

## **1089 - INTEGRATED MULTI-POLYMER PAVEMENT MARKINGS**

### **1089.1 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.

### **1089.2 MATERIALS**

This specification covers a white and yellow engineered integrated multi-polymer reflectorized pavement marking material of a type that is applied to concrete road surfaces or polished asphalt road surfaces. The material is 100% solids and can be applied in a molten state by mechanical means with standard thermoplastic extrude equipment. The polymers offer superior adhesion and can be applied without a primer. An intermix of both AASHTO Type 1 and Type 3 beads shall be used along with a surface application of glass spheres, which upon cooling to normal pavement temperature, produces an adherent reflectorized stripe of specified thickness and width and is capable of resisting deformation. The material for 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. Federal Standards**

- Federal Test Standard No. 5958
- AASHTO Standard Test Method M 249
- AASHTO Standard Test Method T 250
- ASTM Standard Test Method D 4796 (Bond Strength)
- ASTM Standard Test Method D 5420 (Impact Resistance)
- ASTM Standard Test Method D 4960 (Color)
- Others as referenced within specification

**c. Drop-on Glass Beads**

The high performance drop-on 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.

**d. Characteristics**

The pavement marking material shall be homogeneously composed of pigments, resins, polymers (adhesive constituent), glass reflectorizing spheres and other fillers. The pavement marking material shall be available in white, yellow, and black from the same manufacturer. The manufacturer shall have the option of formulating the material according to manufacturer's own specifications. The material shall not exude fumes that are toxic, obnoxious or injurious to person or property, when it is heated to the temperature range specified by the manufacturer for application.

It shall remain stable when held for 4 hours at this temperature, or when subject to 3 reheatings after cooling to ambient temperature. The temperature-viscosity characteristics of the plastic material shall remain constant throughout repeated reheatings, and shall show like characteristics from batch to batch. There shall be no obvious change in color of the material neither as a result of repeated reheatings nor from batch to batch. The material shall easily extrude from the equipment to produce a cross-section of line 90 to 125 mil thick, which shall be continuous and uniform in shape, and have clear and sharp dimensions.

**e. Serviceability**

The material shall resist deterioration by contact with sodium chloride, calcium chloride or other chemicals used to prevent roadway ice, or because of the oil content of pavement materials or from oil droppings or other effects of traffic. The multi-polymer pavement marking material shall show no signs of deterioration or solubility after motor oil is rubbed vigorously into a sample for 2 minutes and allowed to penetrate for 5 minutes.

**f. Specific Gravity**

The specific gravity of the white and yellow pavement marking material shall not exceed 2.15 referred to water at 25 degrees C (77 degrees F) when determined by a water displacement method.

**g. Set Time**

When applied at the specified temperature and thickness, the material shall set to bear traffic in not more than 2 minutes when the air temperature is 10 degrees C (50 degrees F) and not more than 10 minutes when the air temperature is 55 degrees C (130 degrees F).

**h. Composition**

The pigment, intermix reflectorizing spheres, and fillers shall be uniformly dispersed in the resin and polymer upon heating to application temperature. The material shall be free of dirt and foreign matter and must meet or exceed the compositional requirements given in the following Table.

COMPOSITION (Percent by Weight)	WHITE	YELLOW
Glass Beads	48% min	48% min
Titanium Dioxide Pigment	10% min.	--
Organic Yellow	--	Federal Color
Resin/Polymer Content	21% - 26%	21% - 26%
Inert Fillers	16% - 21%	26% - 31%

Note 1: Glass Beads (Intermix): The intermix glass beads shall be either uncoated or coated with an adhesion promoting coating. One half (50%) of the intermix beads shall meet the requirements of AASHTO M247 Type 1. The other half (50%) of the intermix beads shall meet the requirements of AASHTO M247 Type 3.

Note 2: Heavy metal free yellow and black pigment content shall be formulated at the manufactures discretion provided all other requirements are met.

The material shall be thoroughly mixed and furnished in a free flowing granular form and shall readily melt in a uniform mixture. The material shall be free from all skins, dirt, and foreign objects. It shall be of such composition that it will not bleed, stain or discolor when applied to bituminous pavement. The manufacturer shall replace material not meeting the above requirements.

