

S-801 PAVEMENT MARKINGS: This work shall consist of the marking of pavement with various widths of lines and various symbols with extruded thermoplastic, spray thermoplastic, preformed thermoplastic, epoxy or painted materials furnished in yellow and white as described in the plans and in these Specifications. A complete list of pre-approved pavement marking materials is available at the office of the City Engineer or can be found on the City of Lenexa's internet website at www.lenexa.com.

A. CONSTRUCTION REQUIREMENTS:

1. Pavement markings that are installed in parking lots shall be white in color and shall consist of a thermoplastic material, unless otherwise specified by the Engineer.
2. Prior to the installation of the pavement markings, the Contractor shall remove all existing pavement markings not designated to remain (removal to be by shot blasting or grinding, as directed by the Engineer). All blasting and grinding debris, including dust, shall be immediately removed and hauled away, as directed by the Engineer. Any appreciable damage or different appearance from the surrounding surface shall be repaired by the Contractor, at his expense, by methods approved by the Engineer. In addition, any existing markings that are damaged or obscured by the construction process shall be repaired or replaced, as directed by the Engineer.
3. The surface shall be dry and all dust, debris and other foreign matter shall be removed from the road surface prior to the application of the pavement marking material. A rough-textured surface shall be cleaned by air blast. A smooth-textured surface may be cleaned by brooming, but if there is any doubt about the resulting cleanliness, the Engineer can require the use of air blast. Portland cement concrete pavement shall be ground with an abrasive grinder to a depth of 1/8-inch, and for the full width of the pavement marking in the location where the pavement marking is to be placed. After grinding, the surface shall be cleaned by air blast.
4. All beads shall be packed in 50-pound burlap or multi-wall Kraft bags, and shall conform to the requirements of the section of this specification titled Glass Beads. Bags shall be leak-proof, moisture-resistant and of sufficient strength to insure safe delivery, handling and storage of the beads prior to and during their use. For identification purposes, each bag shall be marked with a lot number assigned by the producer.
5. Those sections of pavement where extra dust and grime collects, such as gore areas and adjacent to raised islands, may require a water wash and scrubbing in addition to brushing and air blast.
6. On those sections of pavement where no previously applied markings are available to serve as a guide, the proposed markings shall be laid out in advance of the marking application.
7. Markings shall be applied at the locations and to the dimensions and spacing's shown on the plans. Markings shall not be applied until the layout and conditions of the surface have been approved by the Engineer.
8. Summarized on the following page is a table illustrating the type of pavement marking material that should be used depending upon the age and type of surface. Thermoplastic material shall meet the requirements of AASHTO M249-79.

PAVEMENT MARKING GUIDELINES

Pavement Marking	Pavement Type		
	Asphalt (2)	Concrete	Slurry Seal
WHITE lane line	Thermo	Multi-Component	Thermo
WHITE channelization line	Thermo	Multi-Component	Thermo
WHITE crosswalk lines	Thermo	Multi-Component	Thermo
WHITE stop bar	Thermo	Multi-Component	Thermo
WHITE diagonal	Thermo (1)	Multi-Component	Thermo
YELLOW solid centerline	Thermo	Multi-Component	Thermo
YELLOW broken centerline	Thermo	Multi-Component	Thermo
YELLOW diagonal	Thermo (1)	Multi-Component	Thermo
ARROWS	Preformed Thermo	Multi-Component	Thermo
ONLY	Preformed Thermo	Multi-Component	Thermo
RR Crossing	Preformed Thermo	Multi-Component	Thermo
(1) Preformed thermoplastic may be substituted for extruded thermoplastic. (2) Binder-sealer will be required on asphalt older than two months.			

