

Section 02764

RAISED PAVEMENT MARKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Raised reflective pavement markers and jiggle bars.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for raised pavement markers under this Section unless included as a bid item in Document 00410 - Bid Form. Include payment in unit price for installation and maintenance of traffic control when there is no bid item in Document 00410.
2. Payment for Type I raised reflective pavement markers with one reflective face is for each marker installed.
3. Payment for Type I raised reflective pavement markers with two reflective faces is for each marker installed.
4. Payment for Type I raised pavement markers with no reflective face is for each marker installed.
5. Payment for Type II raised reflective pavement markers with one reflective face is for each marker installed.
6. Payment for Type II raised reflective pavement markers with two reflective faces is for each marker installed.
7. Payment for Type AW@ jiggle bars is on a unit price basis for each jiggle bar.
8. Refer to Section 01270 - Measurement and Payment for unit price procedures.

- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 REFERENCES

- A. ASTM D 2444 - Standard Test Method for Determination of Impact Resistance of Thermoplastic Pipe and Fittings by means of a Tup (Falling Weight).

- B. ASTM E 808 - Standard Practice for Describing Retroreflection.
- C. ASTM E 809 - Standard Practice for Measuring Photometric Characteristics of Retroreflectors.
- D. Federal Specification L-P-380C - Plastic Molding Material Methacrylate.
- 5. TxDOT Material Specification DMS-4100 - Jiggle BarTile.
- 6. TxDOT Material Specification DMS-6130 - Bituminous Adhesive for Pavement Markers.

1.04 SUBMITTALS

- A. Conform to requirements of Section 01330 - Submittal Procedures.
- B. Submit manufacturer's product data concerning following materials for approval:
 - 1. Types I, II, and III, W and Y markers.
 - 2. Primers, solvents, and adhesives.
 - 3. Installation instructions.
- C. Submit certificate by manufacturer that each marker and adhesive conforms to requirements of this Section.
- D. Submit details of manufacturer's replacement policy for each type and class of marker.

1.05 DELIVERY AND STORAGE

- A. Deliver markers in cartons of 100 units, epoxy adhesive in one-gallon pails. Ship like materials in like-sized containers to facilitate storage.
- B. Store material in cool dry conditions until application.

PART 2 PRODUCTS

2.01 MARKERS

- A. Raised Reflective Pavement Markers: Shallow frustum of pyramid shaped markers with tempered glass prismatic reflective elements. Bodies shall be plastic shells with resin/sand fillings, or single-piece injection-molded bodies of impact resistant polymers. Plastic shells

shall be Methyl Methacrylate conforming to Federal Specification L-P-380C, Type I, Class 3 and shall have minimum wall thickness of 0.65 inches.

B. Marker configuration shall be as follows:

	<u>Nominal Dimensions</u>	<u>Reflecting Face Slope</u>	<u>Reflecting Face Surface Area</u>
Type I	4"x4"x0.75" high	30E	3.25 sq. in.
	3"x5"x0.70" high	30E	4.00 sq. in.
Type II	2"x4"x0.40" high	30E	1.87 sq. in.
Type III	3"x5"x0.70" high	30E	4.00 sq. in.

C. Optical performance shall be as follows:

1. Types I and II:	<u>White</u>	<u>Yellow</u>	<u>Red</u>
Specific Intensity, SI, min.			
Entrance Angle = 0E	15.0	9.0	3.5
Entrance Angle = 20E	6.0	3.6	1.2
2. Type III:	<u>White</u>	<u>Yellow</u>	<u>Red</u>
Specific Intensity, SI, min.			
Entrance Angle = 0E	15.0	9.0	3.5
Entrance Angle = 20E	6.0	3.6	1.2

3. Testing Procedure: Locate randomly selected test marker with center of reflecting face 5 feet from uniformly bright light source with effective diameter of 0.2 inches. Use photocell width of 0.05 inches for Type I markers and photocell with annular ring of 0.37 inches by 0.46 inches for Type II markers; shield to eliminate stray light. Distance from light source to photocell center of 0.21 inches. Modify source receiver dimensions and distance between source and receiver proportionally to test distance change for test distances other than 5 feet. Lots containing more than 4 percent reflecting face failures shall be rejected according to ASTM E 808 and ASTM E 809.

D. Physical requirements shall be in accordance with following test procedures:

1. Type I and Type III Markers: Select 3 random markers per lot. Center marker over open end of vertically positioned 1 inch long hollow metal cylinder with 3 inch inside diameter and 0.25 inch wall thickness. Apply load slowly to top of marker through 1-inch

diameter by 1-inch high metal plug centered on marker. Breakage or appreciable deformation of test sample at load less than 2000 pounds shall be cause for lot rejection.

