SECTION 512

MAINTAINING TRAFFIC

I. GENERAL

1.1 DESCRIPTION OF WORK

The Contractor shall furnish all materials, equipment and labor necessary to install and maintain all traffic control devices required for protecting vehicular and pedestrian traffic through areas of construction; maintaining public and private entrances and mailbox turnouts; constructing and obliterating detours; and, protecting the traveling public within the limits of the project and over detours that are not a part of the state or City highway system; in accordance with the Contract Documents, the MUTCD, and the Virginia Work Area Protection Manual, whichever is more restrictive. This work shall also consist of removing and disposing of roadway pavement markings in accordance with these specifications and in reasonably close conformity to the lines and grades shown on the Drawings or as established by the Owner.

1.2 MATERIALS

A. Materials salvaged from the roadway shall be used in the maintenance of traffic insofar as possible. Material shall conform to the requirements of the applicable specifications.

B. Signalization, barricades, channelizing devices, safety devices, and pavement markings shall conform to the requirements specified in Sections 700 and 704, and applicable VDOT Division VII sections, Traffic Control Devices, and the Virginia Work Area Protection Manual except where otherwise indicated. Retroreflective surfaces shall conform to the requirements of VDOT Sections 235, 247, and 702, as applicable.

C. Temporary pavement markers shall conform to the requirements of VDOT Section 235.

D. Construction pavement markings shall conform to the requirements of VDOT Section 246.

E. Construction signs shall conform to the requirements of VDOT Section 247. Sign substrates for rigid construction signs mounted on posts shall conform to the requirements of VDOT Section 701 or be a 0.079-inch-thick aluminum/plastic laminate.

F. Sign substrates for signs mounted on drums, Type III barricades, and portable sign stands shall be of the materials as specified in the charts that follow and shall be the same material that was used when the device was tested and found to be in compliance with the requirements of National Cooperative Highway Research Program (NCHRP) Report 350, Test Level 3, or of other materials allowed in the FHWA acceptance letter.

<u>Sign Substrates for Type III Barricades and Portable Sign Stands</u>

- Rollup sign
- 0.4-inch-thick corrugated polypropylene or polyethylene plastic
- 0.079-inch-thick aluminum/plastic laminate

Sign Substrates for Drums

- 0.4-inch-thick corrugated polypropylene or polyethylene plastic

II. EXECUTION

2.1 PROCEDURES

Traffic shall be maintained and protected in accordance with the requirements of VDOT Section 105.14. Work shall be scheduled and performed so as to provide minimum interference with and maximum protection for traffic. The Contractor's personnel, equipment, machinery, tools, and supplies shall be kept outside the clear zone and clear of active traffic lanes except as necessary for prosecuting active work. Stabilized construction entrances shall be used in construction areas where there is a potential for construction vehicles to track material from the construction site onto a paved surface. Material that is spilled or tracked onto the traveled pavement during prosecution of the work shall be promptly removed.

The Contractor shall maintain the traffic control devices, which shall include, but not be limited to, repositioning of displaced devices including traffic barrier service, replacement due to inadequate structural integrity including traffic barrier service, replacement due to loss of reflectivity, repair of defaced sheeting and legend, replacement of broken supports, repositioning of leaning signs so they are plumb and the sign face is perpendicular to the pavement edge, cleaning of dirty devices, and replacement of stolen or vandalized devices. Barricades, barriers, and other safety devices shall be inspected at least daily, and deficiencies shall be immediately corrected. Safety and protective devices furnished by the Contractor will remain the property of the Contractor and shall be removed from the project site upon completion of the work or as directed by the Owner.

A. Signs**:** The Contractor shall furnish and install temporary sign panels necessary for the project, which shall include, but not be limited to, maintenance of traffic, beginning and end of construction, and off-project detour signing.

Signs and their placement shall conform to the requirements of the *Virginia Work Area Protection Manual*, the *MUTCD*, and the Drawings and as directed by the Owner. The Contractor shall submit to the Owner a sketch of his proposed construction sign layout for approval prior to installation. The Contractor shall furnish supports, i.e., wood posts and barrier and wall attachments, and hardware for use with the temporary sign panels. In lieu of using wood posts, the Contractor may request permission from the Owner to use alternate products on the Special Products Evaluation List. The request shall contain all information related to the manufacturer's installation requirements, including but not limited to, post spacing and the square footage of sign panel the product can support based on AASHTO's requirements for a wind speed of 60 miles per hour. The Contractor shall be responsible for covering, uncovering, or removing and reinstalling existing signs that conflict with the signs needed for maintenance of traffic. Covering of existing signs shall be accomplished in accordance with the requirements of VDOT Section 701.03(d). The Contractor shall furnish and install flags for the temporary sign panels as directed by the Owner except flags will not be required for use on portable sign supports. Signs shall be installed and attached to wooden supports in accordance with Standard WSP-1 of VDOT's *Road and Bridge Standards*. The size and number of wooden supports shall be in accordance with the standard drawings. When alternate products for supports are approved for use by the Owner, the supports, including size and number, and signs shall be installed in accordance with the manufacturer's recommendation.

Retroreflective flexible sign base materials conforming to the requirements of VDOT Section 247 for material that is not Type VI material may be used both day and night up to a maximum of three continuous days.

The Contractor may furnish portable sign stands for mounting temporary sign panels in accordance with the following:

1. Sign installations shall be used for no longer than 3 consecutive days.

2. Portable sign stands shall be used with signs having a substrate material of the type required in VDOT Section 512.02(e) and only those that were tested and found to be in compliance with the requirements of *NCHRP Report 350*, Test Level 3, or otherwise accepted in an FHWA acceptance letter for the specific sign stand.

