement to the auxiliary warning lights.

The vehicles may also be supplemented with truck mounted advance warning arrow panels and truck mounted attenuators as prescribed by this manual.

CONTINUOUS MOBILE OPERATIONS -

A continuous mobile operation moves continuously at all times at speeds of 3 mph or greater without any stops. The minimal traffic flow impacts generated by these operations involve brief traffic flow speed reductions and travel path diversions.

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

The distance intervals between the vehicles as indicated in the illustrations provided in this manual 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 illustrations.

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

Supplement the work vehicles and the shadow vehicles with amber colored flashing dome lights. The vehicles may also be supplemented with truck mounted advance warning arrow panels and truck mounted attenuators as prescribed by this manual.

DETOURS

Conduct and maintain roadway detours by relocating traffic onto alternate routes and returning the traffic to the route closed for the work beyond the closed portion of the roadway. All detour routes should be approved by the District Engineering Administrator.

Design and install all detour route signing in accordance with SCDOT requirements and the illustrations prescribed by this manual.

Select roads for a detour route that have a pavement structure, width 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.

Organize all personnel and equipment 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 work site after each event and resume normal traffic flow through the work site 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 equipped with either a truck mounted changeable message sign or a static sign to convey advance notice to motorists they 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 a 48-inch x 48-inch "Be Prepared To Stop" sign (W3-4-48) with a rigid sign substrate 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.