

## 1. Description

This specification is for furnishing a durable, retroreflective pavement marking material suitable for use as roadway, intersection, commercial or private pavement delineation and markings. Material shall be designed to be adhered to asphalt concrete and portland cement concrete pavements by means of heat fusion. The applied markings shall be very durable: oil and grease impervious; and provide immediate and continuing retroreflectivity.

## 2. Materials - General

**2.1** The preformed retroreflective marking material shall consist of a resilient polymer thermoplastic (alkyd, no hydrocarbon) with uniformly distributed glass beads throughout its entire cross section. Preformed retroreflective markings shall be available conforming to the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways as issued by the U.S. Department of Transportation Federal Highway Administration.

**2.2** The preformed marking materials shall not be brittle and will be sufficiently cohesive and flexible at temperatures exceeding 50°F.

**2.3** The preformed marking materials shall be fusible to asphalt and portland cement concrete pavements by means of the normal heat of a propane type torch. Adhesives, primers, or sealers are not necessary prior to the preformed markings application on asphalt and portland cement concrete pavements.

**2.4** The preformed marking materials shall conform to pavement contours, breaks, and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics and be capable of fusing to itself and previously applied hydrocarbon and / or alkyd thermoplastic pavement markings.

**2.5** The preformed marking materials shall be capable of application on new, dense, and open graded asphalt wearing courses during the paving operation in accordance with the manufacturer's instructions.

**2.6** The preformed marking materials shall be capable and ready to open to traffic 15 minutes after application.

**2.7** The preformed marking materials shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's recommendations.

**3. Manufacturing Control and ISO Certification:** The manufacturer must be ISO 9001:2015 certified and provide proof of current certification. The scope of the certification shall include manufacture of preformed thermoplastic pavement marking material.

**4. Classification:** The preformed marking materials shall be highly durable retroreflective pliant polymer thermoplastic materials designed for transverse, legend, and symbol markings. This system is designed for and subjected to high urban traffic volumes and particularly severe wear conditions including winterized maintenance practices employed by various regions of the US DOT market.

## 5. Requirements

**5.1 Composition:** The preformed marking materials shall consist of a homogeneous mixture of high quality polymeric thermoplastic binders, lead-free pigments, fillers, and intermix glass throughout the entire composition. The thermoplastic material must conform to AASHTO designation M249 with the exception of the relevant differences due to the material being preformed, and identified herein.

**5.1.1 Intermix Glass:** The preformed retroreflective material shall contain a minimum of 30% glass spheres which shall conform to AASHTO M247 Type 1. Glass spheres shall have a minimum of 80% true spheres overall.

**5.1.2 Top Glass:** To provide uniform retroreflectivity, glass beads shall be factory pre-applied at a uniform rate. The glass beads shall have a minimum of 80% true spheres overall.

**5.2 Retroreflectivity:** The preformed marking materials shall upon application exhibit uniform adequate nighttime visibility (retroreflectivity). The applied markings shall have an average minimum retroreflectivity of 400 mcd/lx/m<sup>2</sup> for white markings and 250 mcd/lx/m<sup>2</sup> for yellow markings.

Note: The initial retroreflectivity values assume proper application. For optimum retroreflectivity, beads must be embedded, upon application, 50% - 60% into the preformed thermoplastic.

**5.3 Color Characteristics:** Preformed marking materials without pre-applied top glass beads shall meet the following:

- White: Daytime luminance factor (cap Y) of 80% minimum.
- Yellow: Daytime luminance factor (cap Y) of 45% minimum.

The daytime luminance factor shall not change significantly when the preformed retroreflective thermoplastic is properly applied to the roadway surface.

For highway use, the white markings shall contain a minimum of 10% by weight of titanium dioxide pigment. Yellow color shall reasonably match color chip Number 13538 of Federal Standard number 595 and be lead free.

**5.4 Skid Resistance:** The surface of the preformed marking materials shall provide a post-applied minimum skid resistance value of at least 45 BPN when tested according to ASTM E 303.

**5.5 Thickness:** The thickness of the supplied material shall have a minimum average thickness of 0.090 in. (2.29 mm) (expressed as 90 mils).

**5.6 Flexibility:** The preformed marking materials shall have flexibility at 50°F such that when a 1 in. by 6 in. sample is bent through an arc of 90° at a uniform rate in 10 seconds (9° per second) over a 1 in. mandrel, no cracking occurs in the test sample. The sample must be conditioned prior to testing at 50°F ±2 for a minimum of four hours. At least two specimens tested must meet the flexibility requirements at 50°F for a passing result.

**5.7 Bond Strength:** The preformed marking materials must have superior bonding strength of at least 300 psi on portland cement concrete when tested according to ASTM D 4796, except that a 2 in. by 2 in. specimen shall be placed on a preheated brick (15 minutes at 425°F) and then placed in a 425°F oven for 15 minutes.

**5.8 Tensile Strength and Elongation:** The preformed marking materials shall have a minimum tensile strength of 150 lb. per square inch of cross section when tested according to ASTM D 638, except that a sample 1 in. wide by 6 in. long shall be tested at a temperature between 70°F and 80°F using a jaw speed of 10 in./min. The sample shall have a maximum elongation of 20% at break when tested by this method.

**5.9 Low Temperature Cracking (Stress) Resistance for Extended Period:** The preformed marking materials shall be tested according to AASHTO T250 section 7 with section 7.2.3 modified for extended cold temperature (-9.4°C ±2 (15°F ±3)) exposure period of 72 hours. Any cracking shall constitute failure of the material for portland cement concrete road surfaces.

**5.10 Environmental Resistance:** The applied preformed marking materials shall be resistant to deterioration due to exposure to sunlight, water, oil, diesel fuels, gasoline, pavement oil content, salt, and adverse weather conditions.

**5.11 Effective Performance Life:** When properly applied, in accordance with manufacturer's instructions, the preformed marking materials shall be neat and durable. The markings shall remain skid resistant and show no fading, lifting, shrinkage, tearing, roll back, or other signs of poor adhesion.

**6. Packaging:** The flexible preformed marking materials, for use as transverse or bike symbols as well as legends, shall be available in flat form material up to a maximum of 2 ft. width by 4 ft. length. The material shall be packed in suitable shrink-wrapped cartons clearly labeled for ease of identifying the contents. Packaging shall not use plastic liners within to separate material from itself. Product packaging shall identify part number and mil thickness.

**7. Installation:** The preformed marking materials shall be applied in accordance with the manufacturer's recommendations on clean and dry surfaces. New portland cement concrete surfaces must be sandblasted to entirely remove curing compound. Marking configuration shall be in accordance with the "Manual on Uniform Traffic Control Devices" where applicable.

**7.1 New Surfaces:** Markings specified for newly paved asphalt road surfaces shall be capable of being applied as the original permanent marking on the day the surface is paved.

**7.2 Fusion:** The preformed marking materials shall be fusible to the pavement by means of a propane torch recommended by the manufacturer.

**8. Material Replacement Provisions:** Any properly applied preformed marking materials that shall smear or soften independent of pavement movement or condition within a period of one year from date of application shall be replaced by the supplier.

**9. Technical Services:** The supplier shall provide technical services as may be required.

**10. Performance:** The preformed marking material shall meet state specifications and be approved for use by the appropriate state agency.