

DIVISION 11
WORK ZONE TRAFFIC CONTROL

SECTION 1101

WORK ZONE TRAFFIC CONTROL GENERAL REQUIREMENTS

1101-1 TRAFFIC CONTROL PLAN (TCP)

(A) General

Maintain traffic through work zones in accordance with these Specifications, the Traffic Control Plan, the *MUTCD*, and *Roadway Standard Drawings*.

If a conflict arises, Phasing and Drawings govern over project notes, and local notes govern over general notes.

(B) Phasing

Complete the requirements of each Phase before proceeding to the next Phase and the requirements of each Step before proceeding to the next Step, unless the plans permit work to be performed concurrently.

If a Traffic Control Plan Phasing is broken into Areas, work may be performed in more than one areas simultaneously as described in the plan. If a project is divided into Area 1 and Area 2, work can be performed in both Areas simultaneously but shall progress in each Area through the Phase and Step requirements.

(C) Project Notes

Two types of Project Notes may be included in the Traffic Control Plan:

- (1) General Notes apply at all times during the project.
- (2) Local Notes apply only for the specific times and locations that they are referred to in the phasing and/or detail sheets.

(D) Alternate to Traffic Control Plan

If desired, submit an alternate traffic control plan a minimum of 30 calendar days in advance of the anticipated implementation to allow for adequate review time. Do not implement alternate plans for traffic control until approved in writing and properly sealed. No adjustment in compensation or extension of the completion date(s) will be allowed due to the review time of the alternate. If an alternate traffic control plan is implemented, the Contractor shall be responsible for any unanticipated changes to subsequent Phases and/or Steps.

(E) Traffic Control Plan not fully covered in the Contract

When the Traffic Control Plan does not cover a particular work function, notify the Engineer to allow for the development or modification of a sealed set of the Traffic Control Plans.

1101-2 BLASTING ZONES

When blasting operations are within 305 m of a travelway, provide the appropriate traffic control as shown in the plans and/or the *Roadway Standard Drawings*.

1101-3 CONSTRUCTION VEHICLE CROSSINGS

Do not cross a median, ramps, or loops with vehicles and equipment unless a specific location for crossing is approved and required traffic control devices are used as shown in the *Roadway Standard Drawings*.

1001-4 ON-ROAD CONSTRUCTION VEHICLES

When operating outside of a closed lane or haul road crossing in a work zone, on-road construction vehicles are subject to the North Carolina Division of Motor Vehicle weight and safety regulations as commercial vehicles.

Section 1101

1101-5 EXCAVATIONS WITHIN TRAVELWAY

During the process of excavating in a travelway where traffic is to be later maintained, make provisions to backfill and repair any excavated or damaged pavement before allowing traffic to proceed over the affected lanes. In low speed areas (35 MPH or less) metal plates may be used to cover excavated areas.

1101-6 HAULING OPERATIONS

Comply with the Multiple and Single Vehicle Hauling restrictions as shown in the plans when performing hauling of equipment or materials to or from the project.

Multiple vehicle hauling is defined as the hauling of equipment or materials to or from the project with delivery at intervals of less than five minutes and/or results in more than one vehicle at a particular work site at one time.

Single vehicle hauling is defined as the hauling of equipment or materials to or from the project with delivery at intervals of more than five minutes and results in no more than one vehicle at a particular work site at one time.

1101-7 MATERIAL AND EQUIPMENT STORAGE AND PARKING

When work is not in progress, keep all personnel, equipment, machinery, tools, construction debris and supplies at least 12.2 m away from active travel lanes. When vehicles, equipment, and materials are protected by concrete barrier or guardrail, they should be offset a minimum of 1.5 m from the barrier or guardrail.

1101-8 PARKING OF PERSONAL VEHICLES

Provide staging areas for personal vehicle parking that is a safe distance (12.2 m minimum) from open travel lanes except on freeway facilities. Have staging areas for parking personal vehicles on freeway facilities approved by the Engineer prior to use.

1101-9 PROTECTION OF HAZARDS

Mark all hazards with signs, barricades, drums, or other warning devices.

At each location where work is started which creates a safety hazard, continue the work until completed to the extent that the safety hazard is eliminated. If the work is not pursued in a continuous manner the Engineer will not allow any other work on the project to be performed until the existing safety hazard is eliminated.

1101-10 TEMPORARY LANE CLOSURES

(A) General

Operate all equipment and personnel within the designated work area during lane closures. Do not impede or stop traffic for the purpose of performing construction related work on the traffic side of the lane closure, except when called for in the Traffic Control Plan.

Install lane closures with the traffic flow, beginning with devices on the upstream side of traffic. Remove lane closures against the traffic flow, beginning with devices on the downstream side of traffic.

