

**SPECIFICATION**  
**RETROREFLECTIVE AND SKID RESISTANT MULTI-COLOR INTERCONNECTED**  
**PREFORMED THERMOPLASTIC PAVEMENT MARKINGS**

1. **USE:** A durable, high skid resistant, retroreflective pavement marking material suitable for use as interstate shields, route shields, block contrast, bike path, roadway, intersection, airport, commercial or private pavement delineation and markings.
  - 1.1. The markings must be a resilient white, yellow or other color preformed thermoplastic product, the surface of which must contain glass beads and abrasives in an alternating pattern. Block contrast markings must have contrasting background of black, non-retroreflective, and skid resistant preformed thermoplastic. The markings must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids etc. The markings shall be capable of being affixed to bituminous and/or portland cement concrete pavements by the use of the normal heat of a propane torch or infrared heater.
  - 1.2. The markings must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics, such that it is capable of fusing with itself.
  - 1.3. The material must be capable of being applied in temperatures as low as 45°F (7.2°C) without any special storage, preheating or treatment of the material before application.
  - 1.4. The individual pieces in each material segment, typically 2ft. x 3 ft. (.61m x .915m), must be factory assembled with a compatible material and interconnected so that it is not necessary to assemble the individual pieces within a material segment in the field.
  - 1.5. The material must be able to be applied to asphalt and concrete surfaces without preheating the application surface to a specific temperature.
2. **MANUFACTURING LOCATION, CONTROL AND ISO CERTIFICATION:** The marking material must be produced in the United States, and the manufacturer must be ISO 9001:2015 certified for design, development and manufacturing of preformed thermoplastic pavement markings, and provide proof of current certification.
3. **MATERIAL:** Must be composed of an ester modified rosin resistant to degradation by motor fuels, lubricants etc. in conjunction with aggregates, pigments, binders, abrasives, and glass beads which have been factory produced as a finished product, and meets the requirements of the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways. The thermoplastic material conforms to AASHTO designation M249, with the exception of the relevant differences due to the material being supplied in a preformed state, and potentially being of a color different from white or yellow.
  - 3.1. Graded Glass Beads:
    - 3.1.1. The non-black sections of the markings must contain a minimum of thirty percent (30%) intermixed graded glass beads by weight. The intermixed beads shall conform to AASHTO designation M247, with minimum 80% true spheres and minimum refractive index of 1.50.
    - 3.1.2. The non-black sections of the markings must have factory applied coated surface beads and abrasives in addition to the intermixed beads at a rate of 1/2 lb. (.23 kg) [ $\pm$  20%] per 11 sq. ft. (1 sq. m). The surface beads and abrasives must be applied in an alternating arrangement across the surface of the material so that the surface is covered in what is best described as a “checkerboard” pattern of glass beads and abrasive materials. The abrasive material must have a minimum hardness of 9 (Mohs scale). The factory applied coated surface beads shall have a minimum of 80% true spheres, minimum refractive index of 1.50, and meet the following gradation:
 

Size Gradation		Retained, %	Passing, %
US Mesh	um		
12	1700	0 - 2%	98 - 100%
14	1400	0 - 6%	94 - 100%
16	1180	1 - 21%	79 - 99%
18	1000	28 - 62%	38 - 72%
20	850	62 - 71%	29 - 38%
30	600	67 - 77%	23 - 33%
50	300	86 - 95%	5 - 14%
80	200	97-100%	0 - 3%
  - 3.2. Pigments:
    - 3.2.1. White: The material shall be manufactured with sufficient titanium dioxide pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected.