B. EXTRUDED THERMOPLASTIC MATERIAL:

1. Thermoplastic material shall be applied to the pavement by the extrusion method wherein one side of the shaping die is the pavement and the other three sides are contained by, or a part of, suitable equipment for heating and controlling the flow of material.
2. The equipment used to install hot thermoplastic materials under this Specification shall be constructed to provide mixing and agitation of the materials. Conveying parts of the equipment between the main material reservoir and the shaping die shall be so constructed as to prevent accumulation and clogging. All parts of the equipment that come in contact with the material shall be so constructed as to be easily accessible and exposable for cleaning and maintenance.
3. The equipment shall be constructed so that all mixing and conveying parts up to and including the shaping die will maintain the materials at a temperature not less than 375° F.
4. To assure that the thermoplastic 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.

5. The equipment shall be so 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 use of pans, aprons or similar appliances that the die overruns will not be permitted under this Specification. The equipment shall be so constructed as to provide for varying die widths and to produce varying widths of traffic marking.
6. A special kettle shall be provided for melting and heating the thermoplastic material. The kettle must 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. The heating kettle 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 local authorities.
7. Glass beads applied to the surface of the completed strip shall be applied by an automatic bead dispenser attached to the striping machine in such a manner that the beads are dispensed almost instantaneously upon the installed line. The glass bead dispenser shall be equipped with an automatic cut-off control synchronized with the cut-off of the thermoplastic material.
8. The equipment shall be so arranged as to permit preheating of the pavement immediately prior to application of the thermoplastic material if preheating is recommended by the thermoplastic manufacturer. 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.
9. The applicator shall be capable of containing a minimum of 125 pounds of molten material.
10. To insure proper adhesion, the Contractor shall apply the binder-sealer over the application area prior to the actual thermoplastic installation. The binder-sealer shall be applied by spraying, shall form a continuous wet film of approximately 2 to 3 mils thickness and shall be at least 2 inches wider than the applied thermoplastic so as to ensure adhesion at the edges. The binder-sealer shall be allowed to set long enough for the solvent to evaporate and become tacky. This can be as much as one hour or longer but not less than 30 minutes. If there is doubt, the longer time shall be used even though some tackiness might be lost.
11. For bituminous surfaces less than two months old and having less than 20% bare, exposed aggregate, the application of binder-sealer may be waived.
12. Bubbles forming in the applied thermoplastic is evidence that solvent remains in the binder-sealer. Rather than reduce the rate of application of the binder-sealer, more time should be allowed for evaporation of the solvent before continuing.
13. To insure optimum adhesion, the pavement and ambient air temperature shall be not less than 55° F. and the thermoplastic material shall be applied in a melted state at a temperature of 375° F. to 450° F. The temperature of the thermoplastic in the shaping die shall be maintained at the manufacturer's recommended application temperature, but in no case shall the temperature fall below 375° F.
14. The finished lines shall have well defined edges and be free of waviness. The minimum thickness of thermoplastic lines as viewed from a lateral cross section shall be not less than 3/32-inch near the edges, nor less than 1/8 inch at the center.
15. Measurements shall be taken as an average throughout any 36" section of the line.

16. A device for gauging the thickness of the material shall be furnished to the Engineer for use on the project. The gauge shall be easy to read and shall readily indicate excessive variations.
17. The drop on glass beads shall be applied at a rate of one pound per 20 square feet of line.
18. All thermoplastic lines shall be of uniform thickness with well-defined edges and squared off beginnings and endings of all lines. All lines will have minimal dribbles, runs and overlaps. In the event that thermoplastic long lines must stop and then continue, the restart shall line up to within 0.5 inches of the existing long line and maintain a totally straight line. Hand pushcarts shall be used when doing crosswalks and stop bars. When the crosswalk or stop bar cannot be laid continuous, the overlap in the marking material shall be kept to a minimum. A maximum of two passes can be made in order to achieve the desired width of stop bars. 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. Asphalt shingles or other overrun cutoff material may be used for continental style crosswalks with prior approval, provided they are removed while the material is sufficiently hot to prevent lifting or tearing of the thermoplastic. 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.

