

X78008XX 45 MIL HOT SPRAY THERMOPLASTIC PAVEMENT MARKING

(LCDOT) For use on LCDOT let projects – This item is used on projects with Centerline Rumble Strips and on Traffic’s annual Pavement Marking Replacement project. Delete this note from the Contract Specifications.

Effective: April 27, 2018

Description: This work shall consist of furnishing and applying spray thermoplastic pavement marking lines of the size and color as shown on the plans. The material shall be a mixture of resins and other materials providing an essentially nonvolatile thermoplastic compound especially developed for traffic markings. For Hot Spray Thermoplastic Pavement Marking the application equipment may be either Truck-Mounted or Hand-Operated meeting the requirements of Article 1105.01 of the “Standard Specifications”.

Ingredient Materials:

- (a) Binder: The binder shall consist of a mixture of synthetic resins, at least one of which is solid at room temperature. The total binder content of the thermoplastic compound shall be well distributed throughout the compound. The binder shall be free from all foreign objects or ingredients that would cause bleeding, staining or discoloration. The binder shall be 25 percent minimum by weight of the thermoplastic compound. The binder shall be characterized by an “IR Spectra”. Future shipments of binder will be checked by an “IR Spectra” to verify that the binder has not been changed.
- (b) Pigment: The pigment used for the white thermoplastic compound shall be a high-grade pure (minimum 93 percent) titanium dioxide (TiO₂). The white pigment content shall not be less than ten percent by weight and shall be uniformly distributed throughout the thermoplastic compound.

The pigments used for the yellow thermoplastic compound shall be heat resistant, and color-fast yellows, golds and oranges, which shall produce a compound meeting the requirements of the current Federal Highway Color Tolerance Chart, PR Color No. 1. The medium chrome yellow pigment content shall be not less than four percent by weight and shall be uniformly distributed throughout the thermoplastic compound.

- (c) Filler: The filler to be incorporated with the resins as a binder shall be a white calcium carbonate, silica, or an approved substitute. Any filler, which is insoluble in 6N hydrochloric acid, shall be of such particle size as to pass a No. 100 sieve.
- (d) Glass Beads:
 - (1) Scope:

This specification covers glass beads to be used for reflectorizing pavement marking lines.

Type A – uncoated

Type B - moisture resistant, silicone coated

Type A shall be used as intermix beads with thermoplastic pavement marking materials. They shall be uniformly mixed throughout the material at the rate of not less than 25 percent by weight (retained on the No. 100 sieve) of thermoplastic compound. Type B shall be used as drop-on beads with thermoplastic pavement marking materials and shall be applied uniformly at a minimum rate of six pounds per 100 square feet.

(2) Properties:

The glass beads furnished under this specification shall consist essentially of transparent, water-white glass particles of a spherical shape. They shall be manufactured from a glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering. The glass beads shall conform to the following requirements:

(a) Sieve Analysis: The glass beads shall meet the following sieve requirements:

Total Percent (By Weight)

<u>Sieve Size</u>	<u>Passing</u>
No. 20	100
No. 30	75-100
No. 50	15-40
No. 100	0-5
No. 200	0-1

- (b) Imperfections: The surface of the glass beads shall be free of pits and scratches. The glass beads shall be spherical in shape and shall contain a maximum of 20 percent by weight of irregular shapes when tested by the standard method using a vibratile inclined glass plate as adopted by the Department.
- (c) Index of Refraction: The index of refraction of the glass beads shall be not less than 1.50 when tested by the immersion method at 77 °F.
- (d) Silica Content: The glass beads shall contain not less than 65 percent silica (SiO₂).
- (e) Chemical Stability: Glass beads which show a tendency toward decomposition, including surface etching, when exposed to paint or thermoplastic constituents will be rejected. The glass beads shall be tested by Federal Specification TT-B-1325B, Section 4.3.9 (water resistance) and evaluated for compliance with Section 3.2.9, with the following exceptions:
- (f) The size of the sample to be tested shall be 25 grams and the reflux time shall be 5 hours.

- (f) Flowing Properties: The glass beads shall flow uniformly through dispensing equipment in atmospheric humidity up to 94%.

Intermix beads shall pass the following test: 3½ ounces of glass beads, spread evenly and thinly in a suitable container, shall be conditioned at 77°F for four hours over a solution of sulfuric acid (Sp. Gr. 1.10) in a closed desiccator. After four hours, the glass beads shall flow readily through a clean glass 60° analytical funnel with a diameter of three inches and a stem length of four inches. The inside diameter of the stem shall be a nominal ¼”.

