

1083 - METHYL METHACRYLATE (MMA) PAVEMENT MARKINGS

1083.1 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.

1083.2 MATERIALS

This specification covers a methacrylate based pavement marking material of a type that is applied to Portland cement concrete surfaces at ambient temperature by spraying with a surface application of glass beads. Upon curing it produces a retro-reflective marking of specified thickness and width capable of resisting deformation by traffic and maintenance vehicles. The product consists of white and yellow lead free products. The contractor shall provide complete manufacturer's specifications and material safety data sheets to the Engineer for all material furnished. 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. Glass Beads

The high performance glass beads for high performance pavement markings shall be clear, smooth and spherically shaped and shall conform to the following specific requirements.

(1) Gradation

US Sieve Mesh No.	Microns	% Retained	% Passing
16	1190	0-10	90-100
18	1000	20-35	65-80
30	600	50-70	30-50
50	300	95-100	0-5

(2) Roundness

The beads shall have a minimum of 80% true spheres above the 30 sieve by visual inspection by ASTM Method D 1155 or by Computerized Optical Method (AASHTO PP-74-13) or approved equivalent.

(3) Color / Clarity

Beads shall be colorless and clear and free of carbon residues.

(4) Refractive Index

The glass beads shall have a refractive index of 1.50 to 1.55.

(5) Coating

The bead coating shall meet or exceed the requirements for the particular pavement marking material that is used. This may include coatings for floatation, optimum adhesion and/or embedment.

(6) Air Inclusions

Air inclusions shall be less than 5% by visual count.

(7) Hardness

All beads above the 30 sieve shall exhibit an average crushing strength of not less than 60,000 psi when measured with the L/D² method and with a minimum sampling of 100 glass beads.

(8) Chemical Resistance

The beads shall be resistant to hydrochloric acid, water, calcium chloride, and sodium sulfide as tested per methods outlined in sections 4.3.6 to 4.3.9 of the TT-B Federal Spec. 1325C.

c. Composition

The methyl methacrylate material shall be a two-part material. The composition is 98 parts of Component “A”, homogeneously composed of pigment, filler, resins and glass beads, and 2 parts of Component “B”, liquid hardener. It shall be available in white and yellow. Yellow pigment shall be lead free. Part “B” shall be a benzoyl peroxide catalyst.

d. Test Data

The material shall comply to the following:

TEST	RANGE	METHOD
Density (A)	12 to 15 lbs/gal minimum	ASTM D1475
Viscosity, KU	87 to 100	
Pot life at 77 ° F (mix)	3-5 minutes	AASHTO T-237
Cure Time 77 ° F (mix)	5 to 10 minutes	ASTM D711, mixed as above, 28 mils thick
No Track Time	30 minutes max	D711 with drop on beads
VOC (mix)	100 g/l maximum	EPA Ref Method 24, 40 CFR, Appendix A to Subpart D of Part 59
Total solids (mix)	99% by weight min	As in VOC above
Adhesion (mix)	.200 psi or substrate failure	ASTM D4541
Chemical resistance (mix)	Pass 7 days emersion	Cure 3 days – motor oil, gas, diesel, ATF, salt, anti-freeze
Hardness (Shore D)	50 Min	ASTM D2240

e. Luminosity and Color

The luminosity for white and yellow shall be as indicated:

White:	Daylight reflectance at 45-degree/ 0 degree of 80% minimum
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Yellow:	Daylight reflectance at 45-degree/ 0 degree of 45% minimum.
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Provide white which complies with Federal Standard 595B, 37925. Provide yellow which complies with Federal Standard 595, 33538).

f. Water Absorption

Materials shall have a maximum of 0.5 percent by weight of retained water when tested by ASTM designation D-570, “Water Absorption of Plastics”, procedure (A).

g. Retroreflectivity

The 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 350 millicandelas for white and 225 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).

h. Skid Resistance

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

i. Application Properties

The material, when formed into traffic markings, must be readily renewable by placing an overlay of new material directly over old, clean and dry markings of the same material. Such new material shall bond itself to the old marking in such a manner that no splitting or separation takes place.

j. Safety

The contractor shall follow all safety precautions when working with this product following Federal Regulations and as indicated in the manufacturer’s product literature. The manufacturer shall provide material safety data sheets for the product.

k. Packaging and Mixing

The methyl methacrylate material shall be packaged in suitable containers as recommended by the manufacturer. Each container shall designate the color, user information, manufacturer’s name and address, batch number and date of manufacture. Each batch manufactured shall have its own separate number. Components A and B shall be stored separately.

