TYPE L (LARGE) GLASS BEADS FOR APPLICATION ON TRAFFIC MARKING PAINT

1.0 DESCRIPTION OF MGS-94-01E. These specifications cover Type L (Large) glass beads to be gravity dropped upon traffic marking paint.

1.1 Unless otherwise specified, references to a national standard agency specification (AASHTO, ASTM, etc.) are the latest revision in effect at the time of the contract letting.

2.0 MATERIALS. The Type L beads shall meet the following requirements.

2.1 COATING. The beads shall be coated to insure satisfactory embedment and adhesion when applied to 15 mils (wet) of acrylic waterborne or high heat traffic marking paint.

2.2 REFRACTIVE INDEX. The beads shall have a minimum refractive index of 1.50 when tested in accordance with AASHTO M 247.

2.3 ROUNDNESS. The beads shall have a minimum of 80 percent rounds per screen for the two highest sieve quantities (determined visually) and no more than 3 percent angular particles per screen (visual). The remaining sieve fractions shall typically be no less than 75 percent rounds (determined visually per aspect ratio using microfiche reader). The tests shall be in accordance with Federal Lands Highway (FLH) Test Method T520-93.

2.4 GRADATION. The beads shall meet the following gradation requirements when tested in accordance with ASTM D 1214.

U. S. Standard Sieve No.	Percent Passing
12	100
14	95 -100
16	80 - 95
18	10 - 42
20	0 - 7
25	0 - 2

2.5 SILICA CONTENT. The beads shall be made of glass containing not less than 58.0 percent Silica (SiO_2) when tested in accordance with ASTM C 169, Procedures for Referee Analysis.

2.6 WATER RESISTANCE. The beads shall show no readily discernible dulling and the amount of 0.1 Normal Hydrochloric Acid needed to titrate the filtrate shall not exceed 4.5 milliliters, when tested in accordance with this specification.

2.7 CALCIUM CHLORIDE RESISTANCE. The beads shall show no readily discernible dulling when tested in accordance this specification.

2.8 SODIUM SULFIDE RESISTANCE. The beads shall show no readily discernible darkening or dulling when tested in accordance with this specification.

3.0 TEST METHODS.

3.1 WATER RESISTANCE. Ten 0.5 grams of beads placed in a Whatman single thickness cellulose extraction thimble, 33 by 80 millimeters, are refluxed for one hour in a Soxhlet extractor having an 85 millimeter siphon capacity using 150 milliliters of distilled water. All connections shall be ground glass. At the end of the refluxing period, allow the filtrate to cool to room temperature, and titrate with 0.1 normal hydrochloric acid, using phenolphthalein indicator. The beads shall be dried at 100 C, and examined for dulling under 60 power magnification.

3.2 CALCIUM CHLORIDE RESISTANCE. Immerse approximately 10 grams of the beads in a 1.0 Molar calcium chloride solution for 3 hours. Rinse well, by decantation, with distilled water. Spread beads on a clean filter paper and allow to dry. Examine the beads for dulling under 60 power magnification.

3.3 SODIUM SULFIDE RESISTANCE. Immerse approximately 10 grams of the beads in a 50 percent solution of sodium sulfide for one hour. Rinse well, by decantation, with distilled water. Spread beads on a clean filter paper and allow to dry. Examine the beads for dulling under 60 power magnification.

3.4 Embedment Coating - In accordance with following procedure.

3.4.1 Apparatus and Reagents.

Graduate Cylinder (50ml)
Acetone - Reagent Grade
Dansyl Chloride - 98%
Scale - Analytical Balance (4 place)
Darkened Glass Container (that can be sealed tightly)
Rubber Gloves (long sleeves)
Safety Glasses or Goggles
Medicine Dropper
Glass Filter Paper (4" diameter)
Small Aluminum Weighing Dishes
2-inch (50 mm) Buchner Funnel and Suction Flasks
2-inch (50 mm) diameter Filter Paper (Whatman #1)
Vacuum Pump
Ultra-Violet Light Source - Intensity 7,000 uw/cm^2

Caution: Dansyl Chloride is a hazardous compound. Do not handle without protective gloves and safety glasses or goggles. Do not get onto skin.

3.4.2 Preparation of Dansyl Chloride Solution - Prepare a solution by weighing 0.2 grams of Dansyl Chloride and dissolving it in 25 ml of acetone. This solution can be used for several tests during the day but must be kept refrigerated in a dark, tightly closed container between uses. Make a fresh solution daily.

3.4.3 Procedure.

(1) Set drying oven to 60 C. Turn on ultra-violet light.

(2) Weigh 2 samples of beads of 10 grams each. Place the sample to be evaluated in an aluminum weighing dish. Retain the other sample for a fluorescence observation comparison.

(3) Place a 2" diameter filter paper into the Buchner funnel and attach to the suction flask.

(4) Put the beads in the Buchner funnel and saturate the sample with the Dansyl Chloride solution using a medicine dropper. Let solution and sample stand for 30 seconds.

(5) Place the saturated beads into an aluminum dish and dry in oven at 60 C for 15-20 minutes. Beads will be yellow and agglomerated. Do not let the Dansyl Chloride solution char. (Properly discard the used filter paper because of the toxicity of the Dansyl Chloride.)

(6) Remove sample from the oven and place the glass beads in the Buchner funnel with new filter paper. Rinse the beads with 100 ml of Acetone. Use the suction during this step. All yellow must be removed from the beads.

