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**Standard Specification for**

**White and Yellow Reflective  
Thermoplastic Striping Material  
(Solid Form)**

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**AASHTO Designation: M 249-08**



**American Association of State Highway and Transportation Officials  
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## Standard Specification for

# White and Yellow Reflective Thermoplastic Striping Material (Solid Form)



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## 1. SCOPE

- 1.1. This specification covers a reflectorized thermoplastic pavement striping material that is applied to the road surface in a molten state by mechanical means with surface application of glass beads at a rate specified by the purchaser. Upon cooling to normal pavement temperature, it produces an adherent reflectorized stripe of specified thickness and width capable of resisting deformation by traffic.
- 1.2. The values stated in SI units are to be regarded as the standard.

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## 2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- M 247, Glass Beads Used in Traffic Paints
  - T 250, Thermoplastic Traffic Line Material
- 2.2. *ASTM Standard:*
- D 36, Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
- 2.3. *Federal Standards:*
- Fed. Std. No. 141, Paint, Varnish, Lacquer, and Related Materials: Methods of Inspection, Sampling and Testing
  - Fed. Std. No. 595b, Colors

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## 3. MATERIALS

- 3.1. The thermoplastic material shall be homogeneously composed of pigment, filler, resins, and glass reflectorizing spheres.
- 3.1.1. The thermoplastic material shall be available in both white and yellow.
- 3.1.2. The resin shall be alkyd or hydrocarbon as specified by the purchaser.
- 3.1.3. The vendor shall have the option of formulating the material according to his own specifications. However, the physical and chemical properties contained in this specification shall apply regardless of the type of formulation used. The material, upon heating to application temperature, shall not exude fumes that are toxic, or injurious to persons or property. The pigment

beads and filler shall be well dispersed in the resin. The material shall be free from all skins, dirt, and foreign objects.

3.1.4. *Glass Beads (Pre-Mix)*—The beads shall be uncoated and conform to AASHTO M 247, Type I.

3.1.5. Yellow pigment shall be lead-free.

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#### 4. REQUIREMENTS

4.1. *Specific Gravity*—The specific gravity of the white and yellow thermoplastic traffic line material shall not exceed 2.15.

4.2. *Composition*—The pigment, beads, and filler shall be uniformly dispersed in the resin. The material shall be free from all skins, dirt, and foreign objects and shall comply with requirements according to Table 1.

**Table 1**—Composition

Component	White	Yellow
Binder	18.0 min	18.0 min
Glass beads	30–40	30–40
Titanium dioxide	10.0 min	—
Calcium carbonate and inert fillers	42.0 max	See Note 1.
Yellow pigments	—	—

**Note 1**—Amount of yellow pigment, calcium carbonate, and inert fillers shall be at the option of the manufacturer, providing all other requirements of this specification are met.

4.2.1. The material shall be provided in either granular or block form as specified by the purchaser.

4.3. *Physical Characteristics:*

4.3.1. *Color*—The thermoplastic material after heating for  $240 \pm 5$  minutes at  $218 \pm 2^\circ\text{C}$  ( $425 \pm 3^\circ\text{F}$ ) and cooled to  $25 \pm 2^\circ\text{C}$  ( $77 \pm 3^\circ\text{F}$ ) shall meet the following:

*White:* Daylight reflectance at 45 degrees–0 degrees—75 percent minimum. For highway use the color shall match Federal Test Standard Number 595b, Color 17886.

*Yellow:* Daylight reflectance at 45 degrees–0 degrees—45 percent minimum.

(a) For highway use, the color shall match Federal Test Standard Number 595b—Color 13538.

(b) For airport use, the color shall comply with the requirements established by the FAA. The chromaticity and luminance factors shall be within the limits in Table 2 when determined under standard conditions:

- (a) angle of illumination, 45 degrees;
- (b) direction of view, perpendicular to surface; and
- (c) illuminant, CIE standard illuminant D65.

**Note 2**—The chromaticity and luminance factors of ordinary colors and colors of retro-reflecting materials shall be determined under the following standard conditions:

- (a) angle of illumination: 45 degrees;
- (b) direction of view: perpendicular to surface; and
- (c) illuminant: CIE standard illuminant D65.

**Table 2—CIE Equations**

Yellow	
Orange boundary	$y = 0.130 + 0.636x$
White boundary	$y = 0.910 - x$
Green boundary	$y = 1.35x - 0.093$
Luminance factor	$\beta = 0.27$ (mm)
White	
Purple boundary	$y = x$
Blue boundary	$y = 0.610 - x$
Green boundary	$y = 0.040 + x$
Yellow boundary	$y = 0.710 - x$
Luminance factor	$\beta = 0.35$ (mm)