Portable sign stands shall conform to the requirements of NCHRP Report 350, Test Level 3, and shall be selected from those shown on VDOT's Approved List or the Contractor shall submit a certification letter submitted prior to their use stating the brands and models of portable sign stands to be used along with a copy of the FHWA acceptance letter indicating compliance with NCHRP Report 350, Test Level 3. Portable sign stands shall be selferecting and shall accommodate signs of the shape being used. Portable sign stands shall support a 16-square-foot sign panel in sustained winds of 50 miles per hour without tipping over, walking, or rotating more than ±5 degrees about its vertical axis. Additional weight consisting of no more than one 25-pound sandbag placed on each leg or no more than two cone weights positioned on the center of the sign stand and around the mast may be used to comply with this requirement. When used on uneven surfaces, the portable sign stand shall be capable of adjusting to those surfaces to allow the signs to be installed in their normal upright position ±15 degrees. Portable sign stands shall include decals, stenciling, or other durable marking system that indicates the manufacturer and model number of the stands. Such marking shall be of sufficient size so it is legible to a person in a standing position.

The Contractor shall erect, maintain, move, and be responsible for the security of sign panels and shall ensure an unrestricted view of sign messages for the safety of traffic.

When construction signs are covered to prevent the display of the message, the entire sign shall be covered with silt fence or other materials approved by the Owner such that no portion of the message side of the sign shall be visible. Plywood shall be used on groundmounted construction signs only. Attachment methods used to attach the covering material to .the signs shall be of a durable construction that will prevent the unintentional detachment of the material from the sign. At no times shall a construction sign and/or post be rotated to prevent the display of the message. In addition, the posts where the signs are being covered shall have two ED-3 Type II delineators mounting vertically on the post below the signs at a height of 4 feet to the top of the topmost delineator. The bottom delineator shall be mounted 6 inches below the top delineator.

B. Flagger Service and Pilot Vehicles**:** The Contractor shall provide flagger service in accordance with the requirements of VDOT Section 105.14(c).

When one-way traffic is approved, the Contractor shall provide flagger service and, where necessary, pilot vehicles to maintain traffic. Each vehicle shall be equipped with at least one roof-mounted rotating amber flashing light and shall display required signs while in service.

Portable traffic control signals conforming to the requirements of VDOT Section 512.03(h) 2 may be used in lieu of flagger service when specified or approved by the Owner. When portable traffic control signals are used in lieu of flagger service, the portable traffic control signals will be measured and paid for separately.

C. Electronic Arrows: Electronic arrows shall be electronic flashing or sequential amber arrows having dimmer controls and shall be mounted on suitable trucks or trailers. The Contractor shall maintain and move electronic arrows as needed for traffic control.

Trailers supporting arrow boards and the boards themselves shall be either Virginia highway orange (DuPont Color No. LF74279 AT or color equivalent) or federal yellow in color. The trailer's back frame shall have 2-inch-high retroreflective sheeting conforming to the requirements of VDOT Section 247.02(c) installed on the area facing traffic. The sheeting shall have alternating 11-inch-wide vertical red stripes and 7-inch-wide vertical white stripes.

D. Warning Lights:

1. Type A flashing lights shall be used for advance warning signs and hazardous locations and shall be in operation during hours of darkness and low visibility. A Type A flashing light shall be installed on concrete traffic barrier service at the break point between the transition and tangent sections.

2. Type B flashing lights shall be used when specified on the Drawings for advanced warning signs and extremely hazardous locations and shall be in operation at all times.

3. Type C steady burn lights shall be used when specified on the Drawings for channeling traffic and may be placed on Group 2 channelizing devices. When used on Group 2 channelizing devices, the channelizing devices shall have been tested with the light and an FHWA acceptance letter issued indicating compliance with *NCHRP Report 350*, Test Level 3, as required in (e) herein. Lights shall be placed at intervals of 80 feet along tangent sections and 40 feet along bridges, transitions, and curves greater than 6 degrees. Lights shall be in operation from 30 minutes before sunset until 30 minutes after sunrise, on heavy overcast days, in fog, and during periods of darkness or low visibility as directed by the Owner.

E. Channelizing Devices: Channelizing devices shall conform to the requirements of *NCHRP Report 350*, Test Level 3. Channelizing devices shall be selected from those shown on VDOT's Approved List beginning with the applicable purchasing dates. The Contractor shall provide a certification letter stating the brands and models of channelizing devices contained on the listing that will be used. In lieu of using channelizing devices on that listing, the Contractor may use other brands and/or models conforming to the specification requirements provided he submits catalog cuts/brochures of each brand and model prior to their use and complies with the following requirements:

1. Channelizing devices except drums/cones with an auxiliary device attached and portable vertical panel assemblies: A copy of a letter from the manufacturer certifying that the specific channelizing device is crashworthy, i.e., that it will comply with the evaluation criteria specified in *NCHRP Report 350*. This certification may be a one-page affidavit signed by the manufacturer.

2. Drums/cones with an auxiliary device attached, and portable vertical panel assemblies with or without an auxiliary device attached: A copy of the FHWA acceptance letter indicating compliance with *NCHRP Report 350*, Test Level 3 shall be submitted.

The Contractor shall provide, when applicable, a certification letter indicating that the channelizing devices being used that are not on VDOT's Approved List and for which no catalog cuts/brochures and self-certification are being supplied were purchased prior to October 2, 1998, or October 2, 2000, as applicable.

