



# Illinois Department of Transportation

2300 South Dirksen Parkway / Springfield, Illinois / 62764

January 3, 2007

SUBJECT: Various Routes  
Section D 6-7 H-T PVT MKG REP 2006-08  
Various Counties  
Contract No. 44936  
Item No. 35, January 19, 2007 Letting  
Addendum A

## NOTICE TO PROSPECTIVE BIDDERS:

Attached is an addendum to the plans or proposal. This addendum involves revised and/or added material.

1. Revised pages 4 – 12 of the Special Provisions.

Prime contractors must utilize the enclosed material when preparing their bid and must include any Schedule of Prices changes in their bidding proposal.

Bidders using computer-generated bids are cautioned to reflect any and all Schedule of Prices changes, if involved, into their computer programs.

Very truly yours,

Eric E. Harm  
Interim Bureau Chief  
Bureau of Design and Environment

A handwritten signature in cursive script, reading "Ted B. Walschleger P.E.", with a small "P.E." to the right.

By: Ted B. Walschleger, P. E.  
Engineer of Project Management

cc: Joe Hill; Roger Driskell; Estimates; Design & Environment File

TBW:DB:jc

**45 MIL HOT SPRAY THERMOPLASTIC PAVEMENT MARKING:**

Effective February 28, 1994

Revised December 4, 2006

This work shall consist of furnishing and applying spray thermoplastic pavement marking lines, sizes and colors 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. Spray thermoplastic pavement markings shall be applied only by contractors on the list of Approved Spray Thermoplastic Contractors maintained by the Engineer of Operations and in effect on the date of advertisement for bids.

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 (TiO<sub>2</sub>). The white pigment content shall not be less than 10 percent by weight and shall be uniformly distributed throughout the thermoplastic compound.

**The pigments used for the yellow thermoplastic compound shall not contain any hazardous materials listed in the Environmental Protection Agency Code of Federal Regulations (CFR) 40, Section 261.24, Table 1. The Combined total RCRA listed heavy metals shall not exceed 100 ppm when tested by X-ray fluorescence spectroscopy. The pigments shall also be heat resistant, UV stable and color fast yellows, golds, and oranges, which shall produce a compound which shall match Federal Standard 595 Color No. 33538. The pigment shall be uniformly distributed throughout the thermoplastic.**

- (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 150 um (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 150 um (No. 100) sieve) of thermoplastic compound.

Revised 01/03/2007

Type B shall be used as drop-on beads with thermoplastic pavement marking materials and shall be applied uniformly at a minimum rate of 2.9 kilograms per 10 square meters (6 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:

<u>Sieve Size</u>	<u>Total Percent (By Weight) Passing</u>
850 um (No. 20)	100
600 um (No. 30)	75-100
300 um (No. 50)	15-40
150 um (No.100)	0-5
75 um (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 not more than 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 25° C (77° F).

(d) Silica Content. The glass beads shall contain not less than 65 percent silica (SiO<sub>2</sub>).

(e) Chemical Stability. Glass beads which show 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:

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: One hundred grams of glass beads, spread evenly and thinly in a suitable container, shall be conditioned at 25° C (77° F) for 4 hours over a solution of sulfuric acid (Sp. Gr. 1.10) in a closed desiccator. After 4 hours, the glass beads shall flow readily through a clean glass analytical funnel, 60°, 75mm. diameter and 105mm. stem. Inside diameter of the stem shall be a nominal 6.35mm. (1/4 inch).

Revised 01/03/2007

The drop-on beads shall have a silicone, moisture resistant coating and pass the following test: One hundred grams 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 5 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 5 minutes. The beads will then be poured slowly into a standard glass funnel (Corning 6120), 127mm. diameter, 102mm. stem length and 11 mm. stem inside diameter. 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 may be delivered in approved moisture proof bags or in weather resistant bulk boxes.

Moisture proof bags shall consist of a least five-ply paper construction unless otherwise specified. Each bag shall contain 22.7 kg (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.