1083.3 CONSTRUCTION REQUIREMENTS

The Contractor shall furnish and install white and yellow methacrylate markings on concrete surfaces at the location shown on the plans, in conformance with the details and material specifications included herein. Surface beads shall be applied by drop-on method for initial retroreflectivity.

a. Equipment

Use equipment that is “airless” or “air atomized” and capable of applying spray methyl methacrylate as recommended by the manufacturer. Equipment will be expected to place markings on the left and right sides and place two lines simultaneously with either line in a solid or intermittent pattern in yellow or white. Words and symbols capability will also be required.

b. Mixing

Liquid components must be homogenously stirred in the original containers before mixing components A and the liquid BPO concentrate catalyst, called Part B. Thoroughly mix by weight, 2 parts of the liquid hardener (Part B) with 98 parts of Component A. Mixing must be done by using a static mix tube or impingement system just prior to spray gun application on the job site.

c. Temperature

Material, pavement surface and ambient air temperature must be between 40° F and 105° F, and at least 5° F above dew point prior to striping. Relative humidity must be less than 75%. Installing the materials on surfaces above 105° F can lead to improper cure and dirt pickup. Surface and ambient temperatures should be checked hourly at a minimum if weather conditions cause temperatures to fluctuate during the course of the striping operation. Please note that drying time will be increased when

striping at low temperatures. Both the Part A and B must be mixed together thoroughly prior to application by any of the various application techniques.

d. Surface Preparation

All surfaces must be clean and dry, free of any loose debris and within the proper temperature range prior to striping. Prepare the pavement areas to receive methyl methacrylate pavement markings according to the manufacturer's recommendations. Remove contaminants such as curing agents, surface oils, grease, oil, gasoline, dirt, grass, loose gravel, old, peeling or flaking paint and other contaminants prior to applying pavement marking material. As the bond of the methacrylate materials to substrates is very good, the ultimate adhesion of the product is more dependent on the cohesion of the concrete or to itself. Additional preparation for the surface indicated below is as follows:

(1) Existing striped concrete roadways

Any existing paint, thermoplastic, polyester, epoxy or tape pavement markings must be mechanically removed to a minimum of 90% removal to insure adequate bonding. Removal of existing methacrylate markings is not required unless the old methacrylate is chipping and flaking, or the combined thickness of the recoated marking is undesirable.

(2) New or not previously striped concrete roadways

Concrete must be fully cured for a minimum of 28 days prior to installation. Surface contaminants such as curing agents, membranes, bond breakers or laitance shall not be mechanically removed prior to marking.

e. Application

This material should be readily applied to Portland cement concrete surfaces sprayed at a minimum of 28 mils thick.

f. Drop-on Glass Beads

The drop-on glass beads shall be applied at a rate of 10 to 12 pounds per 100 square feet or as recommended by the manufacturer as specified by the Methyl Methacrylate supplier and shall be coated with a Methacrylate compatible coupling agent.

1083.4 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.

The line shall be uniform thickness across the entire cross section of the line with well-defined edges. Heavy inner thickness and thin edges or vice-versa will not be accepted. Glass spheres shall be spread uniformly over the entire length of line. Beginning and ends of lines shall be clean cut and perpendicular to the centerline of the street.

Remove and replace methyl methacrylate that has foreign covering, discolored areas, improper adhesion, improper width, length, or thickness as verified by the Engineer against the plans or this special provision, areas that present a ragged appearance, areas that do not present clear and sharply defined edges, areas with abrupt unintended changes in alignment, or has retro-reflectivity as measured with a 30-meter geometry retro-reflectometer of less than that stated in this specification. Remove excessive dripping of marking material between lines, and remove and replace any marking applied with a lack or excess of drop-on beads. Remove, to the satisfaction of the Engineer, all pavement marking applied outside the scope or limits of this project. Removal and replacement of unsatisfactory pavement marking will be at the Contractor's expense.

Lack of specified thickness: The full unit price bid per meter (foot) shall be withheld if lack of thickness is found more than three (3) times per 1.6 km (mile), or project if less than 1.6 km (1 mile) in length. Each line shall be checked a minimum of six (6) times per 1.6 km (mile), or project if less than 1.6 km (1 mile) in length, using the random number tables and method of sampling as set forth in section 5.17.06 of Part V of the KDOT Construction Manual.

