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March 1, 2006

Supplemental Specifications - Section 700

of the

Standard Specifications for Road and Bridge Construction

701.13-Method of Measurement. Add the following as the second paragraph:

Handicap Ramps will be measured by the ft.² (m²) complete in place as specified by standard drawings. The area shall be obtained by surface measurements. Where standard widths are constructed, the measurements shall not exceed the standard widths shown on the Plans, unless approved in writing by the Engineer.

Subsection 701.14-Basis of Payment. Revise paragraph to include Handicap ramps as follows:

The accepted quantities of Concrete Sidewalk of each thickness, Handicap Ramps, and Concrete Driveway will be paid for at the contract unit price per ft.² (m²) for the respective items, complete in place. The accepted quantities of Concrete Median Pavement will be paid for at the contract unit price per yd³. (m³), complete in place.

Subsection 705.06: Delete the second and third paragraph, and add the following as the second, third, and fourth paragraph. Revise the bulleted section as shown below.

All post holes, dug or drilled, shall be of such size as will permit proper setting of the posts, and allow sufficient room for backfilling and tamping.

When solid rock is encountered while drilling post holes.

- Within 18 in. (460mm) of the ground surface, an oversized or elongated hole shall be drilled 24 in. (610mm) into the rock. The post shall be set at the roadside edge of the hole and the hole should be backfilled with the cutting spoils. If using wooden posts the oversized hole shall be a single hole 23 in. (580mm) in diameter or three overlapping holes 10 in. (250mm) in diameter to a length of 23 inches. For steel posts, the oversized hole shall be a single hole, 20 in. (530mm) in diameter or three overlapping holes 8 in. (203mm) in diameter to a length of 20 inches.
- Below 18 in. (460mm) of the ground surface hole shall be drilled 12 in. (300mm) into the rock or to the specified depth in Plans. The holes shall be 8 in. diameter for steel posts, and 12 in. diameter for wood posts.
- When installing end terminals using tubes, posts 1 and 2 will be installed to full depth or a minimum of 36 in. into the solid rock. The holes around the steel tube shall be backfilled with the cutting spoils.

- See approved shop drawings for additional information concerning post depth, and size of holes.

To validate proper installation of posts, each guardrail contractor/installer doing work for the Department shall have a minimum of 5 line posts and 5 terminal posts per Region per year pulled by the Department for verification of length. The Regional Construction and Materials and Tests offices may select any post for verification, but at a minimum, must select posts from five different runs of rail. If the posts are found to be in accordance with the plans and specifications, they may be re-installed if they were not damaged during the pulling process. If the post length is found to be deficient, the contractor/installer shall be required to remove the entire run of guardrail or end terminal and replace it properly at his expense.

Subsection 705.10: Add to the end of the section

When no contract unit price has been established for drilling or boring in solid rock, for posts, while placing Single Guardrail, payment for each hole shall be made at a rate equal to 2.0 times the contract unit price for Single Guardrail.

While drilling or boring into solid rock for posts placed in conjunction with Guardrail at Bridge Ends, Parapets, Piers, Concrete Endposts, and other similar edifice, payment shall be made at a rate equal to 1.25 times the contract unit price per hole.

When no unit price has been established for drilling or boring into solid rock for End Terminals posts, payment shall be made at a rate equal to 2.0 times the contract unit price for single guardrail per hole.

Unless posts are driven to refusal in solid rock, prior to drilling or boring, no additional payment will be made for drilling or boring for the placement of posts.

Subsection 709.01, Revise entire subsection to the following:

709.01-Description. Riprap shall consist of furnishing and setting or placing, rubble stones, crushed stone, sacked sand-cement, machined riprap, and embedded riprap. Slope Pavement shall consist of the construction of a reinforced concrete mat on prepared slopes. The riprap and slope pavement shall be constructed within reasonably close conformity to the lines, grades, and cross sections, and at the locations indicated on the Plans or as directed by the Engineer, and in conformity with the requirements and provisions of these Specifications.

Subsection 709.02, Revise entire subsection to the following:

709.02-Materials. Materials used in the construction of riprap and slope pavement, in addition to meeting the general requirements of these Specifications, shall conform to the following:

- (a) Rubble-stone Riprap shall consist of stone or broken Class "A" or paving concrete meeting the requirements of **Subsection 918.10**. In addition, at least 80% of the stone shall have a minimum dimension of 10 in.(250 mm). The remainder shall be 2 to 4 in.(50 to 100 mm), and shall be approximately rectangular and/or trapezoidal in shape. Broken Class "A" or paving concrete shall be free of steel and wire fabric reinforcement. Sand for rubble-stone riprap(grouted) shall meet the requirements of **Subsection 903.01** or **903.02**. Cement for rubble-stone riprap(grouted) shall meet the requirements of **Subsection 901.01**.