C. COLD PLASTIC MATERIAL:

1. Pavement to be striped with Cold Plastic Marking shall be broomed and cleaned prior to application. When markings are to be applied where new pavement is to be installed, application shall be made by placing the marking on the pavement surface immediately behind the laydown machine, and embedding it into the new surface course by a steel roller during the final rolling.
2. Turn arrows, letters, stop bars, cross bars, etc., shall be applied by utilizing an adhesive recommended and supplied by the manufacturer of the pavement marking material. Word and symbol markings shall conform to the applicable shapes and sizes as outlined in the latest revision of the Manual on Uniform Traffic Control Devices (MUTCD).
3. When applied to existing or cold surfaces, the pavement temperature shall be not less than 70° F., and the ambient air temperature shall be not less than 60° F. to ensure optimum adhesion.
4. A minimum of three passes with a tamping cart shall be used to ensure bond of the marking material to the pavement. The tamping cart shall weigh a minimum of 200 pounds. Tamping with tires of an automobile or truck in lieu of the tamping cart shall not be permitted.
5. Applied material must adhere fully and completely to road surface with straight edges and squared ends and shall 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 is allowed. Ends or sides matched to existing markings must not exceed 0.125 inches in separation. Applied material shall be in alignment with existing markings and of consistent size.

D. SPRAY THERMOPLASTIC MATERIAL:

1. The Contractor shall furnish to the Engineer a manufacturer's certification that the material provided complies with all the requirements of this Specification.

2. Glass beads shall be both intermixed and drop on. Intermixed glass beads shall be uncoated and uniformly mixed throughout the thermoplastic material at a rate of not less than 25 percent by weight (retained on the No. 100 sieve) of the thermoplastic material.
3. All equipment for application of thermoplastic marking materials shall be of such design and maintained in such condition as to properly heat, mix and apply the materials. The melting kettle shall be capable of heating the thermoplastic material to its recommended application temperature without scorching and shall be capable of maintaining that temperature. The heating kettle shall have a heat transfer medium and the flame shall not come in direct contact with the material container surface. A temperature gauge shall be visible on the outside of the kettle to indicate the temperature of the thermoplastic material. The melting kettle shall have a continuous mixer or agitator capable of thoroughly mixing the material at such a rate as to maintain homogeneity of material and uniformity of temperature throughout.
4. The dispensing equipment shall be capable of applying molten thermoplastic material at the temperature recommended by the manufacturer of the thermoplastic material in lines from 4 inches to 6 inches wide at a 30 mil thickness. Dispensing devices shall be of the spray type.
5. The thermoplastic dispenser shall be equipped with a drop-on type glass bead dispenser. The glass bead dispenser shall be located so as to drop the glass beads immediately after the molten thermoplastic material is applied. The glass bead dispenser shall be adjustable to regulate flow of the beads and shall uniformly dispense the glass beads over the entire width of the line. The application rate shall be a minimum rate of 8 pounds per 100 square feet. The beads shall adhere to the cured thermoplastic or all marking operations shall cease until corrections are made.
6. The pavement surface on which the thermoplastic material is to be placed shall be clean and dry. Pavement surfaces shall be inspected for cleanliness and any dirt, debris, or other contaminants on the surface to be marked shall be removed.
7. The pavement surface where the thermoplastic material is to be placed shall have a minimum temperature of 55° F. The air temperature shall be at least 50° F. during marking operations. The pavement surface temperature and air temperature shall be determined before the start of each day of marking operation and at any other time deemed necessary by the Engineer.
8. A primer is not required on new bituminous surfaces unless recommended by the manufacturer of the thermoplastic material. If primer is recommended, it shall be applied and cured in accordance with the recommendations of the manufacturer of the thermoplastic material.
9. The temperature of the thermoplastic material at the time of application shall be a minimum of 350° F. and a maximum of 425° F. The temperature of the thermoplastic material shall be checked at the point of deposition with a calibrated thermometer at the beginning of each day's marking, after material is added to the dispensing device, after delays in the marking operation, and any time deemed necessary by the Engineer.
10. Pavement striping shall comply with the standard striping practices as shown on the plans. The Contractor shall begin center line and lane line striping at the beginning of the last existing 10-foot stripe in order to maintain a 40-foot cycle along the entire pavement.
11. Finished markings shall have well-defined edges and lateral deviation shall not exceed one inch in 100 feet. The minimum thickness of thermoplastic markings