Spacing of channelizing devices shall be in accordance with the *Virginia Work Area Protection Manual.*

a. Group 1 devices shall consist of tubular delineators or cones approximately 36 inches in height for interstate and other limited access roadways and approximately 28 inches in height for other roadways. They shall be used as temporary channelizing devices. When used during hours of darkness, they shall be provided with reflectorized collars or sleeves.

b. Group 2 devices shall be drums or vertical panels. Drums shall be round, or partially round with no more than one flat side; made from plastic; have a minimum height of 36 inches, have a cross-sectional width no less than 18 inches in any direction; and conform to the requirements of the *Virginia Work Area Protection Manual*. Drums shall be designed to allow for separation of ballast and drum upon vehicular impact but not from wind and vacuum created by passing vehicles. Drums of two-piece design, i.e., drum and associated base, shall utilize) sufficient amounts of enclosed sand at the base in accordance with the manufacturer's recommendations to provide stable drum support. The base shall be not greater than 5 inches in height. Two-piece drums may also utilize a flared drum foundation and collar of not more than 5 inches in height and of suitable shape and weight to provide stable support. One-piece drums may be used provided they comply with these above requirements.

Vertical panels shall be mounted on posts conforming to the requirements of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.*

Vertical panels will be allowed only for use in locations indicated in the contract documents. Non-portable vertical panels shall be mounted on posts conforming to the requirements of AASHTO's *Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.*

Open-top drums will not be allowed. Markings on drums shall be horizontally circumferential, alternating from the top of the drum, with orange and white 6-inchwide retroreflective stripes. Each drum shall have a minimum of two orange and two white stripes, and the top stripe shall be orange. Any non-retroreflective areas on the drum except the base shall be orange, and spaces between retroreflective stripes shall not exceed 2 inches

in width.

The Contractor shall furnish and install signs (Stop, chevron, Keep Right, etc.) for the drums as directed by the Owner. Sign panels used on drums tested for conformance with *NCHRP 350*, Test Level 3 requirements shall be of the same material as that used for the test except that materials as allowed by the FHWA acceptance letter may be used when approved by the Owner.

F. Traffic Barrier Service**:** Barrier service shall be of sufficient length to protect traffic and personnel in construction areas.
The Contractor shall continuously prosecute the work until completion once a barrier is in place. If the Contractor does not, the Owner may cause him to discontinue operations in other areas on the project and concentrate efforts behind the traffic barrier service. When construction work is completed to the extent that traffic barrier service is no longer required as determined by the Owner, devices shall be removed.

Neither workers nor equipment shall traverse areas confined by traffic barrier service and travel lanes except as approved by the Owner and then only with adequate flagger service to safeguard workers and traffic in advance of and at the point the traffic barrier service is opened. Barrier openings for construction access may be provided only along tangent sections or along the inside of curved sections and shall be limited to the minimum length required for equipment access. The normal pavement alignment at the barrier opening shall be maintained with removable pavement marking. At ingress openings, the exposed end of the barrier service shall be provided with a temporary impact attenuator as approved by the Owner. At egress openings, the exposed end shall be transitioned as dependent on the posted speed for traffic. The transition flare rate shall comply with the requirements of the *Virginia Work Area Protection Manual*. For speeds below 30 miles per hour, the transition flare rate shall be the same as that indicated for 30 miles per hour. An impact attenuator will not be required at the exposed end of egress openings in barrier service provided the deflection angle between the pavement edge and ends of the barrier service openings is 20 degrees or more.

Delineators shall be installed on traffic barrier service in accordance with the requirements of VDOT Section 702. Barrier vertical panels shall be installed on top of the concrete barrier service. Reflectorized sheeting shall comply with the requirements of VDOT Section 247. Design and installation of barrier vertical panels shall comply with the requirements of the *Virginia Work Area Protection Manual.*

The Contractor shall maintain the structural integrity of the barrier and its alignment while it is in use and shall maintain warning lights, delineators, and other devices in a clean and visible condition at all times.

1. Guardrail barrier service and terminal treatments shall be installed in accordance with the requirements of Section 505 except that the offset distance shall be as specified by the Owner. The Contractor may reuse guardrail used for traffic barrier service guardrail for permanent installation provided the guardrail material conforms to the requirements of Section 505 and the standard drawings and is acceptable to the Owner. Marred galvanized surfaces shall be repaired in accordance with the requirements of VDOT Section 233.

2. Concrete barrier service shall be installed in accordance with the Drawings and standard drawings or as directed by the Owner. When barrier terminates at a guardrail, fixed object attachments connecting the barrier to the guardrail shall be installed in accordance with the applicable standard for fixed object attachment. Installation shall include additional guardrail posts and attachments as required. Concrete barrier connections shall be snug to prevent motion between sections.

Precast concrete parapet for precast concrete parapet traffic barrier service shall be anchored as shown on the Drawings. Anchor holes in bridge decks shall be drilled with a rotary impact drill or other approved equipment that will prevent damage to the deck. Anchor holes shall be located so as to avoid cutting reinforcing steel. Upon removal of the parapet, anchor holes shall be cleaned and filled with Type EP-4 or EP-5 epoxy mortar conforming to the requirements of VDOT Section 243.

Parapet used for concrete parapet traffic barrier service will not be permitted for permanent installations on bridge structures.

