

**SPECIFICATION
RETROREFLECTIVE AND SKID RESISTANT BIKE LANE GREEN
PREFORMED THERMOPLASTIC PAVEMENT MARKINGS**

1. **USE:** A durable, high skid resistant, retroreflective pavement marking material suitable for use as bike lane, bike path, roadway, intersection, airport, commercial or private pavement delineation and markings.
 - 1.1. The markings must be a resilient light green color thermoplastic product, the surface of which must contain glass beads and abrasives in an alternating pattern optimizing both skid resistance and retroreflectivity.
 - 1.2. The markings must be resistant to the detrimental effects of motor fuels, lubricants, hydraulic fluids etc.
 - 1.3. The material 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.
 - 1.4. 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 and previously applied thermoplastic when heated with the torch.
 - 1.5. The markings shall not have minimum ambient and road temperature requirements for application, storage, or handling. When manufacturer’s standard application procedures require the use of a 2-component sealer, the material shall be capable of being applied with a compatible 2-component sealer recommended by the manufacturer, at minimum ambient and surface temperatures of 45°F without any special storage, preheating or treatment of the material before application.
 - 1.6. If required, white, retroreflective and skid resistant preformed thermoplastic symbols and/or word legends may be incorporated into the light green retroreflective and skid resistant material background in an interconnected fashion, such that the two materials shall be factory assembled together and applied as a single layer.

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 being supplied in a color other than white or yellow.
 - 3.1. Graded Glass Beads:
 - 3.1.1. The material 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 material must have factory applied coated surface beads and abrasives in addition to the intermixed beads at a rate of 1/2 lb. (.23 kg) [± 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: Light Green: The material shall be manufactured with appropriate pigment to ensure that the resulting colors complies with the Light Green color as specified in the FHWA Memorandum dated April 15th, 2011: Interim Approval for Optional Use of Green Colored Pavement for Bike Lanes(IA-14).

3.2.1. Daytime chromaticity coordinates for the color used for green colored pavement shall be as follows:

1		2		3		4	
X	y	x	y	x	y	x	y
0.230	0.754	0.266	0.500	0.367	0.500	0.444	0.555

3.2.2. Nighttime chromaticity coordinates for the color used for green colored pavement shall be as follows:

1		2		3		4	
X	y	x	y	x	y	x	y
0.230	0.754	0.336	0.540	0.450	0.500	0.479	0.520

3.2.3. The pigment system must not contain heavy metals or any carcinogen, as defined in 29 CFR 1910.1200 in amounts exceeding permissible limits as specified in relevant Federal Regulations.

3.3. Heating indicators: The top surface of the material (same side as the factory applied surface beads/abrasives) 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 bead and abrasives embedment, and as a post-application visual cue that the application procedures have been followed.

3.4. Skid Resistance: The surface of the preformed thermoplastic material shall contain factory applied non-skid material 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. 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 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 $50 \text{ mcd}\cdot\text{m}^{-2}\cdot\text{lx}^{-1}$, 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.

3.7. 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 9 (Mohs scale).

4. APPLICATION:

4.1. Asphalt: The materials shall be applied using the propane torch or infrared heater method recommended by the manufacturer, without minimum requirements for ambient and road temperatures and without any preheating of the pavement to a specific temperature. 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 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. When manufacturer’s standard application procedures require the use of 2-component sealer for large volumes of material, the compatible 2-component sealer supplied by the material manufacturer shall be applied to the substrate prior to material application, to ensure proper adhesion and provide bond reinforcement.

4.2. Portland Concrete: The same application procedure shall be used as described under Section 4.1. However, a compatible primer sealer shall be applied before application to assure proper adhesion.

5. **PACKAGING:** The preformed thermoplastic markings shall be placed in protective plastic film with cardboard stiffeners where necessary to prevent damage in transit. Linear material must be cut to a maximum of 3 ft. (.91 m) long pieces. Legends and symbols must also be supplied in flat pieces. 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. When required, the 2-component sealer must be supplied by the material manufacturer in 300/600ml cartridges, along with 2-component sealer application supplies.

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.