shall be 30 mils and the maximum shall be 50 mils. The thickness will be measured as a wet film except the Engineer may measure cured film by placing a tape or other bond breaker prior to placing the thermoplastic material and then removing a section of cured line and measuring thickness.

12. Damage to pavement marking caused by the Contractor's operation shall be repaired or replaced at his expense.
13. The applied thermoplastic markings should be inspected continually for overall workmanship. Markings shall have clean cut edges. The glass beads shall appear uniform on the entire marking surface. Adhesion to the pavement surface shall be checked with a stiff putty knife or similar instrument. The marking should not be removable from a concrete surface. The marking can be removed from a bituminous surface. However, residue of the bituminous substrate shall be stuck to the marking material.
14. If the thermoplastic line does not provide initial nighttime reflectivity or, if the marking does not have the required minimum thickness, the Contractor shall at his expense, apply additional thermoplastic material to the total thickness specified to the surface of the deficient portion of the marking. If the marking does not meet the required color, the Contractor shall, at his expense, remove the marking in a manner approved by the Engineer and re-apply the material. If the markings do not comply with the Specifications for any other reason, the Engineer may require complete removal or correction at the Contractor's expense.

E. PREFORMED THERMOPLASTIC MATERIAL:

1. Preformed thermoplastic material shall be applied to existing asphalt pavement by means of heat fusion. The markings shall be fusible to the asphalt pavement by means of the normal heat of a propane type of torch. Adhesives, primers or sealers shall not be used prior to the preformed markings application. The applied markings shall be very durable, oil and grease impervious and provide immediate and continuing retroreflectivity.
2. The preformed marking material shall consist of a resilient white or yellow polymer thermoplastic with uniformly distributed glass beads throughout its entire cross section. Preformed words and symbols shall conform to the applicable shapes and sizes prescribed in the latest revision of the MUTCD.
3. The markings shall conform to the 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 markings shall not be brittle and must be sufficiently cohesive and flexible at temperatures exceeding 40° F. for one person to carry without the danger of fracturing the material prior to application.
4. The retroreflective pliant polymer thermoplastic pavement markings shall consist of a homogeneous mixture of high quality polymeric thermoplastic binders, pigments, fillers and glass beads. The thermoplastic material must conform to AASHTO designation M249-79 (86) with the exception of the relevant differences due to the material being supplied in a preformed state. The markings shall be suitable for use for one year after the date of receipt when stored in accordance with the manufacturer's recommendations.
5. 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. Applied material must adhere fully and completely to the road surface with straight edges and squared ends and shall lay smooth on the surface with no warps, folds, creases, waves, bubbles or rips. Color and beading must be uniform and consistent. No overlap of materials is allowed. Ends or sides matched to existing markings must not exceed 0.125 inches in separation. Applied material shall be in alignment with existing markings and of consistent size.

6. The pavement surface where the thermoplastic material is to be placed shall have a minimum temperature of 40° F. The air temperature shall be at least 40° F. during marking operations. The pavement surface temperature and air temperature shall be determined before the start of each day of marking operation and at any other time deemed necessary by the Engineer.