- (b) Sand for sacked sand-cement riprap shall be manufactured or natural sand and shall meet the quality requirements of **Subsection 903.01** or **903.02**. Cement for sacked sand-cement shall meet the requirements of **Subsection 901.01**. Sacks shall be of either cotton or jute, standard grade of cloth, which will hold the sand-cement mixture without leakage during handling and tamping. They shall be strong and shall be sized to hold approximately 1 c.f.(0.03 mm³).
- (c) Reinforced concrete slope pavement shall be composed of Class A concrete meeting the requirements of **Subsection 604.03** and steel reinforcement meeting the requirements of **Subsection 907.01** or **907.03**, whichever is specified. Preformed expansion joint filler shall meet the requirements of **Subsection 905.01**.
- (d) Concrete curing materials shall meet the requirements of **Section 913**.
- (e) Machined Riprap shall be clean shot rock essentially free of sand, dust or organic materials and shall be the size designated for the class specified. The stone shall be uniformly distributed throughout the size range. The thickness of the stone layer shall be that designated for the specified class herein unless otherwise noted on the Plans. Sensitive areas of the project as indicated on project plans, project permits, and/or designated by the Engineer requiring washed and/or clean rock will be provide by the contractor at no additional cost to the project. Washed and/or clean rock must be approved by Engineer prior to placement in environmentally sensitive areas.

When rock or stone is used as riprap, the material when subjected to five alternations of the sodium sulfate soundness test (**AASHTO T 104**), shall not have a weighted percentage of loss of more than 12. The material shall be approved by the Engineer before use.

Subsection 709.08: Second paragraph, **Change** “sawed for a depth of 1 ft.” to “1 in.”

Subsection 709.09, Revise entire subsection to the following:

709.09-Machined Riprap. The Contractor shall exercise care in the preparation of the riprap subgrade to insure that no reduction in the design waterway occurs. No riprap is to be placed until the final subgrade elevation has been verified by the Engineer. When deemed necessary by the Engineer, the riprap shall be rolled down with metal tracked equipment to provide a more dense stone mass with final contours in reasonable conformance to the plans. Placement of the super-structure shall not proceed until the final elevation of the riprap has been accepted by the Engineer.

Upon completion of the work, visual inspection shall reveal that approximately 50% of the surface area consists of stones no smaller than 1/2 of the maximum size specified.

The material shall be dumped and placed by the use of appropriate power equipment in a manner that will produce a surface uniform in appearance. Hand work may be required to correct irregularities.

The Contractor shall exercise care in the preparation of the site referring to erosion control in accordance with the provisions in Subsection 209 and channel excavation in accordance with the provision of Subsections 203.02(c). When required by project plans, permits, or as directed by the engineer, embedded riprap in streams, conveyances, diversions, or other sensitive areas shall be properly tamped into the subsurface or otherwise blended into the substrate. Care is to be taken so that water flows over the embedded riprap and that flow is not lost below and/or within

the rock. If clean rock is required by the project plans, permit, or directed by the engineer, the rock shall meet the provisions of Subsection 709.02 for clean rock.

Subsection 712.01: Add to the end of paragraph 1.

This work shall include both installing additional devices as necessary in construction work zones.

Subsection 712.04: Remove entire subsection text and replace with the following:

General. At the Pre-construction Conference the Contractor shall designate a responsible person who will be assigned to the project to supervise traffic control.

Signs shall be erected in a workmanlike manner such that all supports are plumb, sign panels generally perpendicular to the travelway and legends horizontal so that they effectively convey the intended message. Advanced warning signs shall not be displayed more than 48 hours before physical construction begins. Signs may be erected up to 1 week before needed, if the sign face is fully covered, in a manner approved by the Engineer. The sheeting of the sign shall be free of any damage that would reduce the reflectivity. The use of overlay plates on signs is prohibited. Signs shall be mounted on stationary or portable supports dependent on the type work being performed. Sign supports shall be driven a minimum of 3.5 ft. (1 m) into soil or 1 ft. (300 mm) into solid rock. Where soil and solid rock are both encountered, the depth of the sign support in the ground shall be:

- d1 + 3.33d2 = 1, where
- (d1 + 3.5d2 = 42)
- d1 = depth in m (in.) of support in soil
- d2 = depth in m (in.) of support in solid rock

Stationary sign supports may be spliced, provided the splice is a minimum of 18 in.(450 mm). In addition, the stubs for the splice shall be driven as required above and shall not extend above 18 in.(450 mm) from ground level. The splice shall be fastened with four bolts, 2 placed at each end of the splice. In general, work being performed at spot locations and of short duration will necessitate the use of portable supports properly weighted for stability.