Vehicles used to install or remove lane closures shall have flashing or rotating beacons.

(B) Intersections

When construction proceeds through an intersection, provide flagger(s) and all other necessary Traffic Control as required by the plans to direct the traffic through the intersection. When an intersection is signalized, have authorized personnel place the signal in flash mode prior to beginning work in the intersection.

1101-11 TEMPORARY ROAD CLOSURES**(A) Traffic Pattern Alterations**

Notify the Engineer 21 calendar days, or as specified, prior to altering the existing traffic pattern.

Pre-plan all traffic pattern alterations. Meet with the Engineer to discuss the implementation strategy before altering traffic. The Engineer will then notify the proper authorities and other affected parties as necessary.

(B) Detour

Ensure that all required detour signing and delineation, including work done by others, are in place prior to placing traffic onto a detour.

(C) Traffic Stoppage

Limit the stoppage of traffic to times specified in the plans. Provide enough time between consecutive stoppages to allow the traffic queue to deplete.

1101-12 TRAFFIC CONTROL SUPERVISION

Designate a Traffic Control Supervisor for the project who is knowledgeable of Traffic Control Plan design, devices and application, and has full authority to insure traffic is maintained in accordance with the contract. Coordinate with Department's project traffic control representative on all details concerning the Contractor's traffic control program.

Provide a Traffic Control Supervisor or designated representative to be on call at all times to make any necessary changes in the traffic control operations in a timely manner. Coordinate with and cooperate with traffic control supervisors of adjacent or overlapping construction projects to insure safe and adequate traffic control is maintained throughout the projects at all times including periods of construction inactivity.

1101-13 VEHICULAR ACCESS

Maintain continuous and safe vehicular access, including but not limited to, all residences, businesses, schools, police and fire stations, hydrants, other emergency services, hospitals and mailboxes. Conduct operations in such a manner as to limit the inconvenience to property owners.

SECTION 1105**WORK ZONE TRAFFIC CONTROL DEVICES****1105-1 DESCRIPTION**

Furnish, install, maintain, relocate, and remove traffic control devices in accordance with the plans and Specifications. All traffic control devices furnished by the Contractor will remain the property of the Contractor, unless otherwise specified in the contract.

1105-2 MATERIALS

Refer to Division 10.

Supply certifications that meet the requirements of Article 106-3, at least 72 hours prior to use for all used traffic control devices.

Provide traffic control devices that are listed on the Department's approved product list or accepted as traffic-qualified by the Work Zone Traffic Control Unit.

1105-3 CONSTRUCTION METHODS

Have all traffic control devices inspected and approved prior to using them on the project.

Install traffic control devices before construction operations begin and during the proper phase of construction. Maintain and relocate traffic control devices during the time they are in use. Keep these devices in place as long as they are needed and

Section 1105

immediately remove thereafter. When operations are performed in stages, install only those devices that apply to the present conditions.

1105-4 MAINTENANCE AND INSPECTION

Submit a proposed traffic control device maintenance schedule and checklist for approval prior to construction. Perform continuous maintenance and scheduled inspections of traffic control devices. Review and maintain all traffic handling measures to ensure that adequate provisions are in place for the safety of the public and workers.

Maintenance activities include cleaning of dirty devices or repair or replacement of traffic control devices that are damaged (torn, crushed, discolored), displaced by traffic or other means, or deteriorated beyond effectiveness.

If there are traffic control devices in use, perform inspection on a daily basis.

The name and telephone number of the agency, contractor or supplier may be shown on the non-retroreflective surface of all channelizing devices. Use letters and numbers that are a non-reflective color and not over 50 mm in height.

1105-5 FAILURE TO MAINTAIN TRAFFIC CONTROL

Failure to maintain traffic control measures and traffic control devices in accordance with this Specification may result in formal notification of noncompliance. Implement remedial action immediately for imminent danger situations as directed. Implement remedial action within 48 hours after notification of a safety issue that is not an imminent danger situation. (See Articles 107-22 and 108-7)

Failure to comply may result in having the work performed with available forces and equipment. The Contractor is held responsible for this work, and the actual cost of performing said work will be deducted from the moneys due the Contractor on the contract. In cases of willful disregard for the safety of the public, the Engineer may proceed immediately to implement the measures necessary to provide the appropriate level of traffic control to ensure that the safety of all concerned parties is maintained.

1105-6 MEASUREMENT AND PAYMENT

Payment at the contract unit prices for the various items in the contract will be full compensation for all work covered by this Specification.

SECTION 1110 WORK ZONE SIGNS

1110-1 DESCRIPTION

Furnish, install, maintain, temporarily cover and uncover signs, relocate, and remove work zone signs (stationary) and work zone signs (barricade mounted) in accordance with the contract.