F. MULTI-COMPONENT PAVEMENT MARKING MATERIAL:

1. All curing compounds and laitance shall be removed by shot or sand blasting. Multi-component liquid materials shall be applied closely behind the surface cleaning procedures. Before mixing the components of the pavement marking material, the individual components shall be heated to the temperature ranges recommended by the manufacturer of the material. The maximum recommended temperature shall not be exceeded at any time.
2. The multi-component liquid pavement marking material shall be applied at the thickness recommended by the manufacturer on concrete surfaces. Glass beads shall be applied immediately (via the double drop system) to the multi-component liquid pavement marking material at the rate recommended by the manufacturer to obtain the required level of retroreflectivity and equally divide between the large and regular bead gradations. The large beads shall be applied on the first drop and the regular beads shall be applied on the second drop.

G. CONTRAST PAVEMENT MARKING MATERIAL FOR CONCRETE PAVEMENT:

1. Contrast pavement marking material shall be used on concrete pavement. The contrast tape shall be installed in a groove and shall have a black preformed patterned film border, bonded to the edges to form a continuous roll. These films shall be manufactured without the use of lead chromate pigments or other similar, lead-containing chemicals. The total width of the preformed contrast tape shall be an additional three inches wider than the standard width specified. The additional three inch width shall be black non-reflective film with one and half inches on both sides of the white or yellow film. Preformed words and symbols shall conform to the applicable shapes and sizes as outlined in the Manual on Uniform Traffic Control Devices (MUTCD).
2. No direct measurement will be made for the contrast pavement marking material, completed in place in accordance with the plans and Specifications and as accepted by the Engineer.
3. No direct payment will be made for the contrast pavement marking material. This item shall be subsidiary to the respective pavement marking bid items for concrete pavement and shall be full compensation for the furnishing of all materials, labor, equipment, tools and incidentals necessary to complete the work.

H. EPOXY PAVEMENT MARKING MATERIAL:

1. If no traffic is present and for edge lines under any condition of traffic, a slower curing epoxy material (40 minutes) may be used. If the application is taking

place under traffic, a fast-setting (10 minutes) epoxy material for centerlines and skip lines shall be used. Epoxy shall be applied closely behind the surface cleaning procedures.

2. In the absence of manufacturer's recommendations, the markings shall be applied when the ambient and pavement surface temperatures are 50° F. and rising. Pavement marking operations shall be ceased when the ambient or the pavement surface temperature drops to 50° F.
3. Before mixing the components of the pavement marking material, the individual components shall be heated to the temperature ranges recommended by the manufacturer of the material. The maximum recommended temperature shall not be exceeded at any time.
4. The epoxy pavement marking material shall be applied at a thickness of 0.02 in. \pm 0.0002 in. on the Portland cement concrete. The glass beads shall be applied immediately to the epoxy pavement marking material at a rate of 25 lbs/gal, equally divided between the large and regular bead gradations. The large beads shall be applied on the first drop and the regular beads on the second drop.

I. WATERBORNE TRAFFIC PAINT MATERIAL:

1. Pavement marking paint shall only be used with prior approval, when specified and approved by the Engineer as temporary pavement markings when ambient and surface temperatures prevent the Contractor from properly installing permanent pavement markings, as directed by the Engineer. Once the proper ambient and surface temperatures are reached, the Contractor shall remove the temporary pavement markings and shall install permanent pavement markings as illustrated on the plans. Pavement markings that are installed in parking lots shall be white in color and shall have a minimum 4" width.
2. The pavement marking paint shall be a rapid dry paint and shall provide optimum adhesion for glass spheres when both binder and glass spheres are applied in the recommended quantities. When applied at a wet film thickness of 15 mils with a top dressing of 6 lbs to 10 lbs of glass spheres per gallon of paint and when the ambient temperature is 35° F. and rising, the wind-chill temperature is 35° F. and above, and the relative humidity does not exceed 80%, the binder shall dry to a no-tracking condition in a minimum of 20 seconds and a maximum of 60 seconds. The ambient temperature shall remain at 35° F. and above for at least 10 hours after the paint has been applied in order to ensure adequate drying time at above-freezing temperatures. These dry times shall not be exceeded when the paint is applied with specialized equipment so as to have the pigmented binder at a temperature of 150° F. to 170° F. at the spray gun.
3. The no-tracking condition shall be determined by passing over the applied line in a simulated passing maneuver with a passenger car traveling 35 mph. There shall be no visual deposition of the paint to the pavement surface when viewed from a distance of 50 feet. Furthermore, the pigmented binder, without glass spheres, shall dry to no-tracking condition in 180 seconds or less when tested in accordance with ASTM D-711-67.
4. The paint shall show no cracking, flaking, blistering, appreciable loss of adhesion, softening, coagulation, discoloration and have a minimum bleeding ratio of 0.97 when tested in accordance with Federal Specification TT-P-1952B. The paint shall be capable of dilution with water at all levels without curdling or precipitation such that the wet paint can be readily cleaned up with water only.