The drop-on beads shall have a silicone, moisture resistant coating and pass the following test: 3½ ounces of beads are placed in a 600 ml beaker and an equivalent volume of distilled water shall be added to the beaker. The beaker will then stand for five minutes, at the end of which time the water shall be carefully poured off and the beads transferred to a clean dry beaker and allowed to stand for five minutes. The beads will then be poured slowly into a standard glass funnel (Corning 6120), with a diameter of five inches and a stem length of four inches. The inside diameter of the stem shall be 7/16”.

The beads shall flow through the funnel stem without stoppage. Slight initial agitation to start the flow through the funnel at the beginning of the test is permissible.

- (g) Packaging: The Type B glass beads shall be delivered in approved moisture proof bags consisting of a least five-ply paper construction unless otherwise specified. Each bag shall contain 50 pounds net, and shall be legibly marked with the manufacturer, specifications and type, lot number, and the month and year the glass beads were packaged.

Thermoplastic Compound:

(a) Characteristic Requirements:

- (1) In the plastic state, the material shall not give off fumes that are toxic or otherwise injurious to persons or property. The manufacturer shall provide material safety data sheets for the product.
- (2) The temperature versus viscosity characteristic of the plastic material shall remain constant and the material shall not deteriorate in any manner during reheating processes.
- (3) There shall be no obvious change in color of the material due to repeated heating or from batch to batch. The maximum elapsed time after application after which normal traffic will leave no impression or imprint on the new stripe shall be 30 seconds when the air and road surface temperature is approximately 70 ± 3 °F. After application and proper drying, the material shall show no appreciable deformation or discoloration, shall remain free from tack, and shall not lift from the pavement under normal traffic conditions within a road temperature range of 20 to 150 °F. The stripe shall maintain its original dimensions and placement.

Cold ductility of the material shall be such as to permit normal dimensional distortion due to traffic impact within the temperature range specified.

- (4) The material shall provide a stripe that has a uniform thickness throughout its cross section and has the density and character to provide a sharp edge of the line.
- (5) The thermoplastic compound after heating for four hours (\pm five minutes) at 375°F (\pm 3 °F) and cooled at 77 °F shall meet the following requirements for daylight reflectance and color, when tested, using a color spectrophotometer with 45° circumferential / 0° geometry, illuminant C, and 2° observer angle. The color instrument shall measure the visible spectrum from 380 to 720 nm with a wavelength measurement interval and spectral bandpass of 10 nm.

White: Daylight Reflectance, 75 percent minimum

*Yellow: Daylight Reflectance, 45 percent minimum

*Shall match Federal Highway Color Tolerance Chart, PR Color No. 1.

- (6) Specific Gravity: The specific gravity of the thermoplastic material shall not exceed 2.15.
- (7) Softening Point: After heating the thermoplastic material for four hours (\pm five minutes) at 375 °F (\pm 3 °F) and testing according to ASTM E28, the material shall have a minimum softening point of 180 °F as measured by the ring and ball method.
- (8) Tensile Bond Strength: After heating the thermoplastic material for four hours (\pm five minutes) at 375 °F (\pm 3 °F), the tensile bond strength to unprimed, sandblasted portland cement concrete block, 0.0625 inch thick film drawn-down 375 °F, tested at 75 °F (\pm 2 °F) shall exceed 180 psi when tested according to ASTM D4796-88.
- (9) Impact Resistance: After heating the thermoplastic material for four hours (\pm five minutes) at 375 °F (\pm 3 °F) the impact resistance shall be a minimum of 50 inch pounds with no cracks or bond loss when 0.0625 inch thick film drawdown is made at 375 °F on an unprimed sandblasted portland cement concrete block, male indenter 5/8 inch, no female Die, tested at 75 °F (\pm 2 °F) when tested according to ASTM D2794 minimum.
- (10) Yellowness Index: The white thermoplastic material shall not exceed a yellowness index of 12 when tested according to ASTM D1925.

(b) Identification

Each package of material shall be stenciled with the manufacturer's name; the type of material and IDOT specification number; the month and year the material was packaged; and the lot number. Lot numbers shall begin with the last two digits of the year manufactured and be sequential with Lot 1. The letters and numbers used in the stencils shall be a minimum of 1/2 inch in height.

(c) Packaging

The thermoplastic material shall be packaged in suitable containers that will not adhere to the product during shipment and storage. The container of thermoplastic material shall weigh approximately 50 lbs. Each container shall designate the color, binder (alkyd or hydrocarbon), spray and user information. The label shall warn the user that the material shall be heated in the range of 350 – 400 °F.