Furnish, install, maintain and relocate portable work zone signs and portable work zone sign stands in accordance with the plans and Specifications. When portable work zone signs and portable work zone sign stands are not in use for periods longer than 30 minutes, collapse or remove sign stands and reinstall once work begins again.

Use portable work zone signs only with portable work zone sign stands specifically designed for one another. Portable work zone signs may be roll up or approved composite signs.

1110-2 MATERIALS

(A) General

Refer to Division 10.

| Item | Section |
|-------------------------|---------|
| Work Zone Signs | 1089-1 |
| Work Zone Sign Supports | 1089-2 |
| Barricade Mounted Signs | 1089-3 |

(B) Material Qualifications

Provide portable work zone sign stands, portable signs and sheeting that meet the requirements of NCHRP 350 for Category II traffic control devices and are listed on the Department's approved product list and accepted as traffic-qualified by the Work Zone Traffic Control Unit.

Provide portable work zone signs and stands that are crash tested by the manufacturer. The portable work zone sign and the portable work zone sign stand shall be crash tested together as a system.

(C) Historical Performance

Historical performance of the portable work zone sign and the portable work zone sign stand will help determine the future use of the material by the Department, even if the portable work zone sign or portable work zone sign stand has been traffic-qualified. Poor past or poor current performance of portable work zone signs and/or portable work zone sign stands at any site, whether or not related to a specific contract, may be grounds for non-acceptance of a product on any project under contract.

1110-3 CONSTRUCTION METHODS**(A) Work Zone Signs (stationary)**

Install work zone signs (stationary) to stand within 2° of plumb in all directions and under all conditions. Erect signs per Roadway Standard Drawing No. 1110.01 sheet 1 of 1.

Splicing of work zone sign (stationary) posts is acceptable. Splice work zone sign (stationary) posts according to Roadway Standard Drawing No. 1110.01 sheet 1 of 1. Remove entire post when removing signs with spliced posts. Do not back brace work zone sign (stationary) supports.

When required, cover work zone signs with an opaque material that prevents reading of the sign at night by a driver using high beam headlights. Use material that does not damage the sign sheeting.

Any damage incurred from the covering of work zone signs will be determined using Article 901-4. Replace or repair any damaged signs due to the covering at no expense to the Department.

Field conditions may from time to time dictate that splice, minimum embedment, lateral clearance and/or edge of pavement elevation for stationary work zone signs may not be achievable using equipment and methods standard to normal industry practices. See the *NCDOT Construction Manual* for examples for alternative solutions.

(B) Work Zone Signs (Barricade Mounted)

Mount approved composite or roll up signs to barricade rails so that the signs do not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails. Signs shall be mounted a minimum of 305 mm from the ground to the bottom of the sign.

(C) Work Zone Signs (Portable)**(1) General**

Install the portable work zone sign and sign stand to stand plumb within 10° left and right, within 20° front and back and be capable of standing erect in windy conditions.

When not in use for periods longer than 30 minutes, lay the portable work zone sign flat on the ground and collapse the sign stand and lay it flat on the ground.

Clean the sign face prior to use.

Section 1110

(2) Work Zone Sign (Portable)

Install portable work zone sign stands to carry roll up or approved composite signs at a minimum height of 305 mm from the bottom of the sign to the edge of pavement elevation on two-lane two-way roadways and at least 1.52 m from the bottom of the sign to the edge of pavement elevation on multi-lane roadways.

1110-4 MEASUREMENT AND PAYMENT

Nominal dimensions will be used to compute the sign panel areas

Work Zone Signs (Stationary) will be measured and paid for as the actual number of square meter that have been satisfactorily installed at each location and accepted by the Engineer. Where a particular sign is used at more than one location, measurement will be made at each location.

Work Zone Signs (Barricade Mounted) will be measured and paid for as the actual number of square meter that have been satisfactorily installed on barricades and accepted by the Engineer. Payment will be made for the initial installation only. Relocation of signs will be considered incidental to the measurement of the quantity of signs.

Work Zone Signs (Portable) will be measured and paid for as the actual number of square meter that have been satisfactorily installed and accepted by the Engineer. Payment will be made for the initial installation only. Relocation of signs will be considered incidental to the measurement of the quantity of signs.

No direct payment will be made for stationary work zone sign supports or portable work zone sign stands. All stationary work zone sign supports or portable work zone sign stands are considered incidental to the work of providing work zone signs.