**i. Color**

The multi-polymer pavement marking material after heating for 4 hours ± 5 minutes at 218± 2 degrees C (425 ± 3 degrees F) and cooled to 25 ± 2 degrees C (77 ± 3 degrees F) shall meet the following when tested in accordance to ASTM D4960:

(1) White

Daylight reflectance – 75% min.

The white marking shall be a visual match to FED 595B 17886

Yellowness Index: 0.12 max.

(2) Yellow

Daylight reflectance – 45% min.

The yellow marking shall be a visual match to FED 595B 13538 and lie within the following ranges:

x = 0.485 – 0.510

y = 0.445 – 0.470

(3) Chromaticity and Luminance Factors

The chromaticity and luminance factors shall be determined under the following standard conditions:

- Geometry: 45/0 degrees

- Direction of view: perpendicular to surface
- Illuminate/Observer conditions: CIE D65/2°

**j. Bond Strength**

After heating the multi-polymer pavement marking material for 4 hours  $\pm$  5 minutes at  $218 \pm 2$  degrees C ( $425 \pm 3$  degrees F), the bond strength to Portland Cement Concrete (PCC) shall equal or exceed 300 psi when tested according to ASTM Standard Test Method for Bond Strength of Traffic Marking Materials – D 4796 or ASTM C321. Failures of type described in Section 6.1 of ASTM D 4796, must be repeated to obtain a quantifiable number. Failure of types 6.2, 6.3, and 6.4 of ASTM D 4796-88 bond test, must exceed the specified bond strength given herein.

**k. Tensile Elongation**

The multi-polymer pavement marking material after heating for four hours  $\pm$  5 min. at  $218 \pm 2$  degrees C ( $425 \pm 3$  degrees F) and tested according to ASTM D638 shall have a percent elongation of not less than 40%. The tensile specimens shall be 90 mils thick and in a “dogbone” configuration of a width of approximately 0.45 inches and the pull rate shall be 0.25” per minute. The test result reported shall be an average of three separate tests.

**l. Tabor Abrasion**

The multi-polymer pavement marking material after heating for four hours  $\pm$  5 min. at  $218 \pm 2$  degrees C ( $425 \pm 3$  degrees F) and cooled to  $25 \pm 2$  degrees C ( $77 \pm 3$  degrees F) shall have a maximum tabor abrasion loss of 350 mg when tested according to ASTM D4060. The test shall consist of 1000 cycles using CS17 wheels with a 1000 gram load. Test specimens shall be conditioned at room temperature for 72 hours before testing.

**m. Flash Point**

The multi-polymer pavement marking material shall have a flash point of not less than 260 degrees C (500 degrees F) when tested in accordance with ASTM D 92 “Flash and Fire Points by Cleveland Open Cup.”

**n. Impact Resistance (Gardner Falling Weight)**

The test specimens should be formed according to the following procedure: Heat approximately 1500 grams of material in an open quart can for 4 hours at  $218 \pm 2$  degrees C ( $425 \pm 3$  degrees F). Preheat specimen draw down blade, (2” X 4”, with a 1/8” die opening) for approximately one hour at  $218 \pm 2$  degrees C ( $425 \pm 3$  degrees F). The blade is usually placed in the oven containing the sample material during the last hour of sample heating. After heating the sample for four hours, remove the sample and the draw down blade from the oven. Place the 125 mil blade onto a PCC block. Quickly pour the sample  $218 \pm 2$  degrees C ( $425 \pm 3$  degrees F) into the opening of the draw down screed and draw down the sample for the entire length of the concrete block. Prepare two test specimens in this manner. Allow the drawn down test samples to condition in the open in the standard laboratory atmosphere,  $23 \pm 2$  degrees C ( $73.4 \pm 3$  degrees F) and  $50 \pm 5\%$  relative humidity for 24 hours. Perform the testing procedure according to ASTM test method D 5420 Section 11. Test one sample at room temperature  $23 \pm 2$  degrees C ( $73.4 \pm 3$  degrees F).