(7) Remove the beads from the funnel and place into a new aluminum tray. Allow the beads to dry in the oven for 5 to 10 minutes until free flowing.

(8) Remove the beads from the oven and place on glass filter paper. If beads are agglomerated, break them up with a spatula.

(9) Inspect the treated sample under the ultra-violet light, in a darkened room.

3.4.4 Observations.

(1) Embedment coated beads will emit a yellow-green florescence.

(2) If additional fluorescence is observed when compared with the original untreated sample, the lot is accepted. If no additional fluorescence is observed, the test should be rerun using a new 10 gram sample of beads and a fresh solution of Dansyl Chloride.

(3) If no additional fluorescence is observed on the new sample of beads, the material is not properly coated and the lot is rejected. If additional fluorescence is observed, the lot is accepted.

4.0 SAMPLING AND TESTING.

4.1 The manufacturer shall furnish the engineer free access to all parts of the plant and shall furnish every reasonable facility for inspection.

4.2 The engineer reserves the right to sample at the point of manufacture, at intermediate points of storage, or at destination. The engineer will determine the location and frequency of sampling.

5.0 CERTIFICATION AND ACCEPTANCE.

5.1 The manufacturer shall furnish to the engineer, at destination, prior to approval and use of any material delivered, a certification in triplicate as shown in this specification for each shipment, certifying that the beads conform to all requirements of these specifications. The certification shall include or have attached specific results of tests performed for Roundness, Refractive Index, Coating, and Gradation. The certifications shall also show the purchase order number, destination, quantity, date shipped, and the lot number.

5.2 Pre-approved beads may be accepted by certification and random sampling as designated by the engineer. Beads which have not been pre-approved must be sampled and approved prior to use.

6.0 PACKAGING AND MARKING.

6.1 Beads shall be furnished in 2000 pound bulk cartons or 2400 pound bulk bags as specified in the bid request.

6.2 BULK CARTONS. The bulk cartons shall meet the requirements of Federal Specifications PPP-B-640d, Class II for Boxes, Fiberboard, Corrugated, Triple-wall with a minimum 4 mil. thick plastic bag liner.

6.2.1 The cartons shall be approximately 40 inches square by 29 inches high, shipped on a double faced reusable-type pallet approximately 40 x 42 inches in size.

6.2.2 The cartons shall have two horizontal steel bands and one vertical steel band, each at least 1/2 inch wide and tightened sufficiently to allow double deck storage and to keep the carton from deforming during shipment.

6.3 BULK BAGS. The bulk bags shall meet the requirements of Section 16.1 of the United Nations Recommendations on the Transport of Dangerous Goods, Sixth Edition (ST/SG/AC.10/1/Rev.). The loading for the "Top Lifting Test" shall be modified to require a mass 5 times the maximum possible load.

6.3.1 The bags shall be approximately 43 x 43 x 26 inches, interior baffles and constructed as follows:.

a. The bags shall be constructed of 6 1/2 ounce coated sift proof polypropylene fabric,

b. The bags shall be constructed with a coated sift proof fabric remote opening that can be controlled by a person standing to one side of the bag.

c. The bag shall have four top-lift loops sized to allow lifting from a central hook when the bag is full.

6.3.2 Bags shall be shipped on a double-faced, reusable pallet approximately 42 x 42 inches, topped with a double-faced, type B fluted, 42 inch x 42 inch by 1/8 inch thick, 200-pound test, cardboard sheet. The assembled bag and pallets shall be stackable two high.

6.3.3 Each bag shall be strapped or banded to the pallet with a minimum of three nylon or polypropylene straps. Two straps shall be vertically positioned at 90 degrees to each other. The third strap shall be centrally positioned horizontally to the pallet.

6.4 Each container shall be shrink or stretch wrapped with plastic on the top and sides, so that the contents will completely shed water.

6.5 Each container shall be marked with the name and type of contents, manufacturer of the beads, net weight, and lot designation.

7.0 ORDERING INFORMATION. Beads are to be ordered as Type L Glass Beads. The type of packaging is to be shown in the bid request as "Bulk Cartons" or "Bulk Bags".

8.0 CERTIFICATION STATEMENT. The following form is to be completed, signed and submitted in triplicate with each shipmentof glass beads, however more than one shipment may be shown on a single certification so long as test results are included for each lot:

We hereby certify that Type L Glass Beads described below comply with all requirements of the Missouri Department of Transportation's specifications in Bid Request No. _____.

The following glass beads were manufactured by _____
at _____ and are covered by this certification.

Purchase Order	Destination	Quantity (Pounds)	Lot Number	Date Shipped
No. 1				
No. 2				
No. 3				

Following are specific results of tests performed on these glass beads:

	Destination No. 1	Destination No. 2	Destination No. 3
Type	_____	_____	_____
Lot No.:	_____	_____	_____
Roundness	_____	_____	_____
Refractive Index:	_____	_____	_____
Coating:	_____	_____	_____
Gradation:			
Percent Passing No. 12	_____	_____	_____
Percent Passing No. 14	_____	_____	_____
Percent Passing No. 16	_____	_____	_____
Percent Passing No. 18	_____	_____	_____
Percent Passing No. 20	_____	_____	_____
Percent Passing No. 25	_____	_____	_____

Certified By:_____

Title:_____

Date: _____