5. 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 beads shall be spread uniformly over the entire length of the line. Beginnings and ends of lines shall be clean cut and perpendicular to the centerline of the street. Pavement marking paint materials shall not be applied when pavement temperatures are below 50° F. or when the surface of the pavement shall show evidence of moisture. Temperatures should be at least 50° F. and rising.

H. RAISED PAVEMENT MARKERS:

1. Raised pavement markers may be used as a temporary pavement marking in instances such as before a roadway is slurry sealed. Raised pavement markers shall be subsidiary to the TRAFFIC CONTROL bid item.

I. GLASS BEADS - Glass beads furnished under this Specification shall be transparent, colorless, clean and free of foreign matter, and shall conform to the requirements set forth herein. The beads shall be designated as: Type A-Standard Clear

MATERIAL REQUIREMENTS:

1. Glass bead size:

<u>Sieve Size</u>	<u>% Passing</u>
No. 20	100%
No. 30	75-88%
No. 40	40-50%
No. 50	10-25%
No. 80	0-03%

2. Imperfect Beads: Not more than 30 percent of the beads shall be imperfect. See the subsection entitled "Method of Test".
3. Moisture Resistance: Beads shall pass the "Free Flow Test". See the subsection entitled "Method of Test".
4. Index of Refraction: The beads shall have a minimum index of refraction of 1.50 when tested by the oil immersion method under tungsten light at 77° F.
5. Packaging: All beads shall be packed in 50-pound burlap or multi-wall Kraft bags. Bags shall be leak-proof, moisture-resistant and of sufficient strength to insure safe delivery, handling and storage of the beads prior to and during their use. For identification purposes, each bag shall be marked with a lot number assigned by the producer.