During periods of non-use, warning signs and other devices shall be removed from the work area, covered or otherwise positioned so they do not convey their message to the traveling public and do not present a safety hazard to drivers. If covered, the covering material shall be maintained in a neat and workmanlike manner during its use. The method of covering the sign face shall not deface or damage the sheeting of the sign.

Barricades and other devices that require lighting shall be lighted, as designated by plans details or as directed by the Engineer, with the use of flashing or steady burning lights. The Contractor will be responsible for procuring and bearing the expense of a continuous power source.

Flaggers with proper attire and paddle shall be provided when necessary to safely handle traffic through the construction zone. Flaggers will be considered a general requirement of traffic control and no direct payment will be made for such.

All Uniformed Law Enforcement Officers working on TDOT projects shall have training from a Peace Officer Standards and Training (POST) certified police training academy in the State of Tennessee.

All Uniformed Law Enforcement Officers working within TDOT work zones shall have an additional 4 hours of FHWA approved work zone training by December 31, 2010. Record of this training shall be submitted to the Project Engineer.

The Flashing Arrow Board(s) shall be installed at locations shown on the Plans or as directed by the Engineer and shall comply with all requirements of the "**Manual on Uniform Traffic Control Devices for Highways and Streets**"(MUTCD). The Contractor shall take all necessary precautions to insure that the Flashing Arrow Board(s) perform as described herein. Any Flashing Arrow Board that exhibits any type of malfunction including improper dimming shall be corrected or replaced immediately.

The Flashing Arrow Board shall be capable of displaying the following configurations:

1. Right Arrow - 10 lamps flashing in unison forming an arrow
2. Left Arrow - 10 lamps flashing in unison forming an arrow
3. Double Arrow - 5 lamps in each arrow head and 3 lamps in a common shaft all flashing in unison
4. Four Point Caution - 4 outermost corner lamps flashing in unison

The Flashing Arrow Board(s) shall be used in the single arrow mode for lane closure only and shall be situated and aligned so that the flashing arrow is clearly visible and legible. The single arrow mode display shall have 10 lamps flashing in unison. The sequential arrow configuration, chevron arrow configuration, and horizontal bar configuration will not be allowed. The flash rate shall not be less than 25 flashes per minute or more than 40 flashes per minute. Minimum lamp "on-time" shall be 50% of the cycle.

The Flashing Arrow Board(s) shall be mounted so as to provide a minimum of 7 ft.(2.1 m) between the bottom of the panel and the roadway.

Portable signs may be used when the duration of the work is less than three (3) days or as allowed by other conditions in the proposal. All portable signs and sign mounting devices utilized in work shall be **NCHRP 350** compliant. When not being used, portable signs must be removed from the clear zone. Turning signs sideways or backwards is explicitly prohibited while the signs are in the clear zone. Portable interim signs shall be mounted a minimum of one (1) foot above the level of the pavement edge and shall be mounted at the height recommended by the manufacturer's crashworthy testing requirements.

All regulatory sign blanks shall be rigid.

The Contractor shall make every effort to eliminate the use of interim signs as soon as the Work allows for the installation of permanent signs.

Existing street name signs shall be maintained at street intersections.

Any sign(s) or portions of a sign(s) that are not applicable to the traffic control plan shall be covered so as not to be visible to traffic or shall be removed from the roadway when not in use.

The Contractor shall not remove any existing signs and supports without prior approval from the Engineer. All existing signs and supports that are to be removed shall be stored and protected if this material will be required later in the work.

Interim guide, warning, or regulatory signs required to direct traffic shall be furnished, installed, reused, and maintained by the Contractor in accordance with the **MUTCD**. The bottom of all interim signs shall be mounted at least seven (7 ft.) feet above the level of the pavement edge when the signs are used for long-term stationary operations as defined by Section 6G.02 of the **MUTCD**.

Existing guide and exit directional signs on the Project shall be maintained until conditions require a change in location or legend content. When change is required, the signs shall be in accordance with the Traffic Control Plan. When an existing guide and exit directional sign is in conflict with work to be performed, the Contractor shall remove the conflicting sign and reset it in a new, non-conflicting location that has been approved by the engineer.