Lack of specified width: Payment shall be made with penalty being equal to 25% of the unit price bid per meter (foot) for each 6.4 mm (¼") of width lacking not to exceed 100% of the unit price bid

per meter (foot) for the length of the line less than specified width. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.

Lack of specified length/cycle: Payment shall be made with penalty being equal to 25% of the unit price bid per meter (foot) for each 50 mm (1") of length lacking or exceeding the specified length for broken lane line and/or broken center line not to exceed 100% of the unit price bid per meter (foot) for the length of the line less than specified length. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.

Lack/Excess of Surface Spheres or Improper Application: The full unit price bid per meter (foot) shall be withheld for each lineal meter (foot) of material 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.

Improper adhesion: The full unit price bid per meter (foot) shall be withheld for one meter (one foot) for each occurrence if found more than three (3) times per 1.6 km (1 mile), or project if less than 1.6 km (1 mile) in length.

Line Deviation: A line that in the judgment of the Engineer 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.

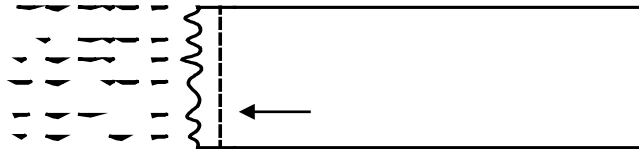
Pointed Ends: The full unit price bid per foot shall be withheld for pointed ends. This penalty shall be for the full 6 feet of a lane line or broken centerline or for no more than 6 feet of a long line.



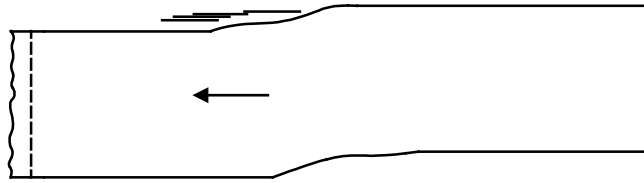
Skewed Ends: The full unit price bid per foot shall be withheld for skewed ends. This penalty shall be for the full 6 feet of a lane line or broken centerline or for no more than 6 feet of a long line.



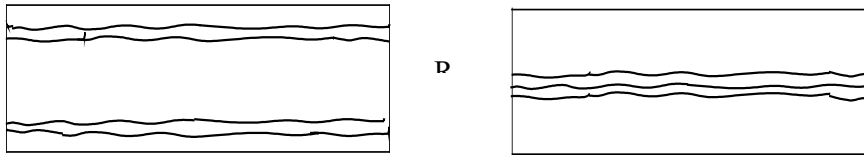
Excessive Dripping between Lines: The full unit price bid per foot shall be penalized for the length of any dribbled open space between broken lines that is not removed to the satisfaction of the Engineer before leaving the project site that work day. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.



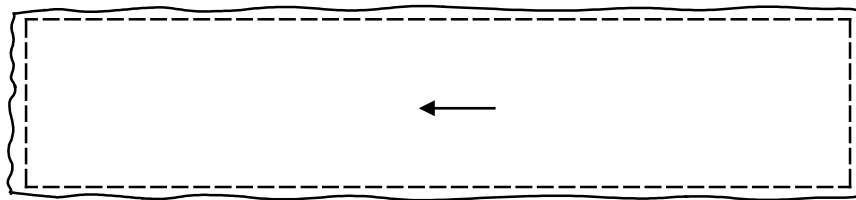
Wavy Line: The full unit price bid per foot shall be withheld for the entire length of waviness in a line caused by poor operation by the driver/operator of the application equipment. Penalty shall be imposed from the first occurrence.



Non-Uniform Thickness: The line shall be uniform thickness across the entire cross section of the line with well-defined edges. Heavy inner thickness and thin edges or vice-versa will not be accepted. The full unit price bid per foot shall be withheld for lines that are not of uniform thickness. Penalty shall be imposed from the first occurrence.



Swollen Line of Excessive Width: The full unit price bid per meter (foot) shall be penalized for swollen lines in excess of the specified width.



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 methyl methacrylate material shall be completely installed within one (1) calendar week 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 one-week window as described above.

1083.5 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 Prices

Measurement for “Methyl Methacrylate (MMA) 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 “Methyl Methacrylate Pavement Markings”, as listed in the proposal, at the contract unit price bid is full compensation for the specified work.

All traffic control necessary for installation of the “Methyl Methacrylate 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.