- 3.2.2. Red, Blue, and Yellow: The material shall be manufactured with sufficient pigment to meet FHWA Docket No. FHWA-99-6190 Table 5 and Table 6 as revised and corrected. The yellow pigments must be organic and must be heavy-metal free.
- 3.2.3. Black: The material shall be manufactured without intermixed glass beads and without factory-applied surface beads. The material shall be manufactured with abrasives to provide skid resistance.
- 3.2.4. Other Colors: The pigments must be heavy-metal free.
- 3.3. Heating indicators: The top surface of the material shall have regularly spaced indents. The closing of these indents during application shall act as a visual cue that the material has reached a molten state, allowing for satisfactory adhesion and proper embedment of the anti-skid/anti-slip elements, and a post-application visual cue that proper application procedures have been followed.
- 3.4. Skid Resistance: The surface of the retroreflective and skid resistant preformed thermoplastic material shall contain factory applied anti-skid elements with a minimum hardness of 9 (Mohs scale). Upon application the material shall provide a minimum skid resistance value of 60 BPN when tested according to ASTM E 303.
- 3.5. Slip Resistance: The surface of the retroreflective and skid resistant preformed thermoplastic material shall contain factory applied anti-skid elements with a minimum hardness of 9 (Mohs scale). Upon application the material shall provide a minimum static coefficient of friction of 0.6 when tested according to ASTM C 1028 (wet and dry), and a minimum static coefficient of friction of 0.6 when tested according to ASTM D 2047.
- 3.6. Thickness: The material must be supplied at a minimum thickness of 90 mils (2.29 mm) or 125 mils (3.15 mm).
- 3.7. Retroreflectivity: The material, when applied in accordance with manufacturer's guidelines, must demonstrate a uniform level of sufficient nighttime retroreflection when tested in accordance to ASTM E 1710. The applied material must have an initial minimum intensity reading of 275 mcd·m<sup>-2</sup>·lx<sup>-1</sup> for white, as measured with a Delta pavement marking retroreflectometer.  
  
Note: Initial retroreflection and skid resistance are affected by the amount of heat applied during installation. When ambient temperatures are such that greater amounts of heat are required for proper installation, initial retroreflection and skid resistance levels may be affected.
- 3.8. Environmental Resistance: The material must be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to oil and gasoline.
- 3.9. Abrasives: The abrasives and surface beads on the retroreflective and skid resistant material must be applied in an alternating arrangement across the surface of the material so that the surface is covered in what is best described as a "checkerboard" pattern of glass beads and abrasive materials. The abrasive material must have a minimum hardness of 9 (Mohs scale).
- 3.10. Interconnected: The material must consist of interconnected individual pieces of preformed thermoplastic pavement material, which through a variety of colors and patterns make up the desired design. The individual pieces in each material segment, typically 2ft. x 3 ft. (.61m x .915m), must be factory assembled with a compatible material and interconnected in a single layer, so that it is not necessary to assemble the individual pieces within a material segment in the field.

#### 4. APPLICATION:

- 4.1. Asphalt: The material shall be capable of being applied using the propane torch method, and/or infrared heater recommended by the manufacturer. The material shall be capable of being applied at ambient and road temperatures down to 45°F (7.2°C) without any preheating of the pavement to a specific temperature. A sealer specified by the manufacturer shall be applied to the pavement surface prior to material application to ensure proper adhesion. The sealer must be supplied by the material manufacturer in 300/600ml cartridges along with sealer application supplies. A thermometer shall not be required during the application process. The pavement shall be clean, dry and free of debris. Supplier must enclose application instructions in English and Spanish with each box/package only pertaining to an application method that does not require preheating of the pavement to a specific temperature before application.
- 4.2. Portland Cement Concrete: The same application procedure shall be used as described under Section 4.1.
- 5. **PACKAGING:** The preformed thermoplastic markings shall be placed in protective plastic film with cardboard stiffeners where necessary to prevent damage in transit. The cartons in which packed shall be non-returnable, shall contain a minimum of 35% post-consumer recycled materials, shall not exceed 40 in. (1.02m) in length and 25 in. (.64 m) width, and shall be labeled for ease of identification. The weight of the individual carton must not exceed 70 lb. (32 kg). A protective film around the box must be applied in order to protect the material from rain or premature aging.
- 6. **TECHNICAL SERVICES:** The successful bidder shall provide technical services as required. Regionally-located manufacturer's representative, employed directly by the manufacturer, can provide no-cost on-site training for proper application.
- 7. **PERFORMANCE:** The preformed thermoplastic markings shall meet state specifications and be approved for use by the appropriate state agency.