2. Type II Markers: Select 20 random markers per lot. Condition markers in convection oven at 130 degrees F for one hour. At elevated temperature, impact reflective face by dropping 90 gram dart, fitted with 0.25 inch radius spherical head, 6 inches perpendicularly onto center of reflective surface. Cracks in impact surface area shall be generally concentric in appearance. Small radial cracks less than 0.25 inches in length will be allowed. Lot will be acceptable when 18 test samples meet testing requirements; failure of 4 test samples will cause lot rejection. Retest additional 20 markers when 3 samples fail; failure of one lens of resample group will cause lot rejection.

E. Impact Resistance: Test in accordance with ASTM D 2444 Tup A.

F. Jiggle Bar Tile, Class A, shall conform to TxDOT Material Specifications D-9-4100, and includes Types I-A, I-C, II-A-A, W and Y.

1. Type I-A shall contain approach face that reflects amber light. Body, other than reflective face, shall be yellow.
2. Type I-C shall contain approach face that reflects white light. Body, other than reflective face, shall be white, silver-white, or light gray.
3. Type II-A-A shall contain 2 reflective faces (approach and trailing) each of which shall reflect amber light. Body, other than reflective faces, shall be yellow.
4. Type W shall have white body and no reflective faces.
5. Type Y shall have yellow body and no reflective faces.
6. Adhesive:
 - a. Bituminous adhesive conforming to TxDOT material Specification D-9-6130 shall be used for Class A type markers on Bituminous pavements.
 - b. Epoxy adhesive for Class A type markers on Portland cement concrete pavements.
 - c. Adhesives shall be as recommended by jiggle bar manufacturer for installation.

2.02 ADHESIVE

- A. Obtain two-component epoxy adhesive from reflective pavement marker manufacturer conforming to manufacturer's requirements for installation for Class A, B, C, and D markers on Portland cement concrete pavements.

- B. Provide Bituminous adhesive conforming to TxDOT Material Specification D-9-6130 conforming to manufacturer's requirements for installation for Class A, B, C, and D markers on Bituminous pavements.

PART 3 EXECUTION

3.01 PREPARATION

- A. Accurately locate and install approved markers to conform to classes and colors indicated on Drawings.
- B. Clean and repair surfaces to receive markings. Remove loose material, dust, contaminants such as oil and curing membrane, and polished aggregates.
- C. Blast clean surfaces indicated on Drawings or where directed by City Engineer in accordance with requirements of Section 02762- Blast Cleaning of Pavement. Do not clean Portland cement concrete pavements by grinding. Mechanical wire brushing may be used to remove curing membranes.

3.02 INSTALLATION

- A. Prepare pavement surfaces and install markers in accordance with marker and adhesive manufacturer's recommendations.
- B. Test pavement surface for moisture content prior to application of markings. Place approximate 2 square foot sheet of clear plastic or tar paper on road surface and hold in place for 20 minutes. Immediately inspect sheet for build up of condensed moisture. When sufficient moisture has condensed to cause water to drip from sheet, do not apply markings. Repeat test as necessary until adequate moisture has evaporated from pavement to allow placement.
- C. Observe manufacturer's recommended pavement and ambient air temperature requirements for application. When manufacturer has no temperature recommendations, do not install markings when pavement temperature is below 60 degrees F or above 120 degrees F.
- D. Position reflective face of markers so that direction of reflection of one (1) face is directly opposite to direction of reflection of other face.
- E. Prepare surfaces to which markers are to be attached by adhesive by method to ensure that surface is free of dirt, curing compound, grease, oil, moisture, loose or unsound pavement markings and other materials which would adversely affect adhesive bond.

- F. Establish guides to mark lateral location of pavement markings as shown on drawings. Guides placed on roadway for alignment purposes shall not establish permanent marking on roadway.
- G. Place pavement markings in alignment with guides. Deviation rate in alignment shall not exceed one (1) inch per 200 feet of roadway. Maximum deviation shall not exceed two (2) inches nor shall deviation be abrupt. Remove and replace markings that are in alignment or sequence.
- H. Apply adhesive in sufficient quantity to ensure adhesion and as recommended by manufacturer for installation.
- I. Markers shall be free of rust, scale, dirt, oil, grease, moisture, or contaminants, which might adversely affect adhesive bond.
- J. Place markers immediately after adhesive is applied and firmly bond to pavement. Adhesive or other materials that impair functional reflectivity will not be acceptable.
- K. Pavement markers shall not be in contact with pavement surface but shall be seated on continuous layer of adhesive. One hundred percent of bonding area of marker shall be in contact with adhesive.
- L. For Bituminous adhesive use, pavement and pavement marker temperature shall be at least 40 degrees F. Do not heat Bituminous adhesive to temperature greater than 400 degrees F. Agitate Bituminous adhesive immediately to ensure even heat distribution.
- M. Prime pavement surface and apply markings as recommended by manufacturer.

3.03 CLEANING

- A. Keep project site free of unnecessary traffic hazards at all times.
- B. Clean area upon completion of work and remove rubbish from work site.

3.04 WARRANTY

- A. Warrant material and labor for period of 12 months from date of installation of markings.

END OF SECTION