1085 - PREFORMED THERMOPLASTIC PAVEMENT MARKINGS

1085.1 DESCRIPTION

The Contractor shall furnish and install white and yellow permanent retro-reflectorized pavement marking materials at the locations shown on the plans, in conformance with the details, and the material specifications included herein.

The permanent pavement markings shall be installed immediately after surface treatment unless prior approval is received by the Engineer or City Inspector. The installation of the yellow markings (as required) is the first priority. If the permanent markings cannot be installed and thus the roadway would be unmarked overnight, interim removable markings shall be installed and remain until the permanent markings can be installed. The contractor shall make every possible effort to remove the interim pavement markings and install permanent pavement markings within 48 hours. Only under extreme circumstances and at the approval of the pavement marking inspector or the engineer, will the duration of the interim pavement markings be extended. Under no circumstance should the interim pavement markings be in place for more than 2 weeks. The interim removable markings shall be removed prior to installation of the permanent markings. If permanent markings cannot be installed within the specified time then temporary markings shall be installed following the guide lines as set forth in the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD) Part VI, Sections 6F.78 and 6G.02.

1085.2 MATERIALS

This specification is for the furnishing of retroreflective preformed thermoplastic pavement marking materials that can be adhered to asphalt and concrete pavements by means of heat fusion. The applied markings shall be very durable, oil and grease impervious and provide immediate and continuing retroreflectivity. The material for permanent pavement markings shall be in accordance with this specification.

a. Pre-Qualification

All material for permanent pavement marking material used by the Contractor shall be from the City's approved list of vendors. It is important that users be completely knowledgeable of all application requirements and procedures prior to product application. It is the responsibility of the installer to contact the supplier of all permanent pavement marking materials if questions regarding application procedures or conditions arise. Manufacturers interested in pre-qualifying material under this specification shall submit a sample of the material along with a complete materials specification for each color of marking material to be considered. The sample will be reviewed for compliance with all requirements of this specification. No material shall be used unless the material has been pre-qualified. A complete list of pre-qualified materials is maintained by the Traffic Engineering Division of the Department of Public Works.

b. Characteristics

The preformed marking material shall consist of a resilient white and yellow polymer thermoplastic with uniformly distributed glass spheres throughout its entire cross section.

Preformed words and symbols shall conform to the applicable shapes and sizes as prescribed in the latest revision of the Manual on Uniform Traffic Control Devices for Streets and Highways.

The preformed markings shall be fusible to asphalt concrete by means of the normal heat of a propane type of torch. No adhesives, primers or sealers shall be used prior to the preformed marking application when applying to asphalt concrete pavements. The markings shall be able to be applied without preheating the pavement to a specific temperature, except to remove surface moisture.

The preformed markings shall conform to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics and be capable of fusing to itself and previously applied worn hydrocarbon and/or alkyd thermoplastic pavement markings.

The preformed markings shall be capable of application on new, dense and open graded asphalt concrete wearing courses during the paving operation in accordance with the manufacturer's instructions.

After application, the markings shall be immediately ready for traffic. The preformed markings shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's recommendations.

The preformed thermoplastic markings shall not be brittle and must be sufficiently cohesive and flexible at temperatures exceeding 50 degrees F for one person to carry without the danger of fracturing the material prior to application.

c. Composition

The retroreflective pliant polymer thermoplastic pavement markings shall consist of a homogeneous mixture of high quality polymeric thermoplastic binders or ester modified rosins, lead-free pigments, fillers and glass spheres. The thermoplastic material must conform to AASHTO designation M-249 with the exception of the relevant differences due to the material being supplied in a preformed state.

d. Glass Spheres

The markings shall contain 30% glass intermixed spheres by weight which shall conform to AASHTO M247 Type 1, except that glass spheres shall have a minimum of 70% true spheres on each sieve and 80% true spheres overall. Factory applied coated beads, in addition to the intermix beads, shall be applied at a rate of 1 lb (±10%) per 10 square feet. The factory applied coated surface beads shall conform to AASHTO M247 designation Type 1 and Type 3 and shall have a minimum of 80% minimum true spheres and a minimum refractive index of 1.50. They shall meet the following gradation.

Sieve Size	Cumulative Percent Retained
No. 12 (1.7 mm)	0 – 2%
No. 14 (1.4 mm)	0 – 3.5%
No. 16 (1.18 mm)	2 – 25%
No. 18 (1.0 mm)	28 – 63%
No. 20 (850 µm)	63 – 72%
No. 30 (600 µm)	67 0 77%
No. 50 (300 µm)	89 – 95%
No. 80 (200 µm)	97 – 100%

The glass spheres must be homogeneously blended throughout the material with a securely bonded protruding exposed layer of spheres that provide immediate and continuous retroreflectivity. No additional glass spheres shall be dropped on the material during application. If using reversible curved arrows without surface beads, additional beads must be applied to the surface in a uniform and even manner during application while the material is in the molten state.