Bulk weather resistance boxes must conform to Federal Specification PPP-8-640D Class II or latest revision. Boxes are to be weather resistant, triple wall, fluted, corrugated-fiber board. Cartons shall be strapped with two (2) metal straps. Straps shall surround the outside perimeter of the carton. The first strap shall be located approximately two (2) inches from the bottom of the carton and the second strap shall be placed approximately in the middle of the carton. All cartons shall be shrink wrapped for protection from moisture. Cartons must be lined with a minimum 4 mil polyester bag and meet ICC requirements. Carton shall be approximately 38 x 38 inches, contain 2,000 lbs. of beads and be supported on a wooden pallet with fiber straps. Each carton 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 re-heating processes.
- (3) There shall be no obvious change in color of the material as a result of 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  $21^{\circ} \pm 2^{\circ} \text{C}$  ( $70^{\circ} \pm 3^{\circ} \text{F}$ ). 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

Revised 01/03/2007

pavement under normal traffic conditions within a road temperature range of -28.9° to 65.6° C (-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 as a result of 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 4 hours  $\pm$  5 min at 190.6°  $\pm$  2° C (375°  $\pm$  3° F) and cooled at 25° C (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 band-pass of 10 nm.

White: Daylight Reflectance, 75 percent minimum  
\*Yellow: Daylight Reflectance, 45 percent Minimum

**\*Shall meet the coordinates of the following color tolerance chart.**

<b>x</b>	<b>0.490</b>	<b>0.475</b>	<b>0.485</b>	<b>0.530</b>
<b>y</b>	<b>0.470</b>	<b>0.438</b>	<b>0.425</b>	<b>0.456</b>

- (6) Specific Gravity - the specific gravity of the thermoplastic material shall not exceed 2.15.
- (7) Softening Point - After heating the thermoplastic material for 4 hours  $\pm$  5 min. at 190.6°  $\pm$  2° C (375°  $\pm$  3° F) and testing in accordance with ASTM E28, the material shall have a minimum softening point of 82.2° C (180° F) as measured by the ring and ball method.
- (8) Tensile Bond Strength - After heating the thermoplastic material for 4 hours  $\pm$  5 min. at 190.6° C (375° F), the tensile bond strength to unprimed, sandblasted Portland cement concrete block, 1.587mm. (0.0625-inch) thick film drawn down 190.6° C (375° F), tested at 23.9°  $\pm$  1° C (75° F  $\pm$  2° F) shall exceed 1.24 Mpa (180 psi) when tested in accordance with ASTM D4796-88.
- (9) Impact Resistance - After heating the thermoplastic material for 4 hours  $\pm$  5 min at 190.6°  $\pm$  2° C (375°  $\pm$  3° F) the impact resistance shall be a minimum of 0.576 kilogram meters (50 inch pounds) with no cracks or bond loss when 1.587mm. (0.0625 inch) thick film drawdown is made at 190.6° C (375° F) on an unprimed sandblasted Portland cement concrete block, male indenter 15.875 mm.(5/8 inch), no female Die, tested at 23.9°  $\pm$  1° C (75°  $\pm$  2° F) when tested in accordance with ASTM D2794 minimum.
- (10) Yellowness Index - The white thermoplastic material shall not exceed a yellowness index of 12 when tested in accordance with ASTM D1925.

Revised 01/03/2007

- (11) **Accelerated Weathering – After heating the thermoplastic for 4 hours  $\pm$  5 min. at 190.6° C (375° F) the thermoplastic shall be applied to a steel wool abraded aluminum alloy panel (Federal Test Std. No. 141, Method 2013) at a film thickness of 30 mils (0.70 mm) and allowed to cool for 24 hours at room temperature. The coated panel shall be subjected to accelerated weathering using the light and water exposure apparatus (fluorescent UV – condensation type) for 75 hours according to ASTM G 53 (equipped with UVB-313 lamps).**

**The cycle shall consist of 4 hours UV exposure at 122° F (50° C) followed by 4 hours of condensation at 104° F (40° C). UVB 313 bulbs shall be used. At the end of the exposure periods, the panel shall not exceed 10 Hunter Lab Delta E units from the original material**

- (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 lot number. Lot numbers must 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 12.7 mm (1/2 inch) in height.

- (c) Packaging

The thermoplastic material shall be packaged in suitable containers, which will not adhere to the product during shipment and storage. The container of thermoplastic material shall weigh approximately 22.7 kg (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 177° - 204° C (350° - 400° F).