Payment will be made under:

| Pay Item | Pay Unit |
|--------------------------------------|-----------------|
| Work Zones Signs (Stationary) | Square Meter |
| Work Zones Signs (Barricade Mounted) | Square Meter |
| Work Zones Signs (Portable) | Square Meter |

SECTION 1115 FLASHING ARROW PANELS, TYPE C

1115-1 DESCRIPTION

Furnish, install, place, operate, maintain, relocate, and remove flashing arrow panels in accordance with the contract.

1115-2 MATERIALS

(A) General

Refer to Division 10.

| Item | Section |
|-----------------------|----------------|
| Flashing Arrow Panels | 1089-6 |

(B) Material Qualifications

Use Flashing Arrow Panels that have been evaluated by NTPEP.

Use Flashing Arrow Panels that are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

(C) Historical Performance

Historical performance of the Flashing Arrow Panels will help determine the future use of the material by the Department, even if the Flashing Arrow Panel has been traffic-qualified. Poor past or poor current performance of Flashing Arrow

Panels at any site, whether or not related to a specific contract, may be grounds for non-acceptance of a product on any project under contract.

1115-3 CONSTRUCTION METHODS

Use arrow panels that have the capability to display mode selections.

Do not use straight-line caution or chevron displays.

Mount flashing arrow panels on trucks, trailers, or other mobile units.

1115-4 MEASUREMENT AND PAYMENT

Flashing Arrow Panels, Type C will be measured and paid for as the maximum number of panels that have been satisfactorily placed and accepted by the Engineer in use at any one time during the life of the project as required by the contract.

Payment will be made under:

| Pay Item | Pay Unit |
|------------------------------|-----------------|
| Flashing Arrow Panel, Type C | Each |

**SECTION 1120
CHANGEABLE MESSAGE SIGNS**

1120-1 DESCRIPTION

Furnish, install, maintain, relocate and remove changeable message signs in accordance with the contract.

1120-2 MATERIALS

(A) General

Refer to Division 10.

| Item | Section |
|--------------------------|----------------|
| Changeable Message Signs | 1089-7 |

(B) Material Qualifications

Use Changeable Message Signs that have been evaluated by NTPEP.

Use Changeable Message Signs that are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

(C) Historical Performance

Historical performance of the Changeable Message Signs will help determine the future use of the material by the Department, even if the Changeable Message Sign has been traffic-qualified. Poor past or poor current performance of Changeable Message Signs at any site, whether or not related to a specific contract, may be grounds for non-acceptance of a product on any project under contract.

1120-3 CONSTRUCTION METHODS

Mount all changeable message signs on a trailer, or truck, as specified in the plans, designed to adequately support the message board in a level position. Align and sight the changeable message sign to provide optimal driver visibility. Sign operator will adjust flash rate so that a minimum of two complete sign panels can be displayed and legible to a driver while approaching the sign at the posted speed.

Relocate the units for the various stages of construction as shown in the plans or as needed to adequately inform the motorists.

Provide an experienced operator for the changeable message sign during periods of operation to ensure that the messages displayed on the sign panel are in accordance with the plans and in accordance with message content guidelines. Ensure that the message

Section 1120

sign is illuminated properly to meet the existing light conditions, and that all adjustments for operation of the sign are made as needed to properly guide motorists.

Expedite repairs due to failure, malfunction, or damage to a changeable message sign. Furnish another changeable message sign (approved by the Engineer and at no additional cost) during the repair time. Repair and/or replace changeable message sign immediately; otherwise, suspend all construction activities requiring the use of the sign until the sign is restored to operation.

1120-4 MAINTENANCE

Perform all maintenance operations recommended by the manufacturer of the sign. Include the periodic cleaning of the sign face and associated solar panels in maintenance operations.

1120-5 MEASUREMENT AND PAYMENT

Changeable Message Signs will be measured and paid for as the maximum number of changeable message signs acceptably placed and in operation, at any one time during the life of the project. Payment for Changeable Message Signs will be made on the following schedule:

70% of the unit bid upon placing the unit in service.

20% of the unit bid when the project is 50% complete.

10% of the unit bid when the project is 100% complete.

Changeable Message Signs (Short Term) will be measured and paid for as the actual number of days the changeable message sign (short term) is used on a project for a specific work operation, removed from the project after the specific operation is complete, and that remains in use on the project no longer than 1 month.

Payment will be made under:

| Pay Item | Pay Unit |
|--------------------------------------|-----------------|
| Changeable Message Sign | Each |
| Changeable Message Sign (Short Term) | Per Day |

SECTION 1130 DRUMS

1130-1 DESCRIPTION

Furnish, install, maintain, relocate, and remove drums with ballast in accordance with the contract.

1130-2 MATERIALS

Refer to Division 10.

| Item | Section |
|-------------|----------------|
| Drums | 1089-5 |

Provide drums that are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

1130-3 CONSTRUCTION METHODS

Utilize the same type of reflective sheeting on all drums installed at any one time during the life of the project.