The Contractor shall visually inspect all traffic barrier service shipped to a project prior to placing it in use. Concrete barrier sections shall be structurally sound with no concrete missing along the top, bottom, sides, or end sections of the barrier; no through cracks; and no exposed rebar. Any traffic barrier service found by the Contractor or Owner to be unacceptable due to inadequate structural integrity or functionality shall be promptly removed from the project site and replaced at no cost to the Owner. Traffic barrier service shall be selected from those shown on VDOT's Approved List, except that the Contractor may use other traffic barrier service provided he submits a copy of the FHWA acceptance letter indicating compliance with *NCHRP Report 350* prior to it being used.

The Contractor shall maintain the structural integrity of the barrier and its alignment while it is in use and shall maintain warning lights, barrier vertical panels, delineators, and other devices in a clean and visible condition at all times. Concrete barrier service shall be cleaned or coated sufficiently to afford good visibility and uniformity of appearance.

G. Impact Attenuator Service: Impact attenuator service shall be installed at locations shown on the Drawings or designated by the Owner. A modified Type III object marker shall be installed on impact attenuators.

H. Temporary Signalization: When specified on the Drawings, the Contractor shall install and maintain temporary or portable traffic control signal equipment. The Contractor shall submit to the Owner a plan for locating, installing, and maintaining signals that shall depict the Contractor's intent for maintaining traffic flows during construction operations, including type of vehicle detection, phase sequencing, and timings. The Contractor shall receive acceptance of the plan from the Owner prior to beginning work that would necessitate installing the proposed temporary or portable traffic control signals. The Contractor's design shall conform to the requirements of the applicable sections of *AASHTO's 1994 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; MUTCD;* and the *Virginia Work Area Protection Manual*. Existing traffic control signal equipment materials on the project may be used. New, salvaged, or refurbished traffic control signal equipment materials brought to the project shall conform to the contract specifications and standards.

1. Temporary traffic control signals shall conform to the following: the controller, accessory, auxiliary, and conflict monitoring equipment shall conform to the requirements of NEMA TS-1, NEMA TS-2, or as approved by the Owner.

2. Portable traffic control signals shall conform to the following:

   a. phase sequencing, timings, and conflict monitoring complying with NEMA TS-1 (Functional Standards).

   b. 5 programmable day programs within a 24-hour period.

   c. 12-inch traffic signal head sections with backplates mounted in the vertical display arrangement.

   d. vehicular detection that will detect all licensed vehicles unless otherwise indicated in the contract documents.

   e. adequate safeguards to prevent unauthorized entry to the control equipment.

   f. trailer-mounted type with at least one of the two traffic signal heads positioned over the travelway with a minimum 16 feet of clearance from the pavement to the lowest point of the signal head assembly.

   g. operate from its own self-contained power supply with the capability of connecting to an external 110-VAC electrical power supply. When operating from a self-contained solar power supply, the battery backup shall be capable of operating for 18 continuous days at 77 degrees F without solar array assist.

   h. back frame of trailer with 2-inch-high reflective sheeting conforming to the requirements of VDOT Section 247.02(c) installed on the area facing traffic; sheeting shall have alternating 11-inch-wide vertical red stripes and 7-inch-wide vertical white stripes.

   i. designed to comply in the operating mode with loading conditions associated with wind gusts of 80 miles per hour as specified in AASHTO's 1994 Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals.

Temporary and portable traffic control signals that are not specified on the Drawings but are installed by the Contractor for his convenience shall be installed at the Contractor's expense and shall be approved through the process specified herein.

Maintenance and operation of temporary and portable traffic control signals shall be the responsibility of the Contractor and shall be in accordance with the requirements of VDOT Section 703.03(a).

When required, the Contractor shall make arrangements with the local utility company for electrical service for new temporary and portable traffic control signals, which shall include the costs of connection, disconnection, and energy. If electrical service is not available, the

Contractor shall provide a generator capable of continuously operating the temporary and portable traffic control signals for at least 24 hours unassisted. The Contractor shall demonstrate the signal's operational procedures and reliability to the Owner for approval prior to beginning work necessitating use of the signal equipment.

I. Construction Pavement Markings: Construction pavement markings shall be installed at locations shown on the Drawings and in the *Virginia Work Area Protection Manual* and at other locations as directed by the Owner. Construction pavement markings shall be selected from VDOT's Approved List of Construction Pavement Marking Materials. Construction pavement markings are classified as Type D, Classes I and II (removable tape); Type E (non-reflective black removable tape); and Type F, Classes I and II (temporary markings). Construction pavement markings shall be used as follows:

1. Type D construction pavement markings shall be used on final roadway surfaces or in areas where traffic patterns are subject to change before pavement is resurfaced unless the surface temperature of the pavement is below the pavement marking minimum application temperature recommended by the manufacturer. When the surface temperature of the pavement is below the manufacturer's minimum application temperature, a Type F construction pavement marking on the approved list under the same class as the specified Type D construction pavement marking may be used except on final surfaces. The Contractor shall select a Type F product known to perform the best under those temperature conditions. When a Type F construction pavement marking is used in lieu of a Type D construction pavement marking due to the surface temperature being below the manufacturer's minimum application temperature, the Contractor will be paid the price bid for Type D, which will include the Type F markings and any necessary eradication of existing pavement markings.

2. Type E construction pavement markings shall be used to cover existing markings in accordance with (j) herein.

3. Type F construction pavement markings shall be used where the roadway is to be resurfaced prior to changes in the traffic pattern or where pavement is to be demolished and traffic patterns will not change before demolition.

