

## SECTION 6150 - PAVEMENT MARKING (PAINT)

### PART 1 - GENERAL

- 1.01 SCOPE:** This Section covers application of water borne paints for white and yellow pavement marking. Topics include worker's qualifications, weather limits, material requirements, patterns and uses, surface preparation, application requirements, and acceptance criteria.
- 1.02 REFERENCE STANDARDS:** In this Section, the "Manual on Uniform Traffic Control Devices," U.S. Department of Transportation, Federal Highway Administration, is referred to as "MUTCD."
- 1.03 INSTALLER'S QUALIFICATIONS:** Installation shall be by an installer with at least ten successful installations of pavement marking of similar scope. The ten installations shall include work for at least 3 separate owners in the Kansas City metropolitan area.
- 1.04 ENVIRONMENTAL LIMITATIONS:** Except when directed by Engineer, pavement markings shall not be placed unless the following environmental conditions are met:
- A. Air temperature shall be 60°F and rising.
  - B. Pavement shall be completely free of moisture.
- 1.05 SUBMITTALS:** The following shall be submitted for review:
- A. Manufacturer's and supplier's test results from an independent testing laboratory demonstrating compliance of paint compound and drop-on beads to the requirements given in Part 2 of this Section.
  - B. Manufacturer's application recommendations.
  - C. References demonstrating installer's qualifications.

### PART 2 - PRODUCTS

#### 2.01 PAINT:

- A. Formulation:
  - 1. The pigment of the yellow paint shall consist of the following for each 100 gallons of paint.
    - a. 30 lbs. of 11-2401 Hansa Yellow XT, from Hoechst Celanese Corp. or approved equivalent.
    - b. 17 lbs. of Rutile Titanium Dioxide.

- c. Other such extender pigments as necessary to produce a close match to the yellow color requirement.
- B. **Drying Time:** When tested according to ASTM D711 at a wet film thickness of 0.012-inch and with the paint and glass plate at 120°F, the paint shall dry to "no pick-up" in not more than 5 minutes; and at 130° to 140°F, the paint shall dry to "no pick-up" in not more than 90 seconds; and at 140° to 150°F, the paint shall dry to "no pick-up" in not more than 60 seconds.
- C. **Dry Opacity:** Contrast ratio shall be not less than 0.96 when the paint is applied with a 0.012-inch film applicator. Dry opacity will be determined according to Method 4121, Federal Test Method Standard No. 141a. Apply the paint with the above applicator to the chart specified in Section 1.1 of Method 4121.
- D. **Daylight Reflectance:** When tested according to Method 6121, Federal Test Standard No. 141a, the Daylight Reflectance of the white paint shall be not less than 80 percent relative to magnesium oxide.
- E. **Color:** The color of the yellow paint shall match the Standard Shade within the red and green tolerance limits when compared with the Highway Yellow Color Tolerance chart obtained from the U.S. Department of Transportation, Washington, DC.
- F. **Consistency (viscosity):** The consistency shall be not less than 75 nor more than 90 K.U. as determined by ASTM D562.
- G. **Flexibility:** Apply the paint to aluminum panels with a 0.005-inch Bird Film Applicator. Air dry 18 hours and bake for 5 hours at a temperature of 105°C to 110°C. Cool for 15 minutes at 77°F and bend over the conical mandrel. Examine without magnification. There shall be no cracking of the film at a mandrel diameter of one inch or larger. The panel shall be aluminum alloy 2024-0, 0.032-inch thick plus or minus 0.003 inch. The conical mandrel shall be as specified in ASTM D522.
- H. **Abrasion Resistance:** When subjected to the Falling Sand Abrasion Resistance Test, the amount of sand required to completely abrade the paint film from an area 5/32-inch in diameter on the panel shall be not less than 70 liters.
- 1. The test shall be conducted according to Method 6191 of Federal Test Method Standard No. 141a with the following additions and exceptions:
    - a. Panel preparation shall be as indicated below.
    - b. Fresh, new unused sand shall be used for each test of three panels.
    - c. Sand shall be measured by weight, with 17.5 lbs. of sand being counted as equivalent to 5 liters.