Use a ballasting method in accordance with manufacturer's specification. When using a tire ballasting method, use approved manufacturer's tires and place the tires flush with the ground.

1130-4 MAINTENANCE

At no cost to the Department, immediately replace any drum, ballast, or reflective sheeting that are torn, crushed, discolored, or otherwise damaged.

1130-4 MEASUREMENT AND PAYMENT

Drums will be measured and paid for as the maximum number of drums acceptably placed and in use at any one time during the life of the project.

Relocation of drums is considered incidental to the measurement of the quantity of drums and no separate payment will be made.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| Drums | Each |

**SECTION 1135
CONES**

1135-1 DESCRIPTION

Furnish, install, relocate, maintain, and remove cones and reflective cone collars in accordance with the contract.

1135-2 MATERIALS

Refer to Division 10.

| Item | Section |
|-------------|----------------|
| Cones | 1089-5 |

Provide cones that are on the Department’s Approved Products List or are traffic-qualified by the Work Zone Traffic Control Unit.

1135-3 CONSTRUCTION METHODS

Use reflective collars on all cones used between dusk and dawn. Use the same type of reflective sheeting on all cone collars installed at any one time during the life of the project. Do not use cones in the upstream taper of lane or shoulder closures for multilane roadways and for no longer than 3 consecutive days.

1135-4 MAINTENANCE

At no cost to the Department, immediately replace any cone or reflective collar that is torn, crushed, discolored, or otherwise damaged.

1135-5 MEASUREMENT AND PAYMENT

Cones will be measured and paid for as the maximum number of cones acceptably placed and in use at any one time during the life of the project.

Relocation of cones is considered incidental to the measurement of the quantity of cones and no separate payment will be made.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| Cones | Each |

**SECTION 1145
BARRICADES**

1145-1 DESCRIPTION

Furnish, erect, maintain, relocate, ballast, and remove barricades in accordance with the contract.

Section 1145

1145-2 MATERIALS

Refer to Division 10.

| Item | Section |
|------------|---------|
| Barricades | 1089-3 |

Provide barricades that meet the requirements of NCHRP 350 for Category II traffic control devices and are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

1145-3 CONSTRUCTION METHODS

At the end of the workday, properly close the road where construction equipment accesses a road closure through Type III barricades.

Use sandbags or other approved ballasting methods to prevent overturning of barricades by the wind. If needed, place sandbags or other acceptable ballasting on the feet of the frame. Do not ballast barricades with objects such as rocks or chunks of concrete.

Do not anchor barricades to any pavement surfaces unless such anchoring method has passed the crash test requirement of NCHRP 350 for work zone category II devices.

Point the striped diagonals on the barricade rails in the direction traffic is being directed.

1145-4 MAINTENANCE

At no cost to the Department, periodically inspect barricades and ballast. Replace any ballast as needed, including sandbags that have loose sand outside the bag.

1145-5 MEASUREMENT AND PAYMENT

Barricades (Type III) will be measured and paid for as the maximum number of linear meter of barricades acceptably placed and in use at any one time during the life of the project. Measurement will be made of the total length of each barricade along one rail.

Relocation of barricades is considered incidental to the measurement of the quantity of barricades.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------------|--------------|
| Barricades (Type III) | Linear Meter |

SECTION 1150 FLAGGERS

1150-1 DESCRIPTION

Furnish, relocate, and maintain the flaggers, hats, vests and STOP/SLOW Paddles and any other incidentals necessary to complete the work in accordance with the contract.

1150-2 MATERIALS

Refer to Division 10.

| Item | Section |
|----------|---------|
| Flaggers | 1089-12 |

1150-3 CONSTRUCTION METHODS

Provide the services of competent and properly equipped flagger(s) (see *Roadway Standard Drawing* No. 1150.01) at locations and times for such periods as necessary for the control and protection of vehicular and pedestrian traffic. Use flagging methods that comply with the guidelines in the *MUTCD*.

Flagging operations are not allowed for the convenience of the Contractor's operations. However, if safety issues exist (i.e. sight/stopping site distance), the Engineer may approve the use of flagging operations.

1150-4 MEASUREMENT AND PAYMENT

The Department will pay for all flaggers, including those used at -Y- lines, that are used in conjunction with a lane closure. Flaggers used for operations not involving a lane closure will be considered incidental to that operation and no payment will be made.

Flaggers (day) will be measured and paid for as the actual number of days that each flagger is satisfactorily provided and accepted by the Engineer during the life of the project. On any calendar day that more than one flagger is used, the quantity to be paid for on that calendar day will be the maximum number of flaggers used at one time in that calendar day.