Condition the other sample by placing it in a cold box maintained at  $0 \pm 2$  degrees C ( $32 \pm 3$  degrees F) for a period of 24 hours. Remove the sample from the cold box and test immediately upon removal. Record and report the type of failure as (a) radial cracking or surface cracking within or just outside the impact area of the striker, (b) cracks that penetrate the entire thickness, (c) brittle shatter (the test specimen shatters in several pieces after impact), or (d) ductile failure (the specimen is penetrated by a blunt tear). Both the yellow and white materials shall have minimum impact resistance of 60 inch pounds (no visible surface cracks) when tested at  $23 \pm 2$  degrees C ( $73.4 \pm 3$  degrees F) and a minimum of 10 inch pounds when tested at  $0 \pm 2$  degrees C ( $32 \pm 3$  degrees F).

**o. Initial 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 250 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).

**p. Retained Retroreflectivity**

Long-term retroreflectivity of the multi-polymer pavement marking material is provided by the intermix glass beads present in the material. The material must have a retained intensity reading of 250 millicandelas for white and 150 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). The minimum retroreflectivity values shall be maintained on non-wheel path areas throughout the service life of the marking.

**q. Low Temperature Cracking Resistance for Extended Period**

The material shall be tested according to AASHTO T 250 modified for an extended cold temperature  $-9.4 \pm 2$  degrees C ( $15 \pm 3$  degrees F) exposure period of 72 hours. Any cracking shall constitute failure of the material to qualify as a non-sealer aggressive bonding material for PCC road surfaces.

**1089.3 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  $\frac{1}{2}$  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. Markings shall be applied to the pavement surface in a molten state by mechanical means with surface application of glass spheres, and upon cooling to normal pavement temperature, produce an adherent retro-reflectorized stripe of specified thickness and width and capable of resisting deformation.

**a. Equipment**

The equipment used to install the integrated multi-polymer material shall be as follows:

A self-propelled machine is required in order to fulfill the timing needs of the marking installation for longitudinal lines.

The equipment shall be constructed to provide mixing and agitation of the materials. Conveying parts between the main material reservoir and the shaping die shall be constructed as to prevent accumulation and clogging. The mixing and conveying parts up to and including the shaping die will maintain the materials at the manufacturer's recommended temperature. To assure that the material does not fall below the minimum temperature, the shaping die shall be heated by means of a gas-fired infrared heater or a heated, oil-jacketed system. It shall be constructed as to insure continuous uniformity in the dimensions of the stripe. The applicator shall provide a means for cleanly cutting off square stripe ends and shall provide a method of applying "skip" lines. The equipment shall be constructed to be able to provide for varying die widths and to produce varying widths of traffic markings. The use of pans, aprons, or similar appliances with die overruns will not be permitted.

All conditions apply as stated above for material temperatures, line definition and workmanship when a hand pushcart is used for cross walks. The Inspector will verify measurement. The pushcart shall be equipped with a special kettle for melting and heating the material shall be provided. The kettle shall

be equipped with a thermostat so that heating can be done by controlled heat transfer liquid rather than by direct flame so as to provide positive temperature control and prevent overheating of the material. It shall be constructed for a nominal application of 90 – 125 mil thickness. The heater and applicator shall be so equipped and arranged as to meet the requirements of the National Board of Fire Underwriters of the National Fire Protection Association, of the state, and of the local authorities. The pushcart shall be equipped with an automatic glass sphere dispenser attached to the striping machine in such a manner that the spheres are dispensed almost instantaneously upon the installed line. The glass sphere dispenser shall be equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material.

The equipment shall be arranged as to permit preheating of the pavement immediately prior to application of the material, if preheating is recommended by the manufacturer. The applicator shall be capable of containing a minimum of 1000 pounds of molten material (not applicable for hand-liner use). The applicator shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

The Contractor's striper shall be equipped with electrical foot counters. The counters shall individually tabulate the length of line applied by each gun whether solid or dashed. The Contractor shall determine the accuracy of the foot counters and establish an adjustment factor as required to determine the pay item quantities. The foot counters shall be periodically checked to assure accurate measurements. No material shall be applied without the accurate operation of the foot counters. The Contractor shall provide the Engineer with a certified document on these calibrations.