- d. A test shall be the average liters of sand required to abrade the 5/32-inch spot on three separate panels.
2. Panels for the test will be prepared as follows: Apply the paint without reduction to a smooth glass panel with a 0.006-inch Bird Film Applicator. Air dry for 24 hours and bake for 3 hours at a temperature of 105° to 100°C. Condition the panel for 24 hours at a temperature of 70° to 80°F and a relative humidity of 50 to 70 percent before making the test. The glass panels shall not be less than 8 inches long, and the abrasion test shall be made on the middle third of the film on the panel.
- I. Water Resistance: Apply a film of the paint with a 0.005-inch Bird Film Applicator to a smooth glass panel approximately 10 inches long. Allow to dry for 48 to 72 hours and then immerse one end of the panel in a beaker of distilled water to a depth of approximately 5 inches. After 24 hours of immersion, remove the panel and examine. After 24 hours of air drying, the immersed portion of the film shall be equal in hardness, toughness, gloss, color, and adhesion to the portion of the film that was not immersed in water. Adhesion shall be checked using a knife blade or spatula on both ends of the film, comparing the ease with which the film can be removed from the glass.
  - J. Stability Test: Fill a one-pint friction top paint can with the thoroughly mixed sample to within one inch of the top. Determine consistency in grams according to Method 4281, Federal Test Method Standard No. 141a. Close the can with the lid and shake for 5 minutes. Place the can in an air oven at 60°C plus or minus 2°C for 18 hours. Remove and cool to room temperature. Open the can, remove any skins, and examine the contents. There shall be no livering or other deteriorations. Thoroughly mix the paint and again determine the consistency in grams. The increase in consistency shall be not more than 17 grams. This 17 grams is equivalent to slightly more than 3.0 K.U. increase in consistency.
  - K. Fineness of Grind: When tested according to ASTM D1210, the fineness of grind shall be not less than 3 Hegman units.
  - L. Freeze-Thaw Resistance Test: When tested according to ASTM D2243, the consistency shall not change by more than 5 K.U. and shall show no breaking of the emulsion or coagulation.
  - M. Bead Embedment: Paint shall be applied to a glass panel at a wet film thickness of 0.012 inch followed immediately by an application of glass beads dripped onto the surface of the paint. After drying or at least 24 hours, observe the amount of bead embedment with a 30 power microscope. At least 90 percent of the beads shall be embedded between 40 percent and 60 percent. The glass beads used for this test shall conform to Article 2.02, Glass Beads, of this Section.

**2.02 GLASS BEADS:**

- A. The following requirements apply to all glass beads used with painted lines:
1. Refractive index shall be between 1.50 and 1.60 when tested by the liquid emersion method at 25°C.
  2. Roundness: At least 75 percent of glass beads shall be true spheres when tested by ASTM D1155.
  3. Gradation of glass beads shall be:

<u>Sieve Size</u>	<u>Percent Passing</u>
No. 20	100
No. 30	75 - 95
No. 50	15 - 35
No. 100	0 - 5

- B. Coatings:
1. Glass beads used in compound shall have an adhesion promoting coating specific to a paint system.
  2. Glass beads used as top dressing shall be resistant to clumping caused by moisture. Beads used as top dressing shall pass the moisture resistance/free flow, anti-wicking, and adhesion tests.

**2.03 APPLICATION EQUIPMENT:** Application equipment shall be as recommended by the marking manufacturer.

**PART 3 - EXECUTION:**

**3.01 STANDARD SIZES AND PATTERNS:** Unless required otherwise in the Special Conditions or drawings the following sizes patterns and materials shall be used:

<u>Use</u>	<u>Color</u>	<u>Size</u>	<u>Pattern</u>
Center Line	Yellow	Double 4" line with 4" space	Continuous line; break at intersections and intersection type commercial entrances
Lane Line	White	6" wide	12.5' line, 37.5' skip
Channelizing line	White	6" wide	Continuous line
Edge line	Varies	6" wide	Continuous line; at median islands, painted medians, and rural arterials and collectors

<u>Use</u>	<u>Color</u>	<u>Size</u>	<u>Pattern</u>
Diagonals	Varies	18" wide	At 45° clockwise rotation from direction of travel; line spacing in feet = posted speed limit in mph
Stop bars	White	24"	4' space from cross walk; otherwise in line with stop sign
Cross walk	White	12" lines	Line separation normally 6', increase to 8' or 10' in areas of high pedestrian traffic
Cross bars	White	24" bars with 4' spaces	Cross bars for midblock use; bar length normally 6', increase to 8' or 10' in areas of high pedestrian traffic
Words	White	8' high	Alphabet style shall conform to MUTCD
Arrows	White	-----	Arrow style shall conform to MUTCD; turn arrow 8' high, through arrow 9.5', turn and through 12.75'

**3.02 SURFACE PREPARATION:** Pavement shall be dry and free of oil, dirt, and debris at time of application. Asphalt surfaces older than 3 months and all concrete surfaces shall be sand or shot blasted, swept, and air blasted before application of pavement markings. Newly laid asphalt, shall be swept and air blasted before application of pavement markings.

**3.03 APPLICATION:** Application procedures shall follow the marking manufacturer's recommendations.

Rate of glass bead top dressing of painted lines shall be 4 to 6 pounds of glass beads per gallon of paint. Beads shall be dispensed uniformly across the section of the painted line. Beads shall imbed themselves to approximately 60 percent of their diameter.

**3.04 TOLERANCES:** Pavement marking be within the following tolerances:

- A. Thickness shall be minimum dry film thickness of 10 mils.
- B. Width shall be true to plan  $\pm 1/4$ -inch for 4-inch and 6-inch lines, and  $\pm 1/2$ -inch for other lines.
- C. Length of stripes, skips, and bars shall be true to plan  $\pm 2$  inches.
- D. Longitudinal lines shall be at proper location to  $\pm 2$  inches and shall not vary more than 1 inch in 200 feet.

**3.05 APPEARANCE STANDARD:** At end of guarantee period, markings shall have uniform surface, crisp edges, and clean cut offs; shall exhibit satisfactory retro-reflectivity; and shall meet the location tolerances of this Section.

END OF SECTION 6150