When it is not possible to utilize existing signs, either in place or relocated, the Contractor shall furnish, erect, maintain, modify, relocate, and remove new interim guide and exit directional signs in accordance with the Plans or as directed by the engineer.

The installation of new permanent guide and exit directional signs and the permanent modification or resetting of existing guide and exit directional signs, when included in the contract, shall be accomplished as soon as practical to minimize the use of interim guide and exit directional signs.

Worker Visibility and Safety. All workers within the right-of-way of a project who are exposed to either vehicular traffic or to construction equipment in the work area shall wear high-visibility safety apparel. High-visibility apparel shall be considered personal protective clothing that meets performance Class 2 or Class 3 of the ANSI/ISEA 107-2004 publication. Class 3 apparel shall be required for night work.

Portable Barrier Rail. All portable barrier rail will be placed as far away from the travel lanes as possible while serving the intended purpose. All portable barrier rail will be moved or removed as directed by the engineer. There shall be no additional payment for removing barrier that is no longer required.

Lane Closures. The length of a lane closure should be held to the minimum length required to accomplish the Work. The advanced warning signs for the project should not overlap with the advanced warning signs for lane shifts, lane closures, etc.

Drums shall be used in all transition tapers for lane closures on multi-lane roads

Night Work Lighting. When night work is required by Contract documents or plans, the Contractor shall supply sufficient lighting according to the following Specification.

The following information regarding the lighting plan must be submitted to the project supervisor:

- Descriptions and sketches of the layout of lighting devices including spacing, luminary height, lateral placement and anticipated illuminance provided.
- Photometric & physical specifications of all lighting equipment.
- Detailed description of all lighting to be used on construction equipment.
- Methods to be employed to reduce glare.
- Contractor's frequency and procedure for checking illumination levels.

In addition to their standard protective equipment, the following information regarding construction personnel and equipment shall be followed as a minimum:

1. Traffic Control Persons, all equipment operators and all other workers shall wear high-visibility apparel that meets performance Class 2 or Class 3 of the ANSI/ISEA 107-2004 publication. Class 3 apparel shall be required for night work.
2. They shall also have a minimum of 12 in² of reflective material added to their hard hats which is visible from all sides.
3. Traffic Control Persons must also be equipped with a flashlight complete with semi-transparent red cone.
4. All traffic control persons shall be equipped with radios or cell phones so that they have communication with each other.
5. All workers shall receive specific training on night work operations.
6. All vehicles in the work area must operate rotating or flashing incandescent amber lights visible in 360 degrees around the vehicle.
7. All work vehicles including trucks must have red and white reflective tape applied to all sides such that it defines the outline of the vehicle.

The following equipment will be outfitted with non glare balloon style lights or equivalent. The lights will be required on each piece of equipment in operation.

<u>Equipment Type</u>	<u>Illuminance Requirement</u>
Paver, Milling Machine, Material Transfer Devices	1- 4000 watt assembly or 2 - 2000 watts assemblies
Grader, Roller, Rumble Strip Machine, Shoulder Machine	1 – 400 watt assembly
Paint truck	1- 400 watt assembly or nonglare 300 watt floodlight assembly
Guardrail driver, stationary Operation	1- 4000 watt assembly or 2 - 2000 watts assemblies or equipment light plant
Trail Vehicle	1-4000 watt assembly or 2 - 2000 watts assemblies

(A trail vehicle will be required to follow the last piece of equipment in a mobile operation(i.e. finish roller, pavement marking, etc.) depicting the beginning of the working area. In addition, portable lighting of at least 400 watts shall be available for the density testing inspector. The illuminance requirement for other vehicles not listed will be determined by the Engineer. A 400 watt metal halide lamp or equal approved by the Engineer may be substituted for a 2000 or 400 watt balloon light assembly.)

All luminaries shall be located and directed in such a way to minimize glare to both motorists and work vehicles. If glare is noted from any travel path, the contractor must adjust the lighting to reduce the glare to an acceptable level to the satisfaction of the Engineer.

The contractor shall replace non-functioning lamps immediately. The luminary aiming shall be checked daily. The luminaries shall be cleaned regularly.

Specification Compliance. The Contractor will be notified for failure to comply with this specification or plans. The safe passage of pedestrians and traffic through and around the temporary traffic control zone, while minimizing confusion and disruption to traffic flow, shall have priority over all other Contractor activities. Continued failure of the Contractor to comply

with the requirements of the Traffic Control Standard Specification or Special Provisions will result in non-refundable deductions of monies from the Contract for non-performance of Work that the deficiency is allowed to remain, not as penalty, but as liquidated damages.