(d) Storage Life

The material shall meet the requirements of this specification for a period of one year. The thermoplastic shall also melt uniformly with no evidence of skins or unmelted particles for this one year period. The manufacturer shall replace any material that does not meet the above requirements.

Sampling and Testing:

- (a) Unless otherwise provided, all materials shall be sampled and tested according to the latest published standard methods of the American Society for Testing and Materials, and revisions thereof, in effect on the date of invitation for bids, where such standard methods exist. In case there are no ASTM Standards which apply, applicable standard methods of the American Association of State Highway Transportation Officials, or the Federal Government, or of other recognized standardizing agencies shall be used.
- (b) The right is reserved to inspect the material either at the place of manufacture or at the destination or at both places. If inspected at the place of manufacture, the manufacturer shall furnish such facilities as may be required for collecting and forwarding samples; and shall also furnish facilities for testing the material during the process of manufacture, if required. Tests will be made by and at the expense of the Department. All material samples for acceptance tests shall be taken or witnessed by a representative of the Bureau of Materials and Physical Research. All material samples shall be submitted to the Engineer of Materials and Physical Research, 126 East Ash Street, Springfield, Illinois 62704-4766, at least 30 days in advance of the pavement marking operations. Random check samples may be taken at the job site at the discretion of the Engineer.
- (c) The Engineer will test and approve the basic ingredients.
- (d) The sample(s) shall be labeled with the lot number, date, quantity and any other pertinent information. The samples shall be submitted in the following manner:
 - (1) Ingredient Materials:
 - (a) Glass beads: At least three randomly selected bags or containers shall be obtained from each lot or shipment of glass beads. The content of each bag or container shall be passed through a large Riffle Sampler, thus splitting the material down until a representative one quart sample is obtained. The sample from each container shall be submitted for testing.

(b) Binder: One pint.

(c) Pigments: One pint.

(d) Filler: One pint.

(2) Thermoplastic:

At least three randomly selected containers shall be obtained from each lot. A ten pound composite sample of the three containers shall be submitted for testing and acceptance. The lot size shall be approximately 44,000 pounds unless the total order is less than this amount.

Manufacturer's Responsibility:

- (a) The manufacturer shall perform tests on a minimum of one sample per 10,000 pounds of thermoplastic produced. Minimum tests required shall be a softening point determination and color. Manufacturer's test results shall be submitted along with the thermoplastic sample to the Bureau of Materials and Physical Research.
- (b) The manufacturer shall retain the test sample for a minimum period of 18 months.
- (c) The manufacturer shall furnish the Bureau of Materials and Physical Research with copies of bills of lading for all material inspected. Bills of lading shall indicate the consignee and destination, date of shipment, lot numbers, quantity, type of material, name and location of source.

Material Acceptance:

Final acceptance of a the lot of thermoplastic will be based on the following:

- (a) Compliance of ingredient materials with the specifications.
- (b) Compliance of thermoplastic material with the specifications.
- (c) Manufacturer's test results for each lot of thermoplastic have been received.
- (d) Identification requirements are satisfactory.

Notification: The Contractor shall notify the Engineer 72 hours prior to the placement of the thermoplastic markings so that an inspector can be present during the operation. At the time of this notification, the Contractor shall indicate the manufacturer and lot numbers of thermoplastic and glass beads that he/she intends to use. The Engineer will ensure that the approved lot numbers appear on the material package. Failure to comply with this provision may be cause for rejection.

Installation Requirements:

- (a) Before applying thermoplastic, the crack sealant shall be fully cured and hardened. The Contractor shall remove any dirt, glaze, grease, or any other material that would reduce the adhesion of the thermoplastic to the pavement.

