1087 - URETHANE ACRYLATE PAVEMENT MARKINGS

1087.1 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.

1087.2 MATERIALS

This specification is for the furnishing of retroreflective pavement marking materials composed of a reflectorized multi-functional urethane acrylate, plural component, durable liquid pavement marking material suitable for application of long line pavement markings on chip seal treated roadways only.

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/D^2 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. Characteristics

It shall consist of a homogeneous blend of multi-functional polyacrylate modified resins, pigments and a top application of retro-reflective beads. It is a 100% solid two-part system that is applied as a 2 to 1 mixture by volume. Two parts of Part A (resin and pigmentation) shall be mixed with one Part B (curing agent) by volume.

d. Composition

The composition of the material shall be as follows:

Part A Component	White	Yellow
Pigments % by Weight (ASTM D-476, Type II)		
TiO_2	24-27%	10-15%
Non-Lead Organic Yellow		7-9%
Resin % by Weight		
Modified Resins	73-76%	76-83%

e. Color

The materials shall visually match the color chips that correspond to the Federal Standard Number 595B for the following colors:

White Color 17925
Yellow Color 13538

The material shall be applied to 3" x 6" steel plates at 20 ± 1 mil thickness without glass beads and exposed per ASTM G-53. The test shall be conducted for 72 hours at 122 degrees F, 4 hours humidity, and 4 hours UV using QUV A-340 bulbs in alternating cycles. The color of the coatings shall be within 5 units of the Federal Standards shown above.

f. 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)

g. Yellowness index

Test in accordance with ASTM D-1925 by curing the prepared sample for 72 hours. The maximum yellow index reading, XYZ C/2° shall not exceed 6.0 preceding the QUV (ASTM G-53) or 15.0 after 72 hours of QUV exposure.

h. Toxicity

Upon heating to the appropriate application temperature, the material shall not exude fumes, which are toxic or injurious to persons or property when handled in accordance with manufacturer specifications. The compositions shall not contain free isocyanate functionality.

i. No Tracking Time

When mixed in the proper ratio and applied at 15 ± 1 mils wet film thickness with 8 pounds per gallon Type 4 gradation beads and 10 pounds per gallon AASHTO M247 Type I beads, the product shall have a no track time of less than 5 minutes when tested according to ASTM D-711 at 75°F ± 2°F. When saturated with a double drop of 12 pounds per gallon Type 4 gradation beads and 12 pounds per gallon AASHTO M247 Type I beads and tested under the same conditions as above, it shall have a no track time of 3 minutes or less.

j. Hardness

The material, when tested according to ASTM D-2240, shall have a Shore D Hardness greater than 75. Samples shall be allowed to cure at 75ºF ± 2ºF for a minimum of 72 hours prior to performing the tests indicated.

k. Flexibility

The material, when tested in accordance with ASTM D-522, shall pass the test at ¾". Panels are prepared by casting 5 mil films on 4" x 12" aluminum panels. The test is run after panels are cured for a minimum of 24 hours at 75ºF ± 2ºF.

l. Adhesion to Concrete

The material, when tested according to ASTM D 4541, shall have greater than 600 psi adhesion to the specified concrete surface such that there shall be a 100% concrete failure in the performance of this test. The prepared specimens shall be conditioned at 75 ± 2ºF for a minimum of 72 hours prior to the performance of the test indicated.

m. Abrasion Resistance

The material, when tested according to ASTM test method D- 4060,using a Taber Abrader with a 1,000 gram load and CS-17 wheels, for 1,000 cycles, shall not have more than 80 mg weight loss. The tests shall be run on cured samples of material (without beads) which have been applied at a film thickness of 15±0.5 mil to code S-16 steel plates. The samples shall be cured at 75°F±2°F for a minimum of 72 hours.

n. Tensile Strength

When tested according to ASTM D-638, the material shall have an average tensile strength of not less than 6,000 pounds per square inch. The Type IV Specimens shall be pulled at a rate of ¼" per minute by a suitable dynamic testing machine. The samples shall be cured at 75 °F ± 2°F for a minimum of 72 hours prior to performing the indicated tests.

o. Compressive Strength

When tested according to ASTM D-695, the material shall have a compressive strength of not less than 12,000 pounds per square inch. The cast sample shall be cured at 75°F ± 2°F for a minimum of 72 hours. The rate of compression of these samples shall be no more than ¼" per minute.