- (d) 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 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 in accordance with 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 and 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

Revised 01/03/2007

samples, for acceptance tests, shall be taken or witnessed by a representative of the Bureau of Materials and Physical Research, and 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. 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 1-liter (1-quart) sample is obtained. The sample from each container shall be submitted for testing.
    - (b) Binder: 0.5 liter (One pint).
    - (c) Pigments: 0.5 liter (One pint).
    - (d) Filler: 0.5 liter (One pint).

(2) Thermoplastic:

At least three randomly selected containers shall be obtained from each lot. A 4.5 kg (10-pound) composite sample of the three containers shall be submitted for testing and acceptance. The lot size shall be approximately 20,000 kg (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 4,500 kg (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 particular lot of thermoplastic will be based on the following:

- (a) Compliance of ingredient materials with the specifications.

Revised 01/03/2007

- (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 in order 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 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 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 177° C (350° F) and a maximum temperature of 204° C (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 10° C (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 50 mm (2 inches) from a longitudinal crack or joint. Edge lines shall be approximately 50 mm (2 inches) from the edge of pavement. The finished center and lane lines shall be straight, with the lateral deviation of any 3 meter (10-foot) line not to exceed 25 mm (1 inch).
- (f) A primer sealer of the type recommended by the manufacturer of the thermoplastic material shall be applied on all Portland 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 thickness of not less than 1.143mm. (0.045-inch), but in no case shall it exceed a thickness of 1.27mm. (0.050-inch). Finished lines shall be within a 6.35mm. (1/4-inch) of the width specified in the plans.

Revised 01/03/2007



- (h) The Contractor shall place the thermoplastic markings with adequate drop on glass in accordance with the above requirements, uniformly applied to assure nighttime reflectivity. It shall be the Contractor's responsibility to use 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 1.143mm. (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 1.143mm. (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 1.143mm. (0.045 inch), additional measurements will be taken on each side of such location at such intervals as the Engineer may select to 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 at least 1.143mm. (0.045 inch).

Equipment Requirements:

- (a) The application equipment used for placing lane and edge line on freeways 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 1800 kilograms (4,000 pounds) of molten thermoplastic. The equipment shall have the capability of automatically placing intermittent and continuous lines. The equipment shall be so constructed as to provide the various widths of pavement marking lines specified. The mounting shall be such as to 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 204° C (400° F) **and shall provide** mixing and agitation of the 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 comes 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, maintains 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 must be equipped with an automatic thermostat control device and material thermometer for positive temperature control and to prevent 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.

Revised 01/03/2007

- (e) The Contractor shall provide an accurate temperature measuring device which shall be 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 45 mil hot spray thermoplastic pavement markings will be inspected following installation, but no later than November 1, and inspected following a winter performance period that extends 180 days from November 1 in accordance with the provisions of Article 780.10 of the Standard Specification.

Method of Measurement:

The lines will be measured for payment in feet of thermoplastic pavement marking lines applied and accepted, measured in place. Double yellow lines will be measured as two separate lines.

Basis of Payment:

This work will be paid for at the contract unit prices per foot of applied line for HOT SPRAY THERMOPLASTIC PAVEMENT MARKING - LINE 4, 5, 6, or 8 inches measured as specified herein.

### **AERIAL SPEED CHECK MARKINGS**

This work shall consist of furnishing and applying 450 mm (18 inches) white Preformed Plastic Type C, Preformed Thermoplastic, Thermoplastic, Epoxy or Polyurea pavement marking lines of the length shown on the plans for aerial speed check zones. The work order shall include the type of material to be applied.

The furnishing and applying of Preformed Plastic Type C or Preformed Thermoplastic pavement markings shall meet the requirements of Articles 780.07 and 780.08.

The lines will be measured for payment in feet of aerial speed check marking lines applied and accepted, measured in place.

This work will be paid for at the contract unit price per foot of applied line for AERIAL SPEED CHECK MARKING, measured as specified. All pavement cleaning work will not be measured for payment but shall be considered incidental to the contract unit price bid for AERIAL SPEED CHECK MARKING.

Revised 01/03/2007