(1) Heating Indicators

The top surface of the material shall have regularly spaced intents to 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.

e. Retroreflectivity

The preformed marking shall upon application, exhibit uniform adequate nighttime retroreflectivity when tested in accordance to ASTM E1710-97. The applied material must have an initial minimum intensity reading of 300 millicandelas for white and 255 millicandelas for yellow as measured with an LTL-2000 Retroreflectometer with a 1.05 degree observation angle, 88.76 degree entrance angle and 30 meter geometry (viewing distance).

f. Color and Luminosity Characteristics

The thermoplastic material without pre-applied top glass spheres shall meet the following:

White:	Daylight reflectance at 45-degree/ 0 degree of 75% minimum
Yellow:	Daylight reflectance at 45-degree/ 0 degree of 45% minimum.

The daylight reflectance shall not change significantly when the preformed thermoplastic is properly applied to the roadway surface

For highway use, the white markings shall contain a minimum of 10% by weight of Titanium Dioxide pigment to ensure a color to meet Federal Docket No. FHWA-99-6190 Table 5 and 6 as revised and corrected. Yellow pigments shall meet Federal Docket No. FHWA-99-6190 Table 5 and 6 as revised and corrected and shall be lead and heavy metal free.

g. Skid Resistance

The surface of the preformed thermoplastic markings shall provide a minimum skid resistance value of 45 BPN when tested according to ASTM E303.

h. Thickness

The supplied material shall have a minimum average thickness of 90 mils.

i. Flexibility

The preformed thermoplastic marking material shall have flexibility at 50 degrees F such that no cracking occurs in the test sample when a 1" by 6" sample is bent through an arc of 90 degrees at a uniform rate in 10 seconds (9 seconds per degree) over a 1" mandrel. The sample must be conditioned prior to testing at 50 $\pm$ 2 degrees F for a minimum of four hours. At least two specimens tested must meet the flexibility requirements at 50 degrees F for a passing result.

j. Environmental Resistance

The applied markings shall be resistant to deterioration due to exposure to sunlight, water, oil, diesel fuels, gasoline, pavement oil content, salt and adverse weather conditions.

k. Low Temperature Cracking (Stress) Resistance for Extended Period

When tested according to AASHTO T250 for an exposure period of 72 hours, no cracking or failure of the material shall be apparent.

l. Effective Performance Life

When properly applied, in accordance with the manufacturer's instructions, the pavement markings shall be neat and durable. The markings shall remain retroreflective and show no fading, lifting, shrinkage, tearing, roll back or other signs of poor adhesion.

1085.3 CONSTRUCTION REQUIREMENTS

The proposed permanent markings shall be laid out by the contractor in advance of the marking installation. Markings shall not be applied until the layout and conditions of the surface have been approved by the City Inspector. If a paint line is used for layout purposes (in lieu of a chalk line or string line) the paint line shall not be wider than ½ inch) in width. If wider, the paint shall be removed following the application of the final permanent marking. New markings shall match existing markings as applicable in areas abutting existing road surfaces. The surface shall be dry and all dust, debris, oil, grease, dirt, temporary markings, existing markings, and other foreign matter shall be removed from the road surface prior to the application of the permanent marking material.

The Contractor shall be responsible for keeping traffic off freshly applied markings until they have set sufficiently to bear traffic. Traffic control is the responsibility of the Contractor and shall conform to the City of Overland Park Traffic Control Handbook. Failure to comply with traffic control guidelines will result in the Pavement Marking Contractor being directed to stop operations and leave the site until proper and approved traffic control has arrived and put in place on site.

The markings shall be applied in accordance with the manufacturer's recommendations on clean and dry surfaces.

a. Application Temperature

The material must be able to be applied at ambient and road temperatures down to 32 degrees F without any preheating of the pavement to a specific temperature. Preformed thermoplastic pavement marking materials shall not be applied when pavement temperatures are below 32 degrees F, or when the surface of the pavement shall show evidence of moisture. The pavement shall be clean, dry and free of

debris and oil or grease residue. At temperatures below 50 degrees F, the preformed thermoplastic pavement markings shall be kept as warm as possible to maintain flexibility.

b. Application Method

All pavement must be free of dirt, dust, chemicals or significant oily substances. Concrete pavements must be free of all curing compounds.