#### **b. Material Application Surfaces**

##### **(1) Asphalt Road Surfaces**

Existing thermoplastic markings may be over laid with multi-polymer pavement marking providing that the existing markings are less than 30 mils thick, and are securely bonded to the substrate. If the markings are greater than 30 mils and securely bonded to the substrate, then it shall be ground to 30 mils, or removed completely if not securely bonded to the road.

Existing solvent based paint may be over laid with multi-polymer pavement marking provided that more than 75% of the road surface is exposed, and there is no more than a single coat of paint on the remaining unexposed area. If more than one layer of paint exists, the paint is not securely anchored to the substrate, or there is less than 75% of the road surface exposed, then the paint must be thoroughly removed.

Existing waterborne paint may be over laid with multi-polymer pavement marking provided that it is a single layer of paint not more than 10 mils in thickness with minimal drop on glass bead coverage. Waterborne paint markings that do not meet these criteria must be removed prior to the application of the multi-polymer pavement marking material.

Existing polyester, epoxy, or other type pavement marking paints must be completely removed from all road surfaces prior to the installation of multi-polymer pavement marking material.

##### **(2) Concrete Road Surfaces**

All existing thermoplastic, polyester, epoxy, or other type pavement marking paints must be removed completely. Pavements shall be free of grease, oil, mud, dust, dirt, grass, loose gravel and other deleterious material, prior to applying pavement markings. Prepare the pavement surface, including removal of curing compound, a minimum of 2 " inch wider than the pavement markings to be placed, such that, an additional 1 inch of prepared area is on all sides of the pavement markings after they are applied. Remove all curing compound and surface laitance from application area of Portland cement concrete pavements. Remove where pavement markings will be placed. Perform curing compound removal by shot blasting, sand blasting, or water blasting. Ensure that the surface is free of all residue, laitance and debris prior to applying the pavement marking. When surface preparation and curing compound removal operations are completed, blow the pavement surface clean by compressed air to remove residue or debris. Conduct all pavement surface preparation including curing compound removal in such a manner that the pavement or joint material is not damaged or left in a condition that will mislead or misdirect the motorist. Repair any damage caused to the pavement, or joint materials caused by surface

preparation or the removal of curing compound by acceptable methods. Where pavement surface preparation results in obscuring existing pavement markings of a lane occupied by traffic, immediately remove the residue, including dust, by approved methods.

**c. Material Temperatures**

The multi-polymer pavement marking material shall readily spray and extrude at temperatures of 204 to 218 degrees C (400 to 425 degrees F), from approved equipment and produce lines of 90 mil thicknesses. Application temperatures shall not exceed 232 degrees C (450 degrees F).

**d. Road Surface Temperatures**

The pavement surfaces where the multi-polymer pavement marking is to be applied must be clean and dry and at a minimum temperature of 50 degrees F to 65 degrees F and rising depending upon the application method being used (Screed extrude at 50 degrees F, Spray at 55 degrees F and Ribbon extrude at 65 degrees F).

**e. Air Temperatures**

The minimum ambient air and wind chill temperature should be no less than 50 degrees F and rising at the time of actual marking. The temperature should be verified at the start of each day's work and monitored accordingly throughout the day. Failure to comply with temperature specifications can lead to premature bond failure. Do not apply when dew point is within 5 degrees of the ambient temperatures.

**f. Surface Moisture Conditions**

Thermoplastic material will not properly adhere to pavement if moisture is present. Do not apply if hot material shows moisture bubbles. 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.

**g. Drop On Retroreflective Elements**

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 to achieve the minimum retroreflectivity as specified herein. The application shall result in the embedment of the retroreflective element in the pavement marking at 50% to 65% below the surface of the pavement marking. All drop on retroreflective optics shall have a coating with both adhesion and moisture resistant properties and shall be approved for use by the manufacturer of the pavement marking.