Any flagger (Days) used for less than one hour will be considered incidental to that operation.

Flaggers (hour) will be measured and paid for as the actual number of hours that each flagger is satisfactorily provided and accepted by the Engineer during the life of the project.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| Flaggers | Day |
| Flaggers | Hour |

**SECTION 1160
TEMPORARY CRASH CUSHIONS**

1160-1 DESCRIPTION

Furnish, install, maintain, reset, and remove temporary crash cushions in accordance with the contract.

1160-2 MATERIALS

(A) General:

Refer to Division 10.

| Item | Section |
|--------------------------|----------------|
| Temporary Crash Cushions | 1089-8 |

(B) Material Qualifications

Use Temporary Crash Cushions that meet the requirements of NCHRP 350 Test Level II or III for work zone traffic control devices and are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

(C) Historical Performance

Historical performance of the Temporary Crash Cushions will help determine the future use of the material by the Department, even if the Temporary Crash Cushion has been traffic-qualified. Poor past or poor current performance of Temporary Crash Cushions at any site, whether or not related to a specific contract, may be grounds for non-acceptance of a product on any project under contract.

1160-3 CONSTRUCTION METHODS

Prior to use, furnish the Engineer detailed brochures, specifications, and other manufacturer's data that completely describes the performance criteria, installation, and instructions for the crash cushion. Ensure that the crash cushion is rated for at least the same speed as the facility on which it will be used.

Section 1160

The Contractor may provide a portable base for installation. When a portable base is used, provide one that is designed and/or approved by the manufacturer of the temporary crash cushion.

Install temporary crash cushions in accordance with the manufacturer's specifications.

Use temporary crash cushions that have a yellow reflective end treatment to delineate the approach end of the crash cushion to oncoming traffic.

Repair any pavement damaged by the installation or removal of a temporary crash cushion at no cost to the Department.

1160-4 MAINTENANCE

Repair or replace within 24 hours any temporary crash cushion that becomes crushed or otherwise damaged to the point that it will not perform its intended purpose. Suspend all construction activities until the temporary crash cushion is repaired or replaced. Provide safe control of traffic until the temporary crash cushion has been repaired or replaced using approved methods.

1160-5 MEASUREMENT AND PAYMENT

Temporary Crash Cushions will be measured and paid for as the actual number of crash cushions that have been furnished, satisfactorily installed and accepted by the Engineer.

Reset Temporary Crash Cushions will be measured and paid for as the actual number of crash cushion relocations as directed.

Payment will be made under:

| Pay Item | Pay Unit |
|-------------------------------|-----------------|
| Temporary Crash Cushion | Each |
| Reset Temporary Crash Cushion | Each |

SECTION 1165 TRUCK MOUNTED IMPACT ATTENUATORS

1165-1 DESCRIPTION

Furnish, install, operate, maintain, and relocate truck mounted impact attenuators (TMIA) in accordance with the contract.

1165-2 MATERIALS

(A) General:

Refer to Division 10.

| Item | Section |
|----------------------------------|----------------|
| Truck Mounted Impact Attenuators | 1089-9 |

(B) Material Qualifications

Use TMIA's that meet the requirements of NCHRP 350 Test Level II or III for work zone traffic control devices and are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

(C) Historical Performance

Historical performance of the TMIA will help determine the future use of the material by the Department, even if the TMIA has been traffic-qualified. Poor past or poor current performance of TMIA at any site, whether or not related to a specific contract, may be grounds for non-acceptance of a product on any project under contract.

1165-3 CONSTRUCTION METHODS

Prior to use, furnish the Engineer detailed brochures, specifications, and other manufacturer's data that completely describes the performance criteria, installation, and instructions for the TMIA.

Use only TMIA's that meet the crash test requirements of Article 1089-9(A).

Do not park TMIA's against rigid objects (i.e. bridge piers or portable concrete barrier) except as a temporary safety measure and in no case for longer than 72 hours. Install the TMIA on a truck that is fully operational, in good running order, and in accordance with the manufacturer's specifications.

Use the appropriate lighting and delineation on the truck and TMIA's as shown in the contract.

1165-4 MAINTENANCE

Repair or replace within 24 hours any attenuator that becomes crushed or otherwise damaged so that it will perform its intended purpose. Suspend all construction activities until the attenuator is repaired or replaced. Provide safe control of traffic until the attenuator has been repaired by using approved methods.

1165-5 MEASUREMENT AND PAYMENT

TMIA will be measured and paid for as the maximum number of TMIA's acceptably placed and in use at any one time during the life of the project for all operations other than Moving and Mobile Operations. TMIA's are considered incidental to all moving and mobile operations. In the case of emergency situations, TMIA's will not be paid for when payment has already been made for a stationary unit.