(1) Asphalt Pavements

The materials shall be applied using the propane torch method recommended by the manufacturer. Remove pavement surface moisture by holding a propane torch approximately 8" to 10" above the section of asphalt using a continuous circular motion. Immediately after removing surface moisture, position the material with exposed sphere side up and heat. Position the torch approximately 12" (or per manufacturer's recommendation) over the marking so the flame is extended and heat is evenly applied moving the torch in a circular motion across the marking. When the correct temperature of the marking has been reached, it will turn slightly darker or pale yellow if the material is white and the heat indicators shall disappear. Over heated or burned material shall be removed. After the entire material section has been heated and bonded to the pavement, re-heat the perimeter of the marking and the road surface to bond the edges. If installing reversible arrows, which do not contain a top coating of glass spheres, the glass spheres shall be hand applied on the molten material. Feather the leading edge of the pavement marking with a putty knife or bevel with the torch. Leading edges are any edge that would be susceptible to snow plow blades approaching from the direction of normal travel. After cooling, use a putty knife to attempt to remove a portion of the material. The material shall not pry off without asphalt embedded to the underside.

(2) Concrete Pavements

The materials shall be applied using the same method as for asphalt pavement except the curing compound on concrete pavement shall be thoroughly removed by water blasting or other approved method and a primer adhesive shall be used. Concrete materials shall be moisture free for 24 hours prior to application.

c. Surface Bead Application

After installation of the pavement marking, beads, meeting the requirement of AASHTO M 247 Type II, shall be immediately broadcast over the material while it is still hot, as a surface dressing, to improve initial retro-reflective numbers.

1085.4 INSTALLATION PERFORMANCE MEASURES

To ensure total understanding of what is expected in the application of any permanent pavement marking material on new pavement surfaces in the City of Overland Park, the following guidelines shall be followed.

Applied material must be from an approved manufacturer, of proper dimensions and composition. Material must be applied per manufacturer's instructions. No substitutions of materials will be allowed without prior approval of the Engineer.

Contractor is responsible for accurate layout and measurement. Preformed thermoplastic to be used only where specified or with approval of the Engineer.

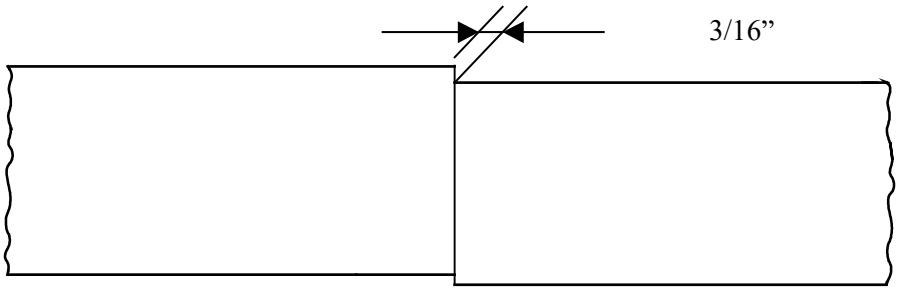
Applied material must adhere fully and completely to road surface, with straight edges and squared ends; lay smooth on surface with no warps, folds, creases, waves, bubbles or rips. Color and beading must be uniform and consistent.

No overlap of materials. Ends or sides matched to existing markings must not exceed 1/8" in separation. Applied material to be in alignment with existing markings and of consistent size.

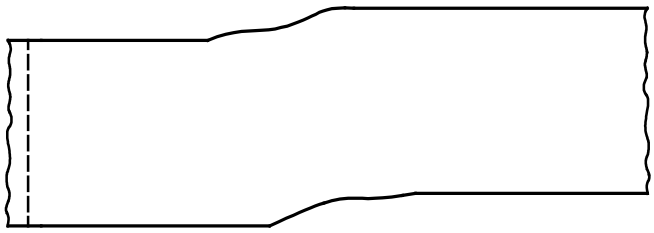
Lack/Excess of Surface Spheres or Improper Application: The full unit price bid per foot shall be withheld for each lineal foot of material or per each for symbol markings with inappropriate application rate of the surface glass spheres. The same penalty shall apply if the spheres are not evenly disbursed across and along a line or if the spheres imbed improperly. This penalty shall be imposed for each instance that the Contractor fails to take corrective action after one warning by the Engineer.

Lack of adhesion: The full unit price bid per foot or per each for symbol markings shall be withheld for one foot for each occurrence if found more than three (3) times per 1 mile, or project if less than 1 mile in length.

Line Deviation: A line that deviates from the specified layout by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.