**h. Line Quality**

The finished lines shall have well defined edges and be free of waviness. Pavement marking lines shall be straight or of uniform curvature and shall conform with the tangents, curves, and transitions as specified in the pavement marking standards and/or as directed by the Inspector.

**i. Line Thickness**

The minimum thickness of the lines as viewed from a lateral cross section shall be not less than 90 mil. Drop-on glass spheres shall not be included in the measurement, or if so, then appropriate allowances shall be made for the added mil thickness. A device for gauging the installed material thickness shall be furnished to the City Inspector as requested for use on the project. The gauge shall be easy to read and shall readily indicate excessive variations.

#### **j. Clean Up**

The Contractor shall be responsible for removing all pavement markings material spilled upon the roadway surface or adjoining area. The Contractor shall use methods acceptable to the Engineer/Inspector for removing the spilled material.

#### **k. Line Repair**

Any pavement marking which is crossed by a vehicle and tracked shall be replaced and any subsequent marking made by the vehicle shall be removed by methods acceptable to the Inspector at NO additional cost to the City.

### **1089.4 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.

All integrated multi-polymer lines shall be of uniform thickness, with well-defined edges and squared off beginnings and endings of all lines.

All integrated multi-polymer lines will have minimal dribbles, runs and overlaps. In the event integrated multi-polymer long lines must stop and then continue, the restart shall line up to within ½ inch of the existing long line and maintain a totally straight line. Hand pushcarts shall be used when doing crosswalks. When the crosswalk cannot be laid continuous, the startup of the line shall be within ¼ inch of the initial line.

The application equipment shall be mobile and maneuverable to the extent that straight lines can be followed and normal curves can be made in a true arc.

**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 mile, or project if less than 1 mile in length. Each line shall be checked a minimum of six (6) times per 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.

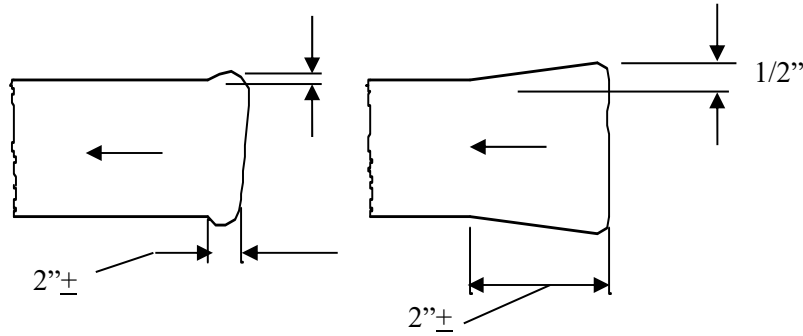
**Lack of specified length/cycle:** Payment shall be made with penalty being equal to 25% of the unit price bid per foot for each 1” of length lacking or exceeding the specified length for broken lane line and/or broken center line not to exceed 100% of the unit price bid per foot for the length of the 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.

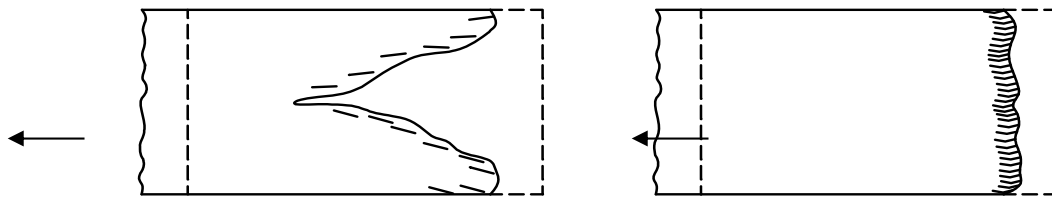
**Bell ends:** The full unit price bid per foot shall be withheld for wide “bell” ends greater in length than 2 inches. This penalty shall be for the full 6 feet of a lane line or broken centerline or for no more than 6 feet of a long line.