   Construction pavement markings shall be installed in accordance with the manufacturer's recommendations. Application thickness and bead application shall comply with the manufacturer's recommendations except as follows. In the event the manufacturer's recommendation for material thickness and quantity of beads is less than that used when the material was tested by the National Transportation Product Evaluation Program (NTPEP), the minimum values used during product installation shall conform to the NTPEP test values that are indicated on the approved list for the specific marking. The Contractor shall furnish a copy of the manufacturer's installation recommendations including the thickness, bead embedment, and dispersement to the Owner.

   The Contractor shall maintain the construction pavement markings and shall correct any deficient markings by reapplying markings. Deficient construction pavement markings are considered to be any markings that do not provide adequate guidance to motorists due to inadequate retroreflectivity or color qualities or due to problems

with adherence to the pavement. The Owner will make a visual nighttime inspection of all construction pavement markings to identify areas of markings that have inadequate retroreflectivity qualities.

Those markings that have inadequate retroreflectivity qualities as determined by the Owner shall be replaced by the Contractor with the following exceptions:

a. Reapplication of skip line construction pavement markings is not required unless the inadequate retroreflectivity qualities are for at least two consecutive skip lines.

b. Reapplication of center; line, except skip lines; or edge line construction pavement markings is not required unless the inadequate retroreflectivity qualities are for at least a continuous section of 70 feet.

c. Reapplication of transverse markings is not required unless the inadequate retroreflectivity qualities are for at least a continuous section exceeding 3 feet.

In lieu of replacement of construction pavement markings based on visual observations by the Owner, the Contractor may have retroreflectivity readings made. These measurements shall be taken within 48 hours after the Contractor has been notified of the deficient markings except additional time will be granted due to inclement weather that prevents the adequate measurement of the markings. The Contractor shall brush any form of debris from the line before performing the measurements. Measurements shall be taken in the presence of the Owner using Contractor-furnished equipment conforming to the requirements of ASTM E 1710. The Contractor shall operate the equipment in accordance with the manufacturer's instructions, and a copy of such instructions shall be provided to the Owner. The photometric quantity to be measured is the coefficient of retroreflected luminance (RL), which shall be expressed as millicandelas per square foot per footcandle. Measurements shall be taken at three random locations within each area of markings that have inadequate retroreflectivity qualities. When the length of the visually inadequate area is greater than 1 mile, measurements shall be taken at three locations per mile segment or portion thereof. Measurements for all lines shall be taken in the middle of the line horizontally. Measurements for skip lines shall be taken in the middle of their length. Measurements for transverse lines shall be taken outside of the wheel path locations. The Owner will designate the locations along the line segments where the measurements shall be taken. The Contractor shall make a log of the measurements and their locations and provide a copy to the Owner. When the average of the three readings for an area is below 100 millicandelas per square foot per footcandle, the Contractor shall reapply the markings as indicated.

Construction pavement markings that no longer adhere to the pavement shall be reapplied by the Contractor with the following exceptions:

d. Reapplication of skip line construction pavement markings is not required unless the markings do not adhere for at least two consecutive skip lines.

e. Reapplication of center; lane, except skip lines; or edge line construction

pavement markings is not required unless the markings do not adhere for at least a continuous section of 70 feet.

f. Reapplication of transverse markings is not required unless the markings do not adhere for at least a continuous section exceeding 3 feet.

However, all construction pavement markings that no longer adhere to the roadway that may cause guidance problems for motorists shall be removed by the Contractor.

Removable construction pavement markings shall be replaced on time frames as recommended by the manufacturer of the marking to prevent the need for eradication. The Contractor shall furnish a copy of the manufacturer's recommendations to the Owner.

Those construction pavement markings found in need of reapplication in accordance with these requirements shall be reapplied by the Contractor at no additional cost to the Owner with the following exceptions:

g. Markings that have been under traffic for more than 90 days will be paid for at the contract unit price when needing reapplication unless the manufacturer's warranty coverage is still in effect.

h. Markings damaged by the Owner's snow removal or other maintenance and construction operations will be paid for at the contract unit price.

Construction pavement markings shall be replaced in accordance with the time requirements of Section 704.

Eradication for reapplication of Type F construction pavement markings is not required if allowed by the marking manufacturer provided the existing marking is well adhered and the total thickness of the existing and reapplied marking combined will not exceed 40 mils. If not well adhered, 90 percent of the existing markings shall be removed prior to reinstallation of the markings.

Temporary pavement markers shall be installed with construction pavement markings in accordance with (k) herein.

J. Eradicating Pavement Markings**:** Markings that may conflict with desired traffic movement, as determined by the Owner, shall be eradicated as soon as is practicable: either immediately prior to the shifting of traffic or immediately thereafter and prior to the conclusion of the workday during which the shift is made.

Eradication shall be performed by grinding, blasting, or a combination thereof. Grinding shall be limited to removal of material above the pavement surface except when removing thermoplastic and preformed tape markings, which may be removed by grinding alone. Blasting shall be used on both asphalt concrete and hydraulic cement concrete pavements to remove all other types of markings. Other methods may be submitted for approval by the Owner. The Contractor shall ensure that the roadway surface is damaged as little as possible when performing the eradication.

When eradicating pavement markings, the Contractor shall ensure workers are protected in conformance to the requirements of *Occupational Safety and Health Administration's (OSHA)* standards as detailed in 29 CFR 1910 or 1926, whichever is the most stringent at the time. The Contractor shall collect the eradication residue during or immediately after the eradication operation, except dust shall be collected during the entire operation. Eradication residue from the removal of any pavement markings is considered to be a non-hazardous waste material and shall be disposed of in a properly permitted waste disposal facility in accordance with state and federal laws and regulations. Testing of the eradication residue for the eight Resource Conservation Recovery Act metals will not be required.