- 4.3.2. *Drying Time*—When applied at a temperature range of  $211 \pm 7^\circ\text{C}$  ( $412.5 \pm 12.5^\circ\text{F}$ ) and thickness of 3.2 to 4.8 mm ( $1/8$  to  $3/16$  in.), the material shall set to bear traffic in not more than two minutes when the air temperature is  $10 \pm 2^\circ\text{C}$  ( $50 \pm 3^\circ\text{F}$ ) and not more than 10 minutes when the air temperature is  $32 \pm 2^\circ\text{C}$  ( $90 \pm 3^\circ\text{F}$ ).
- 4.3.3. *Cracking Resistance at Low Temperature*—After heating the thermoplastic material for  $240 \pm 5$  minutes at  $218 \pm 2^\circ\text{C}$  ( $425 \pm 3^\circ\text{F}$ ), applying to concrete blocks, and cooling  $-9.4 \pm 1.7^\circ\text{C}$  ( $15 \pm 3^\circ\text{F}$ ), the material shall show no cracks.
- 4.3.4. *Impact Resistance*—After heating the thermoplastic material for  $240 \pm 5$  minutes at  $218 \pm 2^\circ\text{C}$  ( $425 \pm 3^\circ\text{F}$ ) and forming test specimens, the impact resistance shall be a minimum of 1.13J (10 in.-lb).
- 4.3.5. *Softening Point*—After heating the thermoplastic material for  $240 \pm 5$  minutes at  $218 \pm 2^\circ\text{C}$  ( $425 \pm 3^\circ\text{F}$ ) and testing in accordance with ASTM D 36 the materials shall have a softening point of  $102.5 \pm 9.5^\circ\text{C}$  ( $215 \pm 15^\circ\text{F}$ ).
- 4.3.6. *Flowability*—After heating the thermoplastic material for  $240 \pm 5$  minutes at  $218 \pm 2^\circ\text{C}$  ( $425 \pm 3^\circ\text{F}$ ) and testing for flowability, the white thermoplastic shall have a maximum percent residue of 18 and the yellow thermoplastic shall have a maximum percent residue of 21.
- 4.3.7. *Yellowness Index*—The white thermoplastic material shall not exceed a yellowness index of 0.12.
- 4.3.8. *Flowability—Extended Heating*—After heating the thermoplastic material  $8.0 \pm 0.5$  hours at  $218 \pm 2^\circ\text{C}$  ( $425 \pm 3^\circ\text{F}$ ), with stirring the last six hours, and tested for flowability, the thermoplastic shall have a maximum percent residue of 28.
- 4.4. *Storage Life*—The material shall meet the requirements of this specification for a period of one year. The thermoplastic must also melt uniformly with no evidence of skins or unmelted particles for this one year time period. Any material not meeting the above requirements shall be replaced by the manufacturer.

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## 5. APPLICATION PROPERTIES

- 5.1. The thermoplastic material shall be capable of being applied by spraying, screed extrusion, or ribbon extrusion, as specified by the purchaser, at temperatures of  $211 \pm 7^\circ\text{C}$  ( $412 \pm 12.5^\circ\text{F}$ ) from approved equipment to produce a line 3.2 to 4.8 mm ( $1/8$  to  $3/16$  in.) thick which shall be continuous and uniform in shape having clear and sharp dimensions, particularly when extruded.
- 5.2. The material shall not exude fumes that are toxic, obnoxious, or injurious to persons or property when it is heated during applications.
- 5.3. The application of additional surface dressing glass beads shall be by means of a pressurized bead dispenser or by drop-on methods at a rate specified by the purchaser and agreed upon by the applicator.

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## 6. PACKAGING AND MARKING

- 6.1. The thermoplastic material shall be packaged in suitable containers to which it will not adhere during shipment and storage.
- 6.1.1. In granular form, it shall be in white or yellow plastic bags of a suitable size to contain approximately 23 kg (50 lb) and shall be made of a material that when introduced into the mix hopper of the application equipment, it will become a part of the mix without any adverse effect to the performance of the thermoplastic material.
- 6.1.2. In block form, blocks of cast thermoplastic material shall be approximately 300 by 915 by 51 mm (12 by 36 by 2 in.) and shall have a mass of approximately 23 kg (50 lb).
- 6.1.3. Each container label shall designate the color, manufacturer's name, batch number, and date of manufacture. Each batch manufactured shall have its own separate number. The label shall specify that the material shall be heated to  $211 \pm 7^\circ\text{C}$  ( $412 \pm 12.5^\circ\text{F}$ ) during application.
- 6.2. The contractor shall assume all cost resulting from the use of patented materials, equipment, devices, or processes used on or incorporated in the work, agrees to indemnify and save harmless the purchaser and his duly authorized representatives from all suits at law, or action of every nature for or on account of the use of any patented materials, equipment, devices, or processes.

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## 7. SAMPLING

- 7.1. The minimum size batch of thermoplastic traffic striping material sampled and tested shall not be less than 1360 kg (3000 lb) unless the total order is less than this amount. Any manufacturer not familiar with the technique of making this material should consult the purchaser. A small trial batch should be made prior to making the thermoplastic traffic striping material in large quantities to make certain the finished product will comply with all the requirements of this specification.

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## 8. TESTING

- 8.1. The material shall be tested in accordance with T 250 or with the appropriate method in Federal Standard No. 141 or ASTM designation.