Failure of the Contractor to comply with this Specification or take immediate correction actions required within forty-eight (48) hours of written notice shall be reason for the engineer suspending all other work on the Project, except erosion prevention and sediment control and traffic control, applying non-refundable deductions of monies from the Contract at a rate of twenty-five hundred dollars (\$2,500) per calendar day per notice and/or withholding payment of monies due to the Contractor for any work on the Project until traffic control deficiencies are corrected. These other actions shall be in addition to the deductions for non-performance of traffic control.

Subsection 712.05: Remove entire subsection text and replace with the following:

Pavement Marking Removal. Conflicting pavement markings must be removed to prevent confusion to vehicle operators. Pavement marking removal shall be accomplished by the Contractor in a manner acceptable to the Engineer.

Final surface pavement markings shall be removed by sand blasting, water blasting, or acceptable grinding methods that will cause the least possible damage to the pavement. Intermediate surface pavement markings shall be removed by sand blasting or water blasting, or other approved methods that will cause the least possible damage to the pavement. The following methods listed below are considered as acceptable for intermediate surface pavement markings: Sand blasting using air or water, High pressure water, steam or superheated water, or Mechanical devices such as grinders, sanders, scrapers, scarifiers, and wire brushes.

The Contractor at his expense shall repair any damage to the pavement or surface caused by pavement marking removal by methods and materials acceptable to the engineer. The end result of the removal shall not cause a condition that appears to be a line that conflicts with the current markings.

Traffic shifts that are done on the final surface shall be accomplished using interim traffic marking tape unless otherwise specified in the plans.

Removal of an existing pavement marking by painting over with black paint or asphalt will not be an acceptable method.

When the method of removal causes sand or other material to be accumulated on the pavement, the residue shall be removed as the work progresses.

Subsection 712-07 Maintenance. Revise entire subsection to the following:

712.07-Maintenance. The Contractor shall assume full responsibility for the continuous and expeditious maintenance of all signs, barricades, temporary impact attenuators and all other traffic control devices to meet the “acceptable” category as described in *Quality Guidelines for Temporary Traffic Control Devices and Features* published by ATSSA. Such maintenance will be considered a part of the original installation cost. Failure to maintain all traffic control devices in such a manner as to provide continuous safety to the public will be cause for suspension of construction operations until proper traffic control is re-established.

Subsection 712.09: Insert the following after the sixth paragraph condition (2).

Additional relocations of barrier rail that will be relocated due to safety of work zone or traffic, as established in the traffic control plans or as directed by the engineer laterally up to 10 ft., shall be paid at ten percent (10%) of the interconnected portable barrier bid amount unless a separate item is in the proposal.

Subsection 712.10: Delete the first paragraph and replace with the following

The lump sum payment for Traffic Control shall include Temporary Workzone Lighting and all equipment, labor, materials and shall included full compensation for furnishing flaggers, traffic cones and removing conflicting and incorrect pavement markings, as required, until project completion.

Subsection 712.10: Insert the following after the second paragraph

Payment for Portable Energy Absorbing Terminals will be made at the contract price per Portable Energy Absorbing terminal, complete in place, with total payment based on the maximum number of portable energy absorbing terminals in place at one time as specified in **Subsection 712.09.**

Subsection 714.02 Revise entire subsection to the following:

714.02-Materials and Submittal Data Requirements. Materials used in this construction shall conform to the requirements of **Section 917** and to the following Sections or Subsections, unless otherwise stipulated:

<u>Section or Material</u>	<u>Subsection</u>
Gray Iron Castings	908.07
Portland Cement Concrete, Class	604
Steel Bar Reinforcement for Concrete Structures	907.01
Welded Steel Wire Fabric	907.03
Crushed Stone Grading D	903.05
Cement Concrete Curing Materials	913
Aluminum Paint	910.04
Conduit	917.05 or 917.07

Within 30 days after the issuance of the work order, the Contractor shall submit to the Engineer, four (4) collated sets of the manufacturer's descriptive literature and technical data which fully describes the types of lighting equipment he proposes to use. Descriptive literature shall include the manufacturer, models, etc. and be adequate to determine if the equipment or material meets the requirements of the Plans and these specifications. These sets of submittal data shall include a list of the materials submitted along with descriptive material for, but not limited to, the following items when applicable:

1. Complete photometric data of luminaires as published by the manufacturer with independent testing laboratory results.
2. Computer printouts showing illumination levels throughout each interchange area where high mast luminaires are to be installed.
3. General details of light standards, breakaway bases and bracket arms.
4. Highmast tower details with a set of design computation for each height including access hole, base, anchorage, head frame, and lowering device. Details are to include specification references for materials and location, type, size and extent of welds.
5. Dimension sheets and performance data on all related equipment.