J. GLASS BEADS - METHOD OF TEST:

1. Sieve Analysis: Split out a representative sample of glass beads of approximately 200 grams (20+/- grams). Weigh to the nearest 0.1 gram and place on the No. 30 sieve equipped with a pan. If preferred, the entire series of sieves (See Subsection 106.1) may be stacked for a preliminary shaking of one minute before continuing with each individual sieve. If the stacking method is used, unbind the first sieve by inverting over a "bread" pan or other suitable shallow pan and brushing with a brass bristle brush. Weigh the beads and return to the sieve with an empty pan attached. Hold the sieve in one hand in a slightly inclined position so that the sample will be well distributed over the sieve, at the same time striking the side of the sieve about 150 times per minute against the palm of the other hand on the upstroke. Turn the sieve every 25 strokes about one-sixth of a revolution in the same direction. At the end of a minute of continuous shaking, remove the beads from the pan and weigh. Put these beads on the next sieve. If the weight of beads collected in the pan amounts to more than 1% of the beads on the sieve at the beginning of the sequence, the sieve is again unblended and the beads are weighed and returned to the sieve. Repeat the procedure for each sieving sequence, using the new weight to determine the percent passing. Continue sieving and weighing until not more than 1% of the beads passes the sieve during any sequence. Repeat the procedure until each sieve in the stack has been used. Weigh and record the final amount retained on each sieve to the nearest 0.1 gram.
2. Subtract the weight of beads retained on each sieve from the weight of the beads on the sieve at the beginning of the sequence. Calculate the percentage of beads passing each sieve. The original sample weight will be used in all calculations for percentage passing each sieve.
3. The sum of the weights of beads retained and the weight of the beads passing the last sieve must be within 0.8 grams of the original sample weight for the analysis to be considered a valid test. If the amount lost during sieving is more than 0.8 grams, that analysis must be discarded. A new sample is then split from the retained portion of beads and the procedure above is repeated, taking care that loss of beads is kept to a minimum.
4. Imperfect Beads: Imperfect beads are defined as beads which are ovate or otherwise non-spherical in shape, two or more beads fused together, opaque bead or pitted beads. Imperfect beads will be determined by visual inspection on a representative sample of not less than 300 beads using a 45 power magnification. All particles retained on a 100 mesh screen regardless of shape will be counted; particles passing a 100 mesh screen will be disregarded and not counted either as perfect or imperfect beads.
5. Moisture Resistance - Free Flow Test:
 - Required Apparatus: Standard one pint screw cap mason fruit jars with two piece covers consisting of a flat cover plate with sealing gasket attached and a screw ring to hold the cover plate on the jar. Special 60° Brass Funnel with a four inch stem. Inside diameter of the stem shall be 0.25 inches plus or minus 0.004 inches. The top funnel shall be soldered to one of the screw rings from a jar cover so that the funnel can be screwed to the top of the jar. The inside surface of the funnel shall be kept polished smooth. Measuring pipette, Mohr Type, capacity 0.100 ml with graduation line at intervals of 1/100 ml or an automatic pipette of similar capacity.

- Procedure: Using a sample splitter, obtain a representative 300 gram sample of the beads. Transfer the sample to one of the pint jars and place the uncovered jar and samples in an air oven at 221° to 230° F. for 16 hours. Remove the jar from the oven immediately and seal it with one of the jar cover plates and screw rings. Allow to cool to room temperature.
- If, after cooling, the beads have stuck together forming lumps, shake the jar violently until all lumps are broken up. This must be done without removing the cover. After breaking up lumps, remove the cover and quickly add 0.090 ml of distilled water from the measuring pipette. Immediately seal the jar with the cover and screw ring and shake jar and contents violently for 20 seconds. Let stand for four hours, shake and tumble the beads in the sealed jar for 20 seconds at the end of the first, second, and third hour of standing.
- At the end of the fourth hour, without shaking, remove the cover and quickly screw the special funnel to the top of the jar. Invert the jar and support it in a vertical position. The beads shall flow from the jar through the stem of the funnel. It is permissible to tap the funnel to keep the bead flow. But if it is necessary to keep tapping the funnel to keep the beads flowing, the beads do not pass the test. A small amount of beads sticking to the sides of the jar shoulder shall not be cause for rejection.

6. Basis of Acceptance:

- Acceptance of glass beads will be made on the basis of a Type "D" certification. Type "D" certification shall be prepared by the manufacturer and shall state that the materials meet the applicable specifications. Those specifications shall be listed by number, section reference or other appropriate identification.
- Visual inspection of performance and consistency on the job site

K. METHOD OF MEASUREMENT: Pavement Marking, except as noted above, will be measured by the linear foot of each width of line, and per each for symbols and text letters, complete in place in accordance with the plans and Specifications and as accepted by the Engineer.

L. BASIS OF PAYMENT: The amount of completed and accepted work, measured as provided above, will be paid for at the Contract unit price bid for each width of "Pavement Markings" and per each symbol or text letter, which price shall be full compensation for the furnishing of all materials, for all labor, equipment, tools and incidentals necessary to complete the work. Removal of existing pavement markings shall be subsidiary to the installation of the new pavement markings.