Relocation of TMIA's are considered incidental to the measurement of the quantities of TMIA's and no separate payment will be made.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| TMIA | Each |

**SECTION 1170
PORTABLE CONCRETE BARRIER**

1170-1 DESCRIPTION

Furnish, install, secure, maintain, remove and reset portable concrete barrier in accordance with the contract.

1170-2 MATERIALS**(A) General:**

Refer to Division 10.

| Item | Section |
|-----------------------------------|----------------|
| Portable Concrete Barrier | 1090 |
| Guardrail and Barrier Delineators | 1088-2 |

Provide Portable Concrete Barrier that meets the requirements of NCHRP 350 Test Level II for work zones that have a posted speed limit of 45 mph or less; and/or meet the requirements of NCHRP 350 Test Level III for work zones which have a posted speed limit greater than 45 mph.

(B) Material Qualifications

Use Portable Concrete Barrier that is on the Department's Approved Products List and is traffic-qualified by the Work Zone Traffic Control Unit.

Section 1170

(C) Historical Performance

Historical performance of the Portable Concrete Barrier will help determine future use of the material by the Department, even if the Portable Concrete Barrier has been traffic-qualified. Poor past or poor current performance of Portable Concrete Barrier at any site, whether or not related to a specific contract, may be grounds for non-acceptance of a product on any project under contract.

1170-3 CONSTRUCTION METHODS

(A) General

Place all types of portable concrete barrier as shown in the contract. When required by the plans, anchor barrier by an approved method as shown in the *Roadway Standard Drawings* and/or refer to Subarticle 1170-3(B).

Use any approved NCHRP 350 portable concrete barrier. Use one type of portable concrete barrier on any continuous run of barrier within the project.

Use portable concrete barrier (drainage), as shown in the *Roadway Standard Drawings*, to avoid trapping water in sags, vertical curves, areas of wedging and paving where super-elevations have been changed, and other low spots as directed. Provide adequate drainage behind the portable concrete barrier (drainage) installation.

Lift, place and reset portable concrete barrier units using a two-point pick up, or other acceptable method, which does not over-stress, damage, or mar the surface of the roadway. Do not use connection points for lifting purposes.

Do not use any barrier units that are cracked, damaged, chipped, or otherwise nonfunctional.

(B) Securing Barrier On Concrete and Asphalt Pavement Surfaces:

(1) Anchoring

Secure barrier to concrete and asphalt pavement surfaces using approved anchoring methods as follows:

- (a) On concrete pavement surfaces where the back side of the portable concrete barrier is 1.2 m or closer to the edge of a drop-off that is 0.9 m deep or greater.
- (b) On bridge decks after the removal of an existing bridge rail or in places where portable concrete barrier is used and the backside of the portable concrete barrier is 1.8 m or closer to the edge of the bridge deck.
- (c) On concrete and asphalt pavement surfaces where portable concrete barrier is used to separate opposite direction of traffic and either side of the portable concrete barrier is 0.6 m or closer to the edge of either opposing travel lane.

(2) Anchoring Methods:

(a) General:

Use anchoring methods shown in *Roadway Standard Drawings*.

(b) Anchor holes:

Drill anchor holes normal to the surface of installation using a pneumatic drill with a depth indicator, unless another drilling method is allowed. Make sure that the diameter of the hole is in strict conformance with the plans or the manufacturer's recommendations. When directed, use a jig or fixture to ensure that correct positioning of the holes and proper alignment during the drilling process. Adjust hole locations, as necessary, to avoid encountering reinforcing steel. Immediately after drilling, brush the holes with a stiff-bristled brush of a sufficient size to effectively remove dust from the sides of the hole,

and blow all holes free of all dust and debris using oil free compressed air. Repeat this procedure until the hole is completely clean.

Inspect each hole immediately prior to placement of the adhesive and anchor. Rework any hole found to deviate from these requirements to ensure that an acceptable hole is achieved.

Check each hole with a depth gauge to ensure proper embedment depth. Satisfactorily repair all spalled or damaged concrete.

Once the barrier and anchors are removed, fill the holes with an approved non-shrink, non-metallic grout (see Article 1054-6). These requirements may be waived if the bridge or roadway will no longer be used by traffic.

(3) **Adhesive Anchoring Method**

Mix adhesives in strict conformance with the manufacturer's instructions.

Pour the mixed adhesive into the hole. Agitate or rotate anchors to ensure complete wetting and encapsulation. Insert the anchors to the specified depth. Completely fill the anchor hole with adhesive and remove any excess adhesive flush with the pavement. Do not disturb any anchors while the adhesive is hardening.

