SPECIFICATION
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 performed thermoplastic. The markings must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids etc. Lines, legends and symbols are capable of being affixed to bituminous and/or portland cement concrete pavements by the use of the normal heat of a propane torch.

    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 markings shall not have minimum ambient and road temperature requirements for application, storage, or handling.

    1.4. The individual pieces in each material segment (typically 24 in. by 36 in.) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a material segment.

    1.5. The material must be able to be applied to asphalt and concrete surfaces without preheating the application surface to a specific temperature. The material must be capable of being affixed to green concrete (concrete that has set but not appreciably hardened). The material shall not require the portland cement concrete application areas to be cured or dried out. The material must be capable of being affixed to bituminous and/or portland cement concrete pavements by the use of the heat of a propane torch, infrared heater, or blue-flame heater.

2. **MANUFACTURING CONTROL AND ISO CERTIFICATION:** The manufacturer must be ISO 9001:2008 certified and provide proof of current certification. The scope of the certification shall include manufacture of reflective highway markings.

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. <u>Graded Glass Beads:</u>

        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 be clear and transparent. Not more than twenty percent (20%) consists of irregular fused spheroids, or silica. The index of refraction shall not be less than 1.50.

        3.1.2. The material must have factory applied coated surface beads and abrasives in addition to the intermixed beads at a rate of 1/2 lb. (± 20%) per 11 sq. ft. 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 7 (Mohs scale). These factory applied coated surface beads shall have the following specifications:

            1) Minimum 80% rounds
            2) Minimum refractive index of 1.5

Size Gradation			
US Mesh	um	Retained, %	Passing, %
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 (same side as the factory applied surface beads) shall have regularly spaced indents. These indents shall act as a visual cue during application that the material has reached a molten state so satisfactory adhesion and proper bead embedment has been achieved and a post-application visual cue that the installation procedures have been followed.

3.4. Skid Resistance: The surface of the preformed retroreflective marking materials, wherein every other shaped portion contains glass beads, or abrasives with a minimum hardness of 7 (Mohs scale), shall upon application provide a minimum skid resistance value of 60 BPN when tested according to ASTM: E 303.

3.5. Thickness: The material must be supplied at a minimum thickness of 90 mils (2.29 mm) or 125 mils (3.15 mm).

3.6. Retroreflectivity: The preformed retroreflective marking materials upon application shall exhibit adequate and uniform nighttime retroreflectivity. The marking materials shall have the following retroreflectivity as measured using a Delta LTL 2000 or LTL-X Retroreflectometer:

White preformed reflective marking materials–minimum of 275 $mcd \cdot m^{-2} \cdot lx^{-1}$

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.

3.7. 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.

3.8. Abrasives: The abrasives and surface beads 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 7 (Mohs scale).

3.9. 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 24 in. by 36 in.) must be factory assembled with a compatible material and interconnected so that in the field it is not necessary to assemble the individual pieces within a material segment.

4. **APPLICATION:**

4.1. Asphalt: The materials shall be applied using the propane torch or an infrared/radiant heater method recommended by the manufacturer. The material must be able to be applied without minimum requirements for ambient and road temperatures and without any preheating of the pavement to a specific temperature. A sealer specified by the manufacturer must be applied to the substrate prior to material application to assure proper adhesion. The material must be able to be applied without the use of a thermometer. The pavement shall be clean, dry and free of debris. Supplier must enclose application instructions with each box/package.

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. Legends and symbols must also be supplied in flat pieces. The cartons in which packed shall be non-returnable and shall not exceed 40" in length and 25" in width, and be labeled for ease of identification. The weight of the individual carton must not exceed seventy (70) pounds. 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.

7. **PERFORMANCE:** The preformed thermoplastic markings shall meet state specifications and be approved for use by the appropriate state agency.