When markings are removed for lane shifts or transitions, 100 percent of the marking shall be removed.

Non-reflective removable black construction pavement marking may be used to cover existing markings in lieu of eradication on asphalt concrete surfaces when its use will not be required for more than 120 days and when specified as a pay item. The Contractor shall use this material to cover markings as indicated in the Drawings or as directed by the Owner. Non-reflective removable black construction pavement marking shall be applied in accordance with the manufacturer's recommendations.

K. Temporary Pavement Markers**:** Temporary pavement markers shall be installed with construction pavement markings, except non-reflective removable markings, in transition (lane drop) or lane shift areas of work zones that will encroach upon the traveled roadway for a period of more than 3 days and in other areas as required by the Owner.

Temporary pavement markers shall be installed on 20-foot centers in lane shift and transition areas. When temporary pavement markers are required in other areas, they shall be installed on 40-foot centers unless otherwise required by the Owner. Temporary pavement markers shall be located between and in alignment with broken lines and beside solid line pavement markings. Where double-line pavement markings separating traffic are installed, two-way markers shall be installed beside each line. The Contractor may install two one-way markers in lieu of each two-way marker at no additional cost to the Owner.

Temporary pavement markers shall be installed with a hot-applied bitumen adhesive except epoxy may be used on hydraulic cement concrete roadways and non-final surfaces of asphalt concrete roadways. Damage to the pavement by removal of markers shall be repaired in kind by the Contractor at no additional cost to the Owner.

Temporary pavement markers found in need of replacement shall be replaced by the Contractor at no additional cost to the Owner except those markers damaged by the Owner's snow removal operations or other maintenance and construction operations will be paid for at the contract unit price.

L. Detours: Where temporary structures are necessary, they shall be designed and provided by the Contractor and of sufficient strength, width, and design to accommodate the volume and character of traffic using the highway. Temporary structures crossing waterways shall provide necessary hydraulic openings to accommodate the flow of the waterway. Temporary structure designs shall be submitted to the Owner for review.
When a detour is no longer required, as determined by the Owner, it shall be promptly removed, and the materials shall be disposed of as approved or directed by the Owner. The

Contractor shall design and provide temporary drainage facilities of adequate size to carry the normal flow of the existing drainage or waterway.

M. Aggregate Material: Aggregate material shall be placed at crossovers, private entrances, and mailbox turnouts and where specified by the Owner.

N. Construction Pavement Message Markings: Markings shall be installed at locations designated on the Drawings and as determined by the Owner and shall consist of messages that comply with the requirements of Section 704. Construction pavement message marking material including maintenance of the markings shall comply with the requirements for construction pavement markings. Retroreflective measurements shall be taken out of the wheel path locations, and each separate entity of a pavement message marking shall be replaced when the average of the three readings for the entity is below 100 millicandelas per square foot per footcandle.

O. Type III Barricades: Type III barricades shall conform to the requirements of *NCHRP Report 350*, Test Level 3, be at least 4 feet in width, and be selected from those shown on VDOT's Approved List. The Contractor shall provide a certification letter stating the brands and models of Type III barricades on the listing that will be used. In lieu of using Type III barricades on that listing, the Contractor may use other brands and/or models provided that prior to their use he submits a copy of the FHWA acceptance letter indicating their compliance with *NCHRP Report 350*, Test Level 3.

P. Truck-mounted Attenuators: Truck-mounted attenuators shall conform to the requirements *of NCHRP Report 350*, Test Level 3.

Prior to their use, the Contractor shall submit catalog cuts/brochures of the truck-mounted attenuator and a copy of the FHWA's acceptance letter documenting acceptance of the specific truck-mounted attenuator

The truck-mounted attenuator shall be no less than 72 inches wide and no more than 96 inches wide. The color of the truck-mounted attenuators shall be yellow or orange.

The rear panel shall have alternate 6-inch-wide orange and black chevron (inverted V) stripes. Stripes shall be sloped at a 45-degree angle downward in both directions from the upper center of the rear panel. Stripes shall be fabricated from fluorescent orange prismatic lens reflective sheeting conforming to the requirements of VDOT Section 247.02(e).

The weight of the support truck shall be as recommended by the manufacturer of the truck-mounted attenuator. The Contractor shall provide a copy of the manufacturer's recommendation to the Owner and a copy of a weigh ticket for the truck. The weigh ticket shall contain adequate information to associate the ticket with the applicable truck. Additional weight may be added to the support vehicle to achieve the range recommended by the manufacturer of the truck-mounted attenuator provided the total weight is within the Gross Vehicle Weight Recommendation of the support vehicle and is installed such that no movement will occur during impacts.

The support vehicle shall have at least one rotating amber light or high-intensity amber strobe light functioning while in operation in accordance with the *Virginia Work Area Protection Manual* (visible for 360 degrees). When allowed by the *Virginia Work Area*

Protection Manual, an electronic arrow operated in the caution mode may be used in lieu of the rotating or high-intensity amber strobe light.

The transmission of the support vehicle with the truck-mounted attenuator in use shall be in second gear, except for those with an automatic transmission, which shall be in park. The parking brake shall be applied and the front wheels aligned straight ahead when operating in the stationary mode.