1087.3 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. 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

Ambient and surface temperature shall be 35°F and rising. The pavement surface temperature and ambient temperature shall be determined and documented before the start of each day of marking operation and at any other time deemed necessary by the inspector.

b. Surface Moisture Conditions

Thermoplastic material will not properly adhere to pavement if moisture is present. Should rainfall occur within 24 hours prior to application, the surface moisture test (plastic wrap or roofing paper method as approved by the inspector) must be performed, and approval obtained from the Inspector. The moisture test can be conducted according to the following methods:

(1) Place a 12×12 inch square piece of plastic wrap on the pavement surface using duct tape to affix the edges. Let stand approximately 15 minutes. Remove the plastic wrap at the end of the waiting period. Visibly inspect and touch the underside of the plastic wrap. If there is no indication of moisture, striping may begin. Otherwise, the pavement contains too much excess water.

(2) Using roofing felt paper, place a 12×12 inch square of felt on the asphalt and install the thermoplastic material directly onto the felt paper. Let it cool for approximately 10 seconds, then lift the paper to check for moisture on the back side. If the paper shows no signs of wetness or visible water droplets, striping may begin. Otherwise, the pavement contains too much excess water.

c. Surface Preparation

The surface shall be clean and dry. The surface preparation shall include, but not be limited to, cleaning and removal of sealing and curing compound. All permanent and temporary pavement markings shall be at least 90% removed and pavements cleaned free of grease, oil, mud, dust, dirt, grass, loose gravel, loose or flaking paint and other deleterious material.

The pavement surface shall first be power broomed and vacuumed. An additional compressed air operation, separate from the compressed air guns on the striping applicator, shall be used to remove residue and debris resulting from the cleaning work. Compressed air shall also be used during striping application. The prepared pavement surface area shall be wider than the material to be applied, such that a prepared area is on all sides of the material after application. On streets treated with chip seal material, the new markings shall not be installed until after the second sweeping operation. Any existing marking which may interfere with the performance of the material shall be physically removed by approved method except for the use of chemicals.

d. Equipment

The material shall be applied with equipment utilizing the impingement mix, solvent free, airless spray application system or standard mix tube application equipment. The equipment shall be designed to control the viscosity of the material accurately at the spray gun. This equipment shall have pressure gauges for each proportioning pump. Each vehicle shall be operated by a technician who is an expert in that particular equipment's operation and plural component application techniques.

e. Application Rate

The material and retro-reflective glass spheres shall be placed according to requirements. The material shall be applied at a rate of 192 feet per gallon based on a minimum of 25 mils applied at a four inch width.

f. Drop-on Glass Beads

The drop-on glass beads shall be a double drop application. The first application of beads shall be applied at a rate of 10 to 12 pounds per 100 square feet followed by the second application of beads at a rate of 10 to 12 pounds per 100 square feet, or as recommended by the manufacturer to achieve the retroreflectivity as specified, herein.

1087.4 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. On streets receiving a thin surface treatment only, such as micro-surfacing or slurry seal, some of the performance measures may be waived by the inspector.

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.

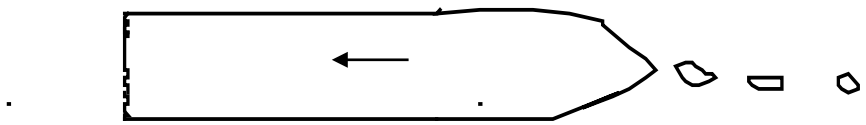
Lack of specified thickness: The full unit price bid per foot shall be withheld if lack of thickness is found more than three (3) times per 1 mile, or project if less than 1 mile in length. Each line shall be checked a minimum of six (6) times per 1 mile, or project if less than 1 mile in length, using 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 foot for each ¼" of width lacking not to exceed 100% of the unit price bid per 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 foot for each 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 foot shall be withheld for each lineal 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.

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.

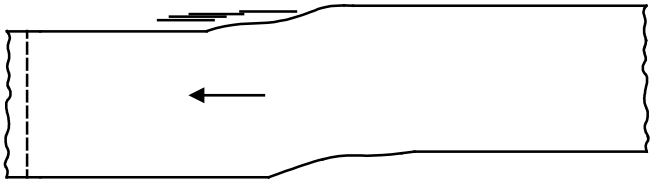


Skewed Ends: The full unit price bid per foot shall be withheld for skewed ends. This penalty shall be for the full 6 feet of a lane line or broken centerline or for no more than 6 feet of a long line.

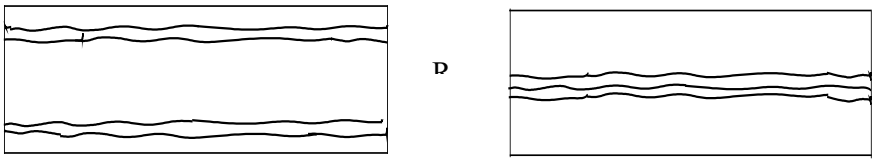
Line Deviation: A line that in the judgment of the Engineer deviates from the specified layout by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer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

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.



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 paint or urethane acrylate 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.

1087.5 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 "Urethane Acrylate 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 "Urethane Acrylate 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 "Urethane Acrylate 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.