- (b) This thermoplastic material shall be readily renewable by placing an overlay of new material directly over old markings of the same material. Such new material shall bond itself to the old markings in such a manner that no splitting or separation takes place. The Contractor shall remove all existing material that might cause premature failure of the new material.
- (c) The thermoplastic material shall be installed in a molten state by the spray method at a minimum temperature of 350 °F and a maximum temperature of 400 °F. Scorching or discoloration of material shall be cause for rejection by the Engineer. The machinery shall be constructed so that all mixing and conveying parts, up to and including the spray gun maintain the material in the molten state.
- (d) Thermoplastic pavement marking materials shall not be applied by the spray method when air and pavement surface temperatures are below 50 °F or when the surface of the pavement contains any evidence of moisture.
- (e) Unless directed by the Engineer, lines shall not be laid directly over a longitudinal crack or joint. The edge of the center line or lane line shall be offset a minimum distance of two inches from a longitudinal crack or joint. Edge lines shall be approximately two inches from the edge of pavement. The finished center and lane lines shall be straight, with a maximum lateral deviation of one inch for any ten feet section.
- (f) A primer sealer of the type recommended by the manufacturer of the thermoplastic material shall be applied on all portland cement concrete pavement surfaces, and if recommended by the manufacturer, on other types of pavement surface, prior to the installation of the thermoplastic material. The primer shall be free of solvent and water prior to the thermoplastic application.
- (g) The thermoplastic material shall be applied at a minimum of 0.045 inch and a maximum thickness of 0.050 inch. The finished lines shall be within a 1/4 inch of the width shown on the plans.
- (h) The Contractor shall place the thermoplastic markings with adequate drop on glass beads according to the above requirements. The glass beads shall be uniformly applied to assure nighttime reflectivity. It shall be the Contractor's responsibility to use a compatible combination of thermoplastic material and beads to preclude the surface beads from sinking deeply into the thermoplastic.
- (i) The thickness of the markings will be measured above the pavement surface at such random points as the Engineer selects to determine conformance to these specifications. If the measurements show less than 0.045 inch, the Engineer will "chip" the edges of the markings at random points and measure the thickness of the chips to determine if the overall thickness of the markings is at least 0.045 inch. If the overall thickness or the thickness above the pavement surface is substantially in conformance with the thickness requirements, payment will be made at 100 percent of the contract unit prices involved. When the thickness at a given location is less than 0.045 inch, additional measurements will be taken on each side of the location at intervals selected by the Engineer determine the extent of the deficient portion of the marking. The Contractor shall then apply additional thermoplastic material and beads to bring the thickness of the markings to the minimum 0.045 inch thickness.

Equipment Requirements:

- (a) The application equipment used for placing lane and edge line on County Highways shall be either Truck-Mounted or Hand-Operated meeting the requirements of Article 1105.01 of the "Standard Specifications" and the following:

Truck Mounted: When the Truck-Mounted method is used, the application equipment shall be permanently mounted on a truck of sufficient size and stability to insure smooth, straight application. The truck shall be equipped to carry a minimum of 4,000 pounds of molten thermoplastic.

Hand-Operated: When the Hand-Operated method is used, the application equipment shall be a self-propelled unit equipped to carry a minimum of 400 pounds of molten thermoplastic with electronic application controls.

The equipment shall have the capability of automatically placing intermittent and continuous lines. The equipment shall be equipped to provide the various widths of pavement marking lines specified. The mounting shall allow the spray equipment to accurately follow road irregularities and produce lines of uniform dimensions.

- (b) The equipment used to install hot applied thermoplastic material shall provide continuous uniform heating to temperatures exceeding 400 °F. The equipment shall provide mixing and agitation of the thermoplastic material. Conveying parts of the equipment between the main material reservoir and the dispensing device shall prevent accumulation and clogging. All parts of the equipment, which come in contact with the material, shall be constructed for easy accessibility and exposure for cleaning and maintenance. The equipment shall operate so that all mixing and conveying parts, including the line dispensing device, maintain the material at the plastic temperature. The use of pans, aprons, or similar devices to prevent die overruns will not be permitted.
- (c) Glass beads applied to the surface of the completed marking shall be applied by an automatic bead dispenser attached to the marking machine so that the beads are dispensed closely behind the installed marking. The glass bead dispenser shall be equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material.
- (d) A special kettle shall be provided for uniformly melting and heating the thermoplastic material. The kettle shall be equipped with an automatic thermostat control device and material thermometer for positive temperature control to prevent the overheating or underheating of the material. The heating kettle and application equipment shall meet the requirements of the National Fire Underwriters and the National Fire Protection Association.
- (e) The Contractor shall provide an accurate temperature measuring device capable of measuring the pavement temperature prior to installation of the thermoplastic and the temperature of the molten thermoplastic material immediately after it is applied.

Inspection: The hot spray thermoplastic pavement markings will be inspected following installation, but no later than November 1 of the year installed. The markings will also be inspected following the winter performance period that extends 180 days from November 1 of the year installed, according to the provisions of Article 780.10 of the "Standard Specifications".

Method of Measurement: Hot Spray Thermoplastic pavement marking lines will be measured for payment in place in feet. Double yellow lines will be measured as two separate lines.

Basis of Payment: This work will be paid for at the contract price per foot of applied HOT SPRAY THERMOPLASTIC PAVEMENT MARKING LINE of the width specified. *The unit price shall include all equipment, materials and labor required to furnish and install the hot spray thermoplastic pavement markings.*