1/2”



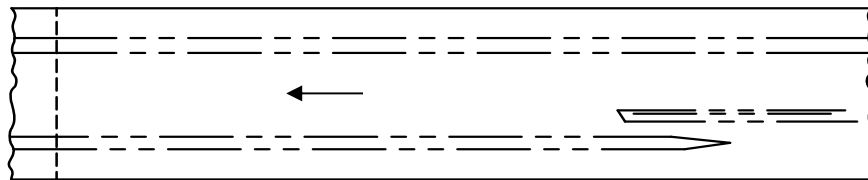


**Lack of adhesion:** The full unit price bid per foot shall be withheld for one foot for each occurrence if found more than three (3) times per 1 mile, or project if less than 1 mile in length.

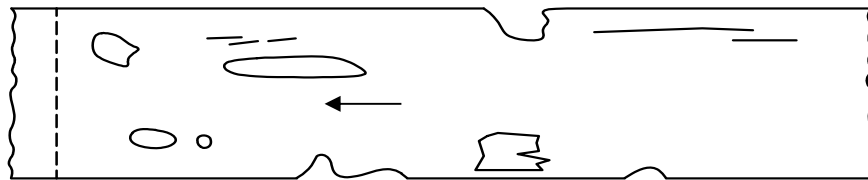


**Line Deviation:** A line that in the judgment of the Engineer deviates from the specified layout by an unreasonable amount shall be replaced. The Contractor shall be responsible for removal of the deviated marking material/repair of the pavement as designated by, and to the satisfaction of, the Engineer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

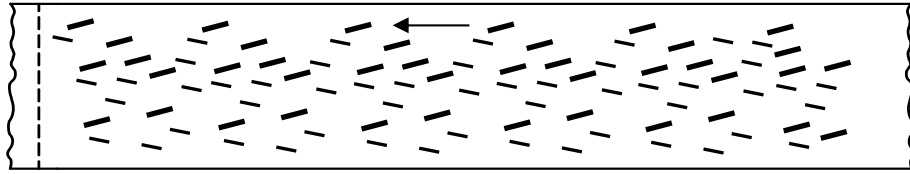
**Pitted Line:** The full unit price bid per foot shall be withheld for each pit greater than 10 feet in length.



**Gaps in Line or Crumbly Edges:** The full unit price bid per foot shall be withheld for the entire length of the portion of any line receiving less than the required amount of thermoplastic material. This penalty shall be imposed when the Contractor fails to correct line quality after the second warning within 1 mile, or project if less than 1 mile in length.



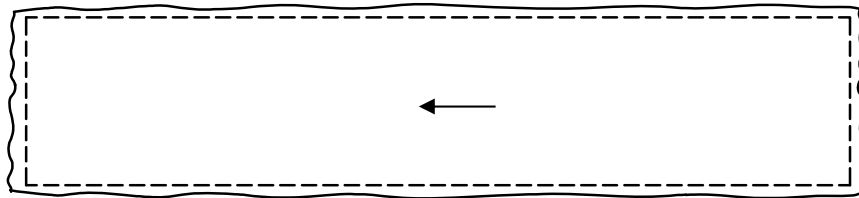
**Rough Line Surface:** The full unit price bid per foot shall be withheld for the entire length of the portion of any line with a rough or "burlap" surface. Penalty shall be imposed upon the first occurrence and every occurrence thereafter.



**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.



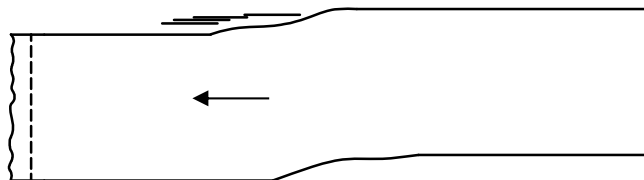
**Swollen Line of Excessive Width:** The full unit price bid per foot shall be penalized for swollen lines in excess of the specified width.



**Smearred Line Edges:** Fifty (50) percent of the unit price bid per foot shall be penalized for each occurrence of a length greater than 15 feet.



**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.



**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 integrated multi-polymer 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.

## **1089.5 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 “Integrated Multi-polymer Pavement Markings” shall be as listed in the bid proposal, which includes all labor, materials, primers, 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.

Payment for “Integrated Multi-Polymer 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 “Integrated Multi-polymer 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.