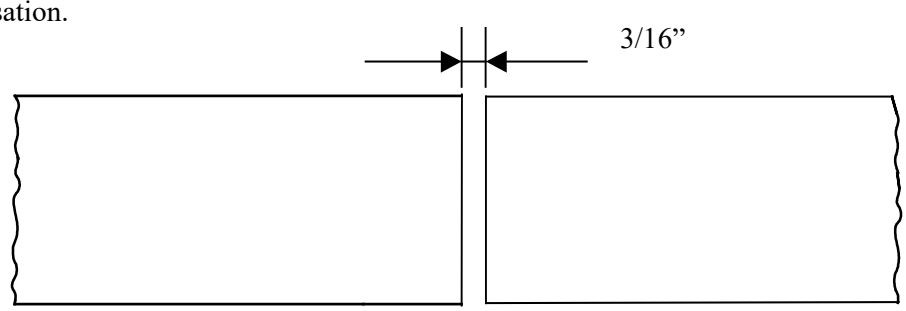


Wavy Line: The full unit price bid per foot shall be withheld for the entire length of waviness in a line caused by poor workmanship and/or application procedures. Penalty shall be imposed from the first



occurrence.

Gaps Between Successive Lines: Successively placed lines that contain gaps as specified by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer at no additional compensation.



Burned or Discolored Markings: Fifty (50) percent of the full unit price bid per foot shall be withheld for each lineal foot of material or per each for symbol markings which shows signs of burning or discoloration due to prolonged application of the torch. This penalty shall be imposed for each instance that the Contractor fails to take corrective action after one warning by the Engineer.

Work Outside the Scope/Limits of Project: Payment for all pavement marking work performed shall be withheld in full until the Contractor (a) removes all pavement marking material placed outside the

scope/limits of the project, and (b) repairs the pavement surface as directed by and to the satisfaction of the Engineer and the local entity, if different from the Engineer.

Timeliness: All preformed thermoplastic material shall be completely installed within two (2) calendar weeks of the road surface material being laid. Failure to install markings on schedule shall result in liquidated damages of $1500 per day, separate from the project liquidated damages as stated elsewhere in the Contract Documents, until pavement markings are installed on schedule, or completion of the markings completes the project. These liquidated damages shall be imposed each time the Contractor fails to install pavement markings within the two-week window as described above.

1085.5 MEASUREMENT AND PAYMENT

a. Lump Sum

The Engineer will measure the pavement markings, as indicated on the plans, complete- in-place and accepted, as a unit lump sum quantity for all work necessary.

Payment for "Permanent Pavement Markings" at the contract lump sum price bid is full compensation for the specified work, which shall include all materials, labor, equipment and incidentals necessary to complete the work. The removal of existing pavement markings prior to installing new markings in the same location shall be considered subsidiary to the bid item "Permanent Pavement Markings".

b. Unit Bid Prices

Measurement for "Preformed Thermoplastic Pavement Markings" shall be as listed in the bid proposal, which includes all labor, materials, tools and equipment necessary to fully complete the installation according to the plans and specifications. No measurement will be made for the removal of existing pavement markings prior to installing new markings in the same location.

The Engineer will measure the various widths, type and color of pavement marking material along the marking centerline by the linear foot complete in place. Each line of double median approach lines, double centerlines, solid and broken centerline or other parallel lines will be measured separately. Crosshatch lines, chevron lines, crosswalk lines, solid lane lines, stop lines and edge lines, etc. will be measured by the linear foot, measured along the centerline of all markings for each length of the various widths, type and color of material complete in place.

The Engineer will measure broken lines, composed of short line segments separated by a specified gap, by the linear foot of the various widths, type of material and color for the actual marked line only complete in place.

The Engineer will measure each symbol marking, consisting of left and right turn arrows, "ONLY" markings, handicap parking symbols, etc. Each isosceles triangle within a yield line will be measured separately. The "X" and "RR" symbols of a railroad crossing markings will be measured as one combined railroad crossing symbol. Parking space markings will be measured per each whether they consist of the full "+" symbols or "T" symbols used at the outer ends of an on-street parking section. No distinction will be made whether it is a full "+" or whether it is a "T". Bicycle lane symbol markings, comprised of a bicycle lane rider symbol and a bicycle lane arrow, will be measured per each for each bicycle lane rider symbol and per each for each bicycle lane arrow. Shared bicycle lane markings (sharrows), comprised of a bicycle lane rider symbol and two chevrons, will be measured per each for each bicycle lane rider symbol and per each for the pair of chevrons.

Payment for "Preformed Thermoplastic Pavement Markings" as listed in the bid proposal, at the contract unit price bid is full compensation for the specified work.

All traffic control necessary for installation of the "Preformed Thermoplastic Pavement Markings" shall be subsidiary to other bid items. The removal of existing pavement markings prior to installing new markings in the same location shall be considered subsidiary to other bid items.