

**SECTION 02855
RAISED PAVEMENT MARKERS**

PART I: GENERAL

1.1 GENERAL REQUIREMENTS

- A. Raised reflective pavement markers and jiggle bars.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for Type I raised reflective pavement markers with one (1) reflective face is per each marker installed.
2. Payment for Type I raised reflective pavement markers with two (2) reflective faces is per each marker installed.
3. Payment for Type I raised pavement markers with no reflective face is per each marker installed.
4. Payment for Type II raised reflective pavement markers with one (1) reflective face is per each marker installed.
5. Payment for Type II raised reflective pavement markers with two (2) reflective faces is per each marker installed.
6. Payment for Type "W" jiggle bars is on a unit price basis per each jiggle bar.
7. Refer to Section 01270 – Measurement and Payment for unit price procedures.

B. Stipulated Price (Lump Sum):

1. If Contract is Stipulated Price Contract, payment for work in this Section is included in Total Stipulated Price.

1.3 REFERENCES

A. ASTM – American Society for