The Engineer shall retain one copy and forward one copy to the Regional Materials and Test Division, one copy to the local entity (city or county engineer), and one copy to the Design Division for their review.

The submittal sets shall also include detailed scale drawings of any non-standard or special equipment and of any proposed deviation from the Plans. Any deviation from plans or specifications shall require approval from the Design Division. A letter requesting deviations or alternate materials must be included in the submittal for Design Division approval. If requested to do so, the Contractor shall submit for approval sample articles of any materials proposed for use. The Department will not be liable for any materials purchased, labor performed, or delay to the work prior to such approval.

In addition to the above, each submittal shall include a notarized letter certifying that all lighting system materials listed in the submittal are in conformance with the Plans and Specifications. The Contractor shall also submit to the Engineer a statement from the Maintaining Agency that the system is acceptable to the Agency.

Subsection 716.02 Delete “Adhesive 918.26” from the table.

Subsection 716.03 Revise entire subsection to the following:

716.03-Thermoplastic Pavement Marking.

(a) General.

The material shall be applied to the pavement by the screed extrusion method or the ribbon dispenser method. The screed extrusion device shall have one side of the shaping die open with the other 3 sides being contained by, or being part of, suitable equipment for heating and controlling the flow of material. Ribbon dispensers shall be heated, suspended above the road surface, and shall apply the material to the width and thickness specified.

The equipment shall be constructed to provide continuous mixing and agitation of the material. Conveying parts of the equipment between the main material reservoir and the shaping die shall be so constructed as to prevent accumulation and clogging. All parts of the equipment which come in contact with the material shall be so constructed as to be easily accessible for cleaning and maintenance. The equipment shall be constructed so that all mixing and conveying parts up to and including the shaping die, maintain the material at the plastic temperature with heat transfer oil or electrical element controlled heat. Direct fire heat transfer will not be allowed.

The equipment shall be so constructed as to insure continuous uniformity in the dimensions of the stripe. The applicator shall provide a method of applying "skip" lines. The use of pans, aprons, or similar appliances which the die overruns will not be permitted under this Specification. The equipment shall be calibrated, and checked periodically by marking over a metal plate. The equipment will be so constructed as to provide for varying widths to produce varying widths of traffic markings.

Glass spheres applied to the surface of the completed stripe shall be applied by an automatic bead dispenser attached to the striping machine in such a manner that the beads are dispensed almost instantaneously upon the installed line. The glass sphere dispenser shall be capable of applying glass spheres to the surface of the completed stripe by a double drop application for initial traffic striping and marking. The bead dispenser for the first

bead drop shall be attached to the striping machine in such a manner that the beads are dispensed closely behind with the thermoplastic material. The second bead dispenser bead shall be attached to the striping machine in such a manner that the beads are dispensed immediately after the first bead drop application. Glass spheres dispensers shall be equipped with an automatic cut-off control that is synchronized with the cut-off of the thermoplastic material and applies the glass spheres in a manner such that the spheres appear uniform on the entire traffic stripes and markings surface with, 50 to 60% embedment.

Special kettle(s) shall be provided for melting and heating the thermoplastic material. The kettle(s) must be equipped with automatic thermostatic control devices so that heating can be done by controlled heat transfer rather than by direct flame, so as to provide positive temperature control and prevent over-heating of the material.

Applicators shall be mobile and maneuverable to the extent the straight line can be followed and normal curves can be made in a true arc.

The applicator equipment to be used on roadway installations shall consist of either hand equipment or truck mounted units depending on the type of marking required.

The hand equipment shall have sufficient capacity to hold 150 lbs (70 kgs) of molten material and shall be sufficiently maneuverable to install crosswalks, lane, edge, and center lines, arrows and legends. The truck mounted unit for lane, edge and center lines shall consist of a mobile self contained unit carrying its own material capable of operating at a minimum speed of 5 mph (8 kph) continuously during an 8 hour period while installing striping.