Limitations: Support vehicles shall not be used for other purposes while the truck-mounted attenuator is being used. There shall be no additional devices in the bed of the support vehicle except the additional weight as allowed in this Section and traffic control devices such as truck-mounted electronic arrows. There shall be no additional devices, including, but not limited to, signs, lights, and flag holders attached to the truck-mounted attenuator except those that were tested on the truck-mounted attenuator and provided by the manufacturer of the truck-mounted attenuator.

In the event the truck-mounted attenuator is impacted, resulting in damage that would cause the unit to be ineffective, all work requiring the use of the truck-mounted attenuator shall cease until such time that the Contractor can provide an acceptable unit by means of repair or replacement.

Work performed in conjunction with (I), (J), (K), and (N) herein shall be performed in accordance with the requirements of VDOT Section 704 except as noted herein.

Replacement and correction of ineffective work zone traffic control devices**:** These shall be accomplished in accordance with the *American Traffic Safety Service Association's (ATSSA) Quality Standards for Work Zone Traffic Control Devices* with the following additions and exceptions:

1. Requirements herein for replacement and correction of construction pavement markings shall be used in lieu of the requirements in the section entitled "Evaluation Guide Pavement Tape & Raised Pavement Markers."

2. The categories for "Arrow Panel (Flashing Arrow and Double Arrow Mode)" shall be replaced by the following:

   Acceptable: No lamps out in stem and arrow head(s), and dimming properly.

   Marginal: No more than 1 lamp out in the stem and no lamps out in the head(s), and dimming properly.

   Unacceptable**:** Any lamp out in the head(s) or more than 1 lamp out in the stem, or arrow panel not dimming properly.

3. "Arrow Panel (Caution Mode - Bar or Corners)" shall be replaced by the following:

   EVALUATION GUIDE - ARROW PANEL (CAUTION MODE - CORNERS)

   Acceptable: No lamps out and dimming properly.

Unacceptable**:** Any lamp out or arrow panel not dimming properly.

Any operating lamp that is out of alignment will be considered not functioning.

4. The "unacceptable" category for arrow panels shall necessitate immediate corrective action if the device is found in operation on the jobsite.

Q. Portable Changeable Message Sign (PCMS):
Units shall be self-contained, including message board, power supply, and trailer. The controller head shall have a back-up system to prevent loss of memory. The trailer and sign frame shall be painted federal yellow or Virginia Highway Orange (DuPont Color #LF74279 AT or color equivalent). The sign panel support shall provide for an acceptable roadway viewing height that shall be not less than 7 feet from bottom of sign to crown of road.

The message board shall provide for 3 lines of legend and shall be formed of characters no less than 18 inches high. Each line shall be composed of at least eight characters and each character module shall at a minimum use a five-wide by seven high pixel matrix. The message shall be composed from keyboard entries. The message shall be legible in any lighting condition. Motorists should be able to read the entire PCMS message twice while traveling at the posted speed.

The sign shall be capable of sequentially displaying at least 3 messages of 3 lines each with appropriate controls for selection of messages and variable off-on time.

The Contractor shall determine from its plan of operations or working schedule the most efficient and effective use of the PCMS units based on its construction sequencing or traffic control operations. PCMS signs shall be periodically checked by the Contractor for compliance with manufacturer's requirements for operation and functions, and shall be ready for immediate use once employed on the project.

During emergency situations the Contractor shall make every effort to deploy units it has assigned to the project. However, if the number of units shown on the Drawings are already in operation and cannot be reassigned to handle the emergency situation, then the Contractor shall immediately contact the Owner. The Owner will then make a determination as to the most expeditious manner in which to deploy units for emergency use, whether by using Owner supplied units, directing the Contractor to reassign those units he has committed to the project, or having the Contractor supply additional units as may be necessary. In these circumstances, the cost for such additional units that are authorized by the Owner shall be in accordance with the requirements of Section 109.II.

If the use of additional units beyond the number of those identified in the Drawings is required due to reasons attributable to the Contractor or his manner of operations as determined by the Owner, and no units are available, the Contractor shall furnish such additional unit(s) to the project within two hours of the Owner's request or the Owner will move to provide such units as necessary and deduct the cost from any monies due the Contractor. This action shall in no way relieve the Contractor of the responsibility for controlling, maintaining, and completing the work.

The number of units estimated by the Owner to be used for the project will be as shown on

the Drawings. The number of units and hours of use estimated by the Owner was based on the suggested Sequencing of Construction shown in the Drawings and may be different from the Contractor's own construction plan.

III. MEASUREMENT FOR PAYMENT

A. Flagger service will be measured in hours as authorized or approved by the Owner except when used for the Contractor's convenience, such as for ingress and egress for moving construction equipment or materials. In such cases, payment will not be made for flagger service. Flagger service will be paid for at the contract unit price per hour. This price shall include paddles, safety equipment, and portable traffic control signals.

B. Pilot vehicles will be measured in hours of actual use, as required by the Owner, and will be paid for at the contract unit price per hour. This price shall include vehicles, necessary warning devices, drivers, fuel, and maintenance.

C. Electronic arrows will be measured in hours of actual use, as required by the Owner, except when used as an option to the use of a rotating amber light or alternating high-intensity amber strobe light. In such cases, payment will not be made for electronic arrows. Electronic arrows will be paid for at the contract unit price per hour. This price shall include arrow panels, fuel, maintenance, and a truck or trailer having flashing amber warning lights.

D. Warning lights for use on sign panels will be measured in days of actual use for the type specified and will be paid for at the contract unit price per day. This price shall include maintaining, relocating, and removing warning lights. Warning lights installed on traffic barrier service will not be measured for separate payment, but the cost thereof shall be included in the linear foot price bid for traffic barrier service.