Coat all anchors used with the adhesive bonding method with a debonding agent so they can be easily removed. Formulate the debonding agent such that it does not reduce the strength of the anchor system.

(4) **Through the Deck Anchoring Method**

Anchor barrier to bridge decks as shown in Roadway Standard Drawing 1170.01, sheet 4 of 4. Do not use this method on prestressed concrete bridge deck panels.

(C) Resetting Barrier

Reset portable concrete barrier as shown in the plans.

(D) Stockpiling

Stockpile the portable concrete barrier when the barrier is not utilized on the project or it becomes necessary to stockpile units between two (2) separate installations.

Stockpile the barrier at a location off the project of your choosing, unless otherwise noted in the plans or to a location within the project limits if provided. Provide the stockpile area at no cost to the Department.

(E) Barrier Delineators

Use any of the several alternate delineator types for barrier (see *Roadway Standard Drawings*) that are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

Use only one delineator type for barrier throughout the project.

The delineators consist of a reflector and base or casing. Attach the delineator to the barrier as shown in the *Standard Drawings*. Use one attachment position throughout the project length.

Position delineators perpendicular to the centerline of the road. Use yellow delineators in the median and on the left side of one-way ramps, loops, or other one-way facilities. Use crystal delineators on the right side of divided highways, ramps, loops and all other one-way or two-way facilities. In all cases, the color of the delineator shall supplement the color of the adjacent edgelines.

Section 1170

1170-4 MEASUREMENT AND PAYMENT

Portable Concrete Barrier () will be measured and paid for as the actual number of linear meter that has been furnished, satisfactorily installed, accepted by the Engineer, maintained, and removed. Measurement will be made by counting the number of barrier units used and multiplying by the length of a unit.

Reset Portable Concrete Barrier () will be measured and paid for as the number of linear meter of barrier that has been moved from one location on the project to another location on the project. Measurement will be made by counting the number of barrier units moved during any one move and multiplying by the length of a unit. Where barrier units are moved more than once, each move will be measured separately. Whenever the Engineer directs the Contractor to move barrier units from an installed location to a stockpile either on or off the project and then back to another installed location, the complete move from the first installed location to the next installed location will be measured as 2 moves.

There will be no measurement made of barrier delineators as they are considered incidental to the other pay items in this Specification.

Payment will be made under:

| Pay Item | Pay Unit |
|--|-----------------|
| Portable Concrete Barrier | Linear Meter |
| Portable Concrete Barrier (Anchored) | Linear Meter |
| Portable Concrete Barrier (Drainage) | Linear Meter |
| Reset Portable Concrete Barrier | Linear Meter |
| Reset Portable Concrete Barrier (Anchored) | Linear Meter |
| Reset Portable Concrete Barrier (Drainage) | Linear Meter |

SECTION 1180 SKINNY DRUMS

1180-1 DESCRIPTION

Furnish, install, maintain, relocate, and remove Skinny Drums with ballast in accordance with the contract.

1180-2 MATERIALS.

Refer to Division 10.

| Item | Section |
|--------------|----------------|
| Skinny Drums | 1089-5 |

Provide Skinny Drums that are on the Department's Approved Products List and are traffic-qualified by the Work Zone Traffic Control Unit.

1180-3 CONSTRUCTION METHODS

Use the same type of reflective sheeting (minimum of Type III) on all Skinny Drums installed at any one time during the life of the project.

Use ballasting methods in accordance with manufacturer's specification.

Use Skinny Drums as follows:

Skinny Drums may be used in lieu of cones.

Space Skinny Drums equal in meters to $\frac{2}{3}$ the posted speed limit (mph), not to exceed 15.2 m spacing, in the tangent sections on multilane roadways.

Do not use Skinny Drums as follows:

Do not use Skinny Drums for tapers on multilane roadways.

Do not substitute Skinny Drums for normal drums or intermix with drums unless directed by the Engineer or the Traffic Control Plans.

Do not use Skinny Drums to separate two directions of travel that have been shifted on a multilane roadway unless directed by the Engineer or Traffic Control Plans.

Do not use Skinny Drums for lane closures on multilane roadways for longer than 3 consecutive days.

1180-4 MAINTENANCE

At no cost to the Department, immediately replace any Skinny Drum, ballast, or reflective sheeting that are torn, crushed, discolored, or otherwise damaged.

1180-5 MEASUREMENT AND PAYMENT

Skinny Drums will be measured and paid for as the actual number of Skinny Drums satisfactorily placed, accepted by the Engineer and in use at any one time during the life of the project.

Relocation of Skinny Drums is considered incidental to the measurement of the quantity of Skinny Drums and no separate payment will be made.

Payment will be made under:

| Pay Item | Pay Unit |
|-----------------|-----------------|
| Skinny Drum | Each |