Hand equipment used for stop bars, cross walks, legends, directional arrows and other specialty markings shall use the same thermoplastic formulation as described above with the exception of placing the marking at a minimum thickness of 0.090 in. (3mm) and a single drop of AASHTO M-247-09, Type 1 bead at the rate of 8 to 10 pounds per 100 square feet {3.6 to 4.5 kg per 9.3 m²} of stripe.

As an alternate, the Contractor may apply preformed thermoplastic marking material for stop bars, cross walks, legends or directional arrows. The preformed thermoplastic material shall have a minimum thickness of 0.090 in. (3 mm) and fused to the pavement by the heat of a torch.

(b) Application.

The pavement temperature shall be a minimum of 50° F (10° C) and rising before application begins. Application shall be suspended at any time the pavement temperature falls below 50° F (10° C). All surfaces to be marked shall be thoroughly cleaned of all dust, dirt, grease, oil and all other foreign matter before application of the striping.

To insure optimum adhesion of thermoplastic applied on all Portland cement concrete pavements, the Contractor shall apply a binder-sealer material as recommended by the thermoplastic manufacturer. To insure optimum adhesion, the thermoplastic material shall be installed in a melted state at a temperature of 400 to 450° F (205 to 230° C). The material, when formed into traffic stripes, must be readily renewable by placing an overlay of new material directly over an old line of compatible material. Such new material shall bond itself to the old line in such a manner that no splitting or separation takes place.

Longitudinal lines shall be off-set at least 2 in. (50 mm) from longitudinal joints of Portland Cement Concrete pavements.

Unless specified on the plans, a minimum average film thickness of 0.100 in. (2.54 mm) for lane and edge lines shall be maintained on all markings. This is to be computed on the basis of the amount of material used each day. The film thickness shall be uniform in appearance throughout its application. The glass sphere top coating must be applied by means of a pressure type spray gun designed specifically for this purpose, and which will embed the spheres into the line surface to at least one-half their diameter.

Placement of Drop on Glass Beads AASHTO M-247-09, Type 1 and AASHTO M-247-09, Type 4 shall each be placed on the thermoplastic stripe at a rate of 8 to 10 pounds per 100 square feet {3.6 to 4.5 kg per 9.3 m²} of stripe.

The AASHTO M-247-09, Type 4 glass beads shall be placed immediately after the first bead drop application of AASHTO M-247-09, Type 1 beads.

“Regardless of the application methods and procedures, or pavement types, the Contractor will be responsible for replacing any and all pavement markings that fail to comply with these specifications or fail to adhere to the pavement for one year after installation at the Contractor’s own expense.”

Contractor’s Responsibility for Notification.

Notify the Engineer prior to the placement of the thermoplastic materials. Furnish the Engineer with the manufacturer’s name and batch numbers of the thermoplastic materials and glass spheres to be used. Ensure that the approved batch numbers appear on the thermoplastic materials and glass spheres packages.

When thermoplastic is used on the final surface, the Contractor shall have the option of using reflectorized paint installed to permanent standards at the end of each day's work and then installing the permanent marking after the paving operation is completed. Short, unmarked sections will not be allowed.

Protection of Newly Applied Traffic Stripes and Markings.

Do not allow traffic onto or permit vehicles to cross newly applied pavement markings until they are sufficiently dry. Remove and replace any portion of the pavement markings damaged by passing traffic or from any other cause, at no additional cost to the Department.

Subsection 716.04 Replace the first paragraph with the following:

716.04-Raised Reflective Pavement Markers. Markers shall be bonded to the pavement with an epoxy listed on the Departments QPL and approved by the marker manufacturer or a hot bituminous adhesive conforming to the requirements as described below. Markers manufactured with a self adhesive backing will not be allowed. Markers shall be spaced as shown on the plans but shall not be installed over joints in rigid type pavements.

Subsection 716.06: Replace with the following

The application of preformed plastic pavement markings shall be made on clean dry surfaces free of dirt and foreign matter. The pavement temperature shall be 60° F (15° C) or over. Should plastic require activators for the adhesive or various special coatings for different

pavement surfaces, the bidder shall include the cost of the activator or special coatings in the unit price of plastic bid upon.

The vendor will furnish with each package of reflectorized pavement marking materials complete instructions and/or specifications for the application of pavement marking materials to pavement surface. The reflectorized pavement marking materials are to be installed according to the vendor's specifications. Any adhesion used in the installation shall be as specified by the manufacturer. An adhesion-promoting primer shall be required when recommended by the pavement marking manufacturer.

Guides to mark the lateral location of pavement markings shall be established as shown on the plans or as directed by the Engineer. The Contractor shall establish the pavement marking guides and the Engineer will verify the location of the guides. Markings shall be placed in proper alignment with the guides. The deviation rate in alignment shall not exceed 1 inch per 200 feet of roadway. The maximum deviation shall not exceed 2 inches nor shall any deviation be abrupt.

Markings placed that are not in alignment or sequence, as shown on the plans or as stated in this specification, shall be removed and replaced by the Contractor at the Contractor's expense. Removal shall be in accordance with **Subsection 712.05, Pavement Marking Removal**. Guides placed on the roadway for alignment purposes shall not establish a permanent marking on the roadway in the opinion of the Engineer.

When markings are specified in the contract for newly paved asphalt concrete surfaces, they shall be placed immediately after final rolling of the mat. A rubber tired roller cart with a minimum weight of 200 pounds or a truck operated at no more than 3 m.p.h. shall be used to assure proper adhesion when the markings are in place. Steel wheel rollers may not be used for this purpose.

Subsection 722.09 Concrete Cylinder Storage. Revise entire subsection to the following:

722.09 Concrete Cylinder Storage-The Contractor shall provide a storage shed/building for temporary storage of concrete acceptance cylinders. The storage facility shall be of sufficient size and construction to protect the concrete cylinders from the elements and damage. The storage facility location shall be approved by the Engineer and access to the storage shed/building shall be under the control of Department personnel. The storage shed shall have a concrete curing box or water curing tank with a heating/circulating system of sufficient size to properly cure all acceptance cylinders before transferring for final storage and testing. The curing box or curing tank and heater/circulator shall comply with AASHTO M-201, and proper curing of the cylinders shall be in accordance with AASHTO T-23.

SECTION 740-GEOTEXTILES. Revise heading to the following:

GEOTEXTILES AND GEOSYNTHETICS

Subsection 740.01-Description. Revise subsection to include Geosynthetics as follows:

This work shall consist of the placement of Geotextiles and Geosynthetics in accordance with these Specifications and/or Standard Drawings, at the locations and in reasonably close conformity with the lines, grades and dimensions shown on the Plans or established by the Engineer.

Subsection 740.02-Materials. Revise subsection to include Geosynthetics as follows:

Materials used in this construction shall meet the requirements of **Subsection 918.27** for the Type Geotextile or Geosynthetic called for in the plans.

The contractor shall furnish a certified laboratory test report from an approved testing laboratory with each shipment of materials. Laboratory test reports shall include the actual numerical test data obtained. All rolls shall be clearly labeled as being part of the same production run from which the test date was derived. Fabric shall be protected to prevent damage during transportation, storage, and installation. Geotextile and geosynthetic rolls shall be covered during storage to protect against UV degradation and shall be stored with rolls elevated up off of the ground. Fabric that is torn, punctured, or otherwise damaged shall not be installed.

Subsection 740.03-General. Revise subsection to include Geosynthetics as follows:

Geotextile and Geosynthetic fabric shall be placed as specified on the Plans for the specific application. The surface on which the Geotextile or Geosynthetic fabric is to be placed shall be compacted, as directed by the Engineer, and prepared as smooth as possible and free from debris, obstructions and depressions which could result in gaps, tears, or punctures in the fabric during cover operations. The Geotextile or Geosynthetic shall be installed in such a manner that placement of cover material will not excessively stretch nor tear the Geotextile or Geosynthetic. After fabric is placed, the initial lift of cover material shall be installed within five (5) calendar days. Under no circumstances shall any equipment operate directly on the Geotextile or Geosynthetic fabric. Cover material shall be placed such that at least the minimum initial lift thickness, as specified by the Engineer, is between the Geotextile or Geosynthetic and equipment tires or tracks at all times. Turning of equipment/vehicles shall not be allowed on the first lift above the Geotextile or Geosynthetic.

Subsection 740.04-Method of Measurement. Revise subsection to include Geosynthetics as follows:

Geotextiles or Geosynthetics of the type specified shall be measured by the yd² (m²), complete in place. No measurement for payment will be made for overlaps, splices, sewing joints, etc.

Subsection 740.05-Basis of Payment. Revise subsection to include Geosynthetics as follows:

The accepted quantities of Geotextiles or Geosynthetics of the type specified, measured as provided for above, will be paid for at the contract unit price per yd².(m²) complete in place, which price shall be full compensation for labor, equipment, materials, tools and all incidentals necessary to complete the work. Fabric that is damaged during or after placement shall be replaced or repaired, as directed by the Engineer, at the expense of the Contractor.