E. Group 1 channelizing devices will not be measured for separate payment. The cost thereof shall be included in the price for other appropriate pay items.

F. Group 2 channelizing devices, as required by the Owner, will be measured and paid for at the contract unit price per day. This price shall include maintaining devices, removing devices when no longer required, and signs. When Group 2 channelizing devices are moved to a new location or are removed and re-installed at the same location, they will be measured for separate payment. However, when the Group 2 channelizing devices are moved from one lane to another by simply moving the devices across the lane edge line without removal from the roadway, no additional payment will be made.

G. Traffic barrier service will be measured and paid for at the contract unit price per foot per location. This price shall include warning lights, delineators, barrier vertical panels, fixed object attachments, patching restraint holes, maintaining, and removing when no longer required. When fixed object attachments are used on traffic barrier service in locations where existing guardrail is in place, this price shall include restoring existing guardrail to its original condition. When traffic barrier service is moved to a new location as directed or approved by the Owner, the relocation will be measured for separate payment. Payment for traffic barrier service will not be made until the work behind the barrier is actively pursued.

H. Traffic barrier service guardrail terminal will be measured and paid for in units of each or

linear feet, as applicable, which price shall include furnishing, installing, and removing when no longer needed. When traffic barrier service guardrail terminal is moved to a new location, as directed or approved by the Owner, the relocation will be measured for separate payment.

I. Impact attenuator service will be measured and paid for at the contract price per each. Impact attenuators used with barrier openings for equipment access will not be measured for separate payment.

J. Temporary traffic control signal will be paid for on a lump sum basis. This price shall include, but not be limited to, poles; span wire; conduit; conductor cable; traffic signal heads; backplates; hanger assemblies; necessary control items; vehicle detection; and, when approved, portable traffic control signal equipment. The price shall also include maintaining, adjusting, and aligning equipment; providing electrical service; utility company costs; and removing equipment when no longer required.

K. Construction pavement markings will be measured and paid for at the contract unit price per linear foot. This price shall include marking materials, preparing the surface, adhesive, maintaining, removing removable markings when no longer required, inspections, and testing. Those construction pavement markings found in need of reapplication in accordance with these requirements shall be reapplied by the Contractor at no additional cost to the Owner with the following exceptions:

1. Markings that have been under traffic for more than 90 days will be paid for at the contract unit price when needing reapplication unless the manufacturer's warranty coverage is still in effect.

2. Markings damaged by the Owner's snow removal or other maintenance and construction operations will be paid for at the contract unit price.

L. Construction pavement message markings will be measured and paid for at the contract unit price per each. This price shall include marking materials, preparing the surface, adhesive, and maintaining and removing removable markings when no longer required.

M. Temporary pavement markers will be measured and paid for at the contract unit price per each. This price shall include furnishing and installing pavement markers, surface preparation, adhesive, maintaining and replacing lost or damaged markers, and removing the pavement markers and adhesive when no longer required.

N. Eradication of existing pavement markings will be measured in linear feet of a 6-inch width or portion thereof. Widths that exceed a 6-inch increment by more than 1/2 inch will be measured as the next 6-inch increment. Eradication of existing pavement markings will be paid for at the contract unit price per linear foot. This price shall include removing pavement line markings and messages and disposal of residue.

O. Temporary detours will be measured in linear feet along the centerline of the detour or by individual components with the quantities shown on the Drawings as maintenance of traffic items, in which the components will be measured in accordance with the applicable specifications. This price shall include removing and restoring. When a pay item, temporary detour will be paid for at the contract unit price per linear foot. This price shall include excavating, aggregate materials, drainage items, grading, asphalt, maintaining and removing

detour, disposing of surplus and unsuitable material, and restoring property.

P. Aggregate material will be and paid for at the contract unit price per ton for the type specified. This price shall include preparing the grade and furnishing, placing, maintaining, and removing material as required.

Q. Type III barricades will be measured and paid for at the contract bid price per each for the width specified. Multiple 4-foot-wide Type III barricades may be used together to obtain the width being specified in the pay item. This price shall include the barricades; retroreflective sheeting; and maintaining, relocating to new locations, and removing the barricades when no longer required.

R. Construction signs will be measured and paid for at the contract price per square foot. This price shall include furnishing, installing, maintaining, covering and uncovering, relocating, and removing temporary sign panels, sign supports, hardware, delineators and flags. Payment based on square footage shall be compensation for the sign(s) for the duration of the project; multiple payments for the same sign used more than once will not be allowed.

S. Truck-mounted attenuator will be measured in hours of actual use and will be paid for at the contract unit price per hour. This price shall include the truck-mounted attenuator; support vehicle; lights; electronic arrows if allowed but not required; and maintenance. When electronic arrows are used at the option of the Contractor in lieu of the rotating or high-intensity amber strobe light, the cost of the electronic arrow shall be included in the price bid for truck-mounted attenuators. When electronic arrows are required and not only allowed on the truck-mounted attenuator support vehicles, they will be paid for separately.

T. Portable traffic control signal will be paid for on a lump sum basis. This price shall include portable traffic control signal equipment; installation; energy source; and maintaining, adjusting, aligning, removing, and relocating equipment.

U. Portable changeable message sign will be measured and paid for in hours of use, which price shall be full compensation for furnishing or mobilizing the unit(s) to the project, maintenance, operation, and repositioning the unit(s).

End of Section