

ITEM 660

REFLECTORIZED PAVEMENT MARKINGS

- 660.1 Description. This Item shall govern for furnishing and installing reflectORIZED pavement markings of the types, colors, shapes, sizes, widths and thickness shown on the plans.
- 660.2 Materials.
1. Type I Marking Materials. Type I markings are thermoplastic type materials that require heating to elevated temperatures for application. Type I marking materials shall conform to Texas Department of Transportation Materials Specification DMS-8220. Each container of Type I marking material shall be clearly marked to indicate the color, weight, type of material, manufacturer's name and the lot/batch number.
 - a. Submittal. Submit supplier's certification verifying shelf life of Type I thermoplastic material.
 2. Type II Marking Materials. Type II markings are paint-type materials that are applied at ambient or slightly elevated temperatures. Type II marking materials shall be in conformance with Item 661 "Traffic Paint (Solvent Based) and Item 662 "Glass Reflective Spheres for Traffic Paint".
- 660.3 Equipment Requirements. Equipment used to place pavement markings shall:
1. Be maintained in satisfactory operating condition.
 2. Be considered in satisfactory operating condition if it has an average placement rate of 5,000 linear feet per hour of acceptable 4 inch solid or broken lines over any 5 consecutive working days.
 3. Meet or exceed the material handling at elevated temperatures requirements of the National Fire Underwriters and the Texas Railroad Commission.
 4. Be capable of placing a minimum of 40,000 linear feet of 4 inch solid or broken markings per working day.
 5. Have production capabilities similar to 4 inch marking equipment and shall be capable of placing linear markings up to 8 inches in width in a single pass when used for placing markings in widths other than 4 inches.

6. Have production capabilities considered satisfactory by the Engineer when used to place markings other than solid or broken lines.
7. Be capable of placing a center-line and no-passing barrier-line configuration consisting of 1 broken line with 2 solid lines at the same time to the alignment and spacing shown on the plans.
8. Be capable of placing broken and/or continuous white line from both sides.
9. Be capable of placing lines with clean edges and of uniform cross-section. All lines shall have a tolerance of $\pm 1/8$ inch per 4 inch width.
10. Have an automatic cut-off device with manual operating capabilities to provide clean, reasonably square marking ends to the satisfaction of the Engineer, and to provide a method of applying broken line in an approximate stripe-to-gap ratio of 15 to 25. The length of the stripe shall not be less than 15 feet or more than 15.5 feet. The total length of any stripe-gap cycle shall not be less than 39.5 feet or more than 40.5 feet.
11. Provide continuous mixing and agitation of the pavement marking material. The use of pans, aprons or similar appliances which the die overruns will not be permitted for longitudinal striping applications.
12. Apply beads by an automatic bead dispenser attached to the pavement marking equipment in such a manner that the beads are dispensed uniformly and almost instantly upon the marking as the marking is being applied to the road surface. The bead dispenser shall have an automatic cut-off control, synchronized with the cut-off of the pavement marking equipment.

When Type I markings are to be placed, the Contractor shall have a hand-held thermometer on the project. The thermometer shall be capable of measuring the temperature of the pavement marking material to be placed.

660.4 Construction Methods.

1. General. When required by the Engineer, the Contractor and the Engineer shall review the sequence of work to be followed and estimated progress schedule.

Markings may be placed on roadways either free of traffic or open to traffic. On roadways already open to traffic, the markings shall be placed under traffic conditions that exist with a minimum of interference to the operation of the facility. Traffic control shall be as shown on the plans or as approved by the Engineer in writing.

All markings placed under open-traffic conditions shall be protected from traffic damage and disfigurement. On roadways open to traffic, with 3 lanes of travel in one direction, all markings shall be placed from the outside lanes only, unless otherwise approved in writing by the Engineer.

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 shall essentially have a uniform cross-section. The density and quality of markings shall be uniform throughout their thickness. The applied markings shall have no more than 5 percent, by area, of holes or voids, and shall be free of blisters.

Markings, in place on the roadway, shall be reflectorized both internally and externally. Glass beads shall be applied to the materials at a uniform rate sufficient to achieve uniform and distinctive retroreflective characteristics when observed in accordance with TxDOT Test Procedure Tex-828-B.

The Contractor's personnel shall be sufficiently skilled in the work of installing pavement markings.

Markings placed that are not in alignment or sequence, as shown on the plans or as stated in this Item, shall be removed by the Contractor at the Contractor's expense. Removal shall be in accordance with Item 674 "Removing Pavement Striping and Markings" except for measurement and payment. Guides placed on the roadway for alignment purposes shall not establish a permanent marking on the roadway.

Unless otherwise shown on the plans, pavement markings may be applied by any method that will yield markings meeting the requirements of this Item.

2. Surface Preparation. New portland-cement-concrete surfaces shall be cleaned in accordance with Item 669 "Pavement Surface Preparation for Markings" to remove curing membrane, dirt, grease, loose and/or flaking existing construction markings and other forms of contamination.

Older portland-cement-concrete surfaces and asphaltic surfaces that exhibit loose and/or flaking existing markings shall be cleaned

in accordance with Item 669 "Pavement Surface Preparation for Markings", to remove all loose and flaking markings.

Pavement to which material is to be applied shall be completely dry. Pavement shall be considered dry if, on a sunny day after observation for 15 minutes, no condensation occurs on the underside of a one (1) foot square piece of clear plastic that has been placed on the pavement and weighted on the edges.

3. Application of Type I Markings. New portland-cement-concrete surfaces shall be further prepared for Type I markings, after cleaning, by placing a Type II marking as a sealer in accordance with this Item. When placing Type I markings in new locations on asphaltic surfaces 3 years old or older or any portland-cement-concrete surfaces, a Type II marking shall be used as a sealer. Unless otherwise shown on the plans, Type II markings will not be required as a sealer when existing pavement markings on existing pavement are replaced with Type I pavement markings. In this case, the existing markings may be used as a sealer in lieu of Type II markings. Type II markings shall be placed a minimum of 2 and a maximum of 30 calendar days in advance of placing Type I markings. Type II markings which become dirty due to inclement weather or road conditions shall be cleaned by washing, brushing, compressed air or other means approved by the Engineer, prior to application of Type I markings. If washing is used, the surface of Type II markings shall become thoroughly dry before placing Type I markings. Color, location and configuration of Type II markings shall be the same as that of Type I markings.

Type I pavement marking material shall be applied within temperature limits recommended by the material manufacturer. Application of Type I pavement markings shall be done only on clean, dry pavement having a surface temperature above 50° F. Pavement temperature shall be measured in accordance with TxDOT Test Procedure Tex-829-B.

When Type I pavement marking application is by spray, and operations cease for 5 minutes or more, the spray head shall be flushed by spraying pavement marking material into a pan or similar container until the pavement marking material being sprayed is at the proper temperature for application.

Unless otherwise directed by the Engineer in writing, Type I pavement marking materials shall not be placed on roadways between September 30 and March 1, subject to temperature and moisture limitations specified herein.

Unless otherwise shown on the plans, Type I marking minimum thickness shall be 0.060 inches (60 mil) for edgeline markings and 0.090 inches (90 mil) for stop-bars, legends, symbols, gore and center-line/no-passing barrier-line markings, when measured in

accordance with TxDOT Test Procedure Tex-854-B. The maximum thickness of all Type I markings shall be 0.180 inches (180 mil).

The thickness of Type I markings at the time of placement will be measured above the plane formed by the pavement surface. The Engineer will supply a device to measure the thickness of the applied markings. The markings shall be of uniform thickness throughout their lengths and widths.

4. Application of Type II Markings.

The application of Type II marking materials shall be done only on surfaces with a minimum surface temperature of 50 F.

The application rate for Type II marking material shall be: between 15 and 20 gallons per mile of solid 4 inch line and between 30 and 40 gallons per mile for solid 8 inch line except that, for new surface treatment projects the application rate shall be between 25 and 30 gallons per mile of solid 4 inch line and between 40 and 50 gallons per mile for solid 8 inch line.

Pavement marking for new surface treatment projects shall be applied in 2 applications each approximately one-half the application rate. The first application shall not contain glass beads. The interval between the first and second applications shall be a minimum of 1 hour.

When, in the case of impending inclement weather, and the Engineer directs the Contractor to apply water-based traffic paint, the markings are damaged by subsequent rain, sleet, hail, etc., the Contractor will be paid for the initial placement and the replacement markings. However, if the Contractor places the markings at his option, the Contractor is responsible for all costs associated with the replacement markings.

660.5 Performance Period for Type I Markings.

Type I pavement markings shall meet all requirements of this Item for a minimum of 15 calendar days after installation. Pavement markings that fail to meet all requirements of this Item shall be removed and replaced by the Contractor at the Contractor's expense. The Contractor shall replace all pavement markings failing the requirements of this Item within 30 calendar days following notification by the Engineer of such failing. All replacement markings shall also meet all requirements of this Item for a minimum of 15 calendar days after installation.

660.6 Measurement.

This Item will be measured by the linear foot, by each of the various words, symbols or shapes, or by any other unit as shown on the plans.

Where double stripes are placed, each stripe will be measured separately.

This is a plans quantity measurement Item and the quantity to be paid for will be that quantity shown in the proposal and in the bid items sheets, contract documents except as may be modified by the Engineer. If no adjustment of quantities is required, additional measurements or calculations will not be required.

Type II pavement markings requiring 2 applications on new surface treatments will be measured as 1 marking.

Type II pavement marking materials, when used as a sealer for Type I markings will be considered incidental to the Type I markings.

660.7 Payment.

The work performed and the materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Reflectorized Pavement Markings" of the various types, colors, shapes, sizes, widths, and thickness (Type I markings only) specified. Type II pavement markings used as a sealer for Type I markings will be considered incidental to the Type I markings. This price shall be full compensation for furnishing all materials; surface preparation for application of pavement markings; and for all other labor, tools, equipment and incidentals necessary to complete the work, except as shown below.

Final work zone pavement markings (paint and beads) which will be used as a sealer for Type I pavement markings will be paid for under this Item.

When replacement Type II markings are required due to damage to the original markings from rain, sleet, hail, etc., and the original markings were placed at the direction of the Engineer, the plan quantity requirements under "Measurement" do not apply to the original and replacement markings. The Contractor will be paid for the actual quantity of original and replacement markings at the unit price bid for that bid item.

There are line code(s), description(s), and unit(s) for this Item.

END OF ITEM 660