
Special Specification 6149

All-Weather Thermoplastic Pavement Markings



1. DESCRIPTION

Furnish and install a wet reflective pavement marking system in accordance with this Specification and in conformance to the dimensions and lines shown on the plans or established by the Engineer.

2. MATERIALS

- 2.1. **Thermoplastic Pavement Marking Materials.** Furnish thermoplastic pavement marking material meeting the minimum requirements of DMS-8220, "Hot Applied Thermoplastic."
- 2.2. **Traffic Beads.** Furnish a traffic bead system to meet the desired performance requirements of this specification.

3. EQUIPMENT

- 3.1. **General.** Use pavement marking application equipment that:
- is maintained in satisfactory condition,
 - meets or exceeds the requirements of the National Board of Fire Underwriters and the Texas Railroad Commission for this application,
 - uses an automatic bead dispenser attached to the pavement marking equipment, and
 - can provide continuous mixing and agitation of the pavement marking material
- 3.2. **Material Placement Requirements.** Pavement marking equipment must also meet the following requirements:
- Equipment will be capable of providing uniform heating of striping materials to temperatures exceeding 390°F (199°C).
 - Equipment will be capable of maintaining the thermoplastic striping material in a plastic state in all mixing and conveying parts, including the line dispensing device until applied.
 - Equipment will be capable of producing varying widths and thickness of thermoplastic traffic stripes.
 - The equipment will be a mobile, truck mounted and self-contained pavement marking machine.
 - The equipment will be capable of traveling at a uniform, predetermined speed over variable road grades to produce uniform application of striping material, following straight lines and making normal curves in a true arc. The equipment will be capable of air-blasting the pavement, applying the thermoplastic stripe and immediately applying the drop-on glass beads in a single.
 - The equipment will be capable of application of drop-on glass beads to the surface of the pavement marking by double drop application.
 - The applicator for the drop-on glass beads will be equipped with an automatic cut-off control that is synchronized with the cut-off of the thermoplastic material.
 - The applicator for the drop-on glass beads will be capable of delivering a uniform drop rate at variable thermoplastic application speeds.
 - The drop-on glass beads are applied such that they appear uniform on the entire traffic stripe and markings.

- The melt kettle must be equipped with an automatic temperature control device and thermometer to thermostatically control the temperature and prevent overheating of the thermoplastic material. It must also be equipped with enough agitation to prevent settling of the inter-mix beads.

3.3. **Retroreflectometers.**

3.3.1. **Mobile Retroreflectometer.** Use a mobile retroreflectometer approved by the Materials and Tests Division and certified by the Texas Transportation Institute Mobile Retroreflectometer Certification Program.

3.3.2. **Portable Retroreflectometer.** Use a portable retroreflectometer meeting the requirements of ASTM E2832 and that has either an internal global positioning system (GPS) or the ability to be linked with an external GPS with a minimum accuracy rating of 16.4 ft. in accordance with the circular error probability (CEP) method (CEP is the radius of the circle with its origin at a known position that encompasses 50% of the readings returned from the GPS instrument); and can record and print the GPS location and retroreflectivity reading for each location where readings are taken.

4. **CONSTRUCTION**

Place markings before opening to traffic unless providing for short-term or work-zone markings.

4.1. **General.** Obtain approval for the sequence of work and estimated daily production. On roadways already open to traffic, place markings with minimum interference to the operations of that roadway. Use traffic control as shown on the plans or as approved. Protect all markings placed under open-traffic conditions from traffic damage and disfigurement.

Establish guides to mark the lateral location of pavement markings as shown on the plans or as directed and have guide locations verified. Use material for guides that will not leave a permanent mark on the roadway.

Apply markings on pavement that is completely dry and meets all temperature and humidity requirements of the manufacturer:

Apply markings:

- using widths, colors, and at locations shown on the plans,
- in proper alignment with the guides without deviating from the alignment more than 1 in. per 200 ft. of roadway or more than 2 in. maximum,
- free of blisters and with no more than 5%, by area, holes, or voids,
- with uniform cross-section and thickness,
- with clean and reasonably square ends,
- that harden properly with no tackiness,
- using personnel skilled and experienced with installation of pavement markings,
- that are reflectorized, and
- that meet requirements in Tex-828-B.

Remove all applied markings that are not in alignment or sequence as stated on the plans or as stated in the specifications at the Contractor's expense in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers," except for the "Measurement" and "Payment" articles.

4.2. **Surface Preparation.** Unless otherwise shown on the plans, prepare surfaces in accordance with this section.

4.3. **Cleaning Asphalt Surfaces Younger Than 3 Yr. and All Retracing.** Air-blast or broom old hydraulic cement concrete surfaces and all asphalt surfaces to remove loose material, unless otherwise shown on the plans.

4.4. **Cleaning Asphalt Surfaces Older than 3 Yr. and all Hydraulic Concrete (No Existing Markings).** Clean in accordance with Item 678, "Pavement Surface Preparation for Markings," to remove curing membrane, dirt, grease, loose and flaking existing construction markings, and other forms of contamination.

4.5. **Sealer for Type I Markings.** For asphalt surfaces more than 3 yr. old or for concrete, apply a pavement sealer before placing Type I markings on locations that do not have existing markings, unless otherwise approved. The pavement sealer may be either a Type II marking or an acrylic or epoxy sealer unless otherwise shown on the plans. Follow the manufacturer's directions for application of acrylic or epoxy sealers. When the sealer becomes dirty after placement, clean by washing or in accordance with Section 4.2.1, "Cleaning for New Asphalt Surfaces and Retracing of All Surfaces." Place the sealer in the same configuration and color (unless clear) as the Type I markings unless otherwise shown on the plans.

4.6. **Application.** Apply markings on surfaces with a minimum surface temperature of 50°F, when measured in accordance with Tex-829-B.

Apply markings during good weather unless otherwise directed. If markings are placed at Contractor option when inclement weather is impending and the markings are damaged by subsequent precipitation, the Contractor is responsible for all costs associated with replacing the markings if required.

Apply markings at a minimum of 125 mil film thickness.

4.7. **Retroreflective Requirements.** Meet the minimum retroreflectivity values in Table 1 for edgeline markings, center-line/no passing barrier-line, and lane lines. Minimum retroreflectivity measurements for wet retroreflectivity will be taken immediately after application of the pavement markings. Remove all loose beads from the markings without removing the imbedded beads before taking the measurements. Minimum retroreflectivity measurements for dry retroreflectivity will be taken anytime between 3 days but not later than 10 days after application.

Table 1
Minimum Initial Retroreflectivity
(mcd/m²/lux)

	White	Yellow
Dry (ASTM E 1710)	400	325
Wet continuous (ASTM E 2832)	150	125

4.8. **Retroreflectivity Measurements.** Use a mobile retroreflectometer to measure dry retroreflectivity. Use a portable retroreflectometer to measure wet retroreflectivity.

4.8.1. **Mobile Reflectometer Measurements.** Provide mobile measurements averages for every 0.1 mi. unless otherwise specified or approved by the Engineer. Take measurements on each section of roadway for each series of markings (e.g., edge-line, center skip line, each line of a double line) and for each direction of travel. Take all measurements in the direction of traffic flow, except on centerline on 2-way roadways, take measurements in both directions. Furnish measurements in compliance with Special Specification 6040, "Mobile Retroreflectivity Data Collection for Pavement Markings," unless otherwise approved by the Engineer. The Engineer may require an occasional field comparison check with a portable retroreflectometer meeting the requirements listed above to ensure accuracy. Use all equipment in accordance with the manufacturer's recommendations and directions. Inform the Engineer at least 24 hr. in advance of taking any measurements.

4.8.2. **Portable Reflectometer Measurements.** When using a portable reflectometer to measure continuous wetting retroreflection take measurements in accordance with ASTM E 2832. Use a portable retroreflectometer to take a minimum of 3 measurements on an individual stripe and average the 3 measurements. If the average of the 3 measurements taken on a specific marking falls below the minimum retroreflectivity value, take a minimum of 6 more measurements on two additional stripes and average them. If the average of these 6 measurements falls below the minimum retroreflectivity value the marking does not meet the performance values.

- 4.8.3. **Traffic Control.** Provide traffic control, as required, when taking retroreflectivity measurements after marking application. On low volume roadways (as defined on the plans), refer to the figure entitled "Temporary Road Closure" in Part VI of the Texas Manual on Uniform Traffic Control Devices for the minimum traffic control requirements. For all other roadways, the minimum traffic control requirements will be as shown on the standard plans TCP (3-1) and TCP (3-2). The lead vehicle will not be required on divided highways. The traffic control plan and traffic control devices must meet the requirements listed in Item 502, "Barricades, Signs, and Traffic Handling." Time restrictions that apply during striping application will also apply during the retroreflectivity inspections except when using the mobile retroreflectometer unless otherwise shown on the plans or approved.
- 4.9. **Department Verification.** The Department must be notified when wet retroreflectivity measurements are to be taken. The Department will observe the wet retroreflectivity readings. Department verification of dry retroreflectivity data will be performed via the Department's pavement marking retroreflectivity data verification program. Provide traffic control upon request for all Department verification measurements.
- 4.10. **Performance Period.** All markings (and replacement markings) must meet all requirements of this Specification, except for Section 4.7., "Retroreflective Requirements," for a minimum of 30 calendar days after installation.

Remove all pavement markings that fail to meet the requirements of this Specification and replace at the Contractor's expense unless otherwise directed. Replace all failing markings within 30 days of notification.

5. MEASUREMENT

This Item will be measured by the foot. Double stripes will be measured separately.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.2, "Plans Quantity Measurement." Additional measurements or calculations will be made if adjustments of quantities are required.

Acrylic sealer, epoxy sealer, or Type II markings, when used as a sealer will be measured as Pavement Sealer.

6. PAYMENT

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "All-Weather Thermoplastic Pavement Markings" of the type and color, shape and size specified. This price is full compensation for cleaning and preparing the pavement surface, for furnishing and placing all materials, and for all materials, labor, tools, equipment and incidentals necessary to complete the work.

Surface Preparation, when shown on the plans, will be paid for under Item 678, "Pavement Surface Preparation for Markings."

Final work-zone pavement markings (Type II), which can be used as a sealer for Type I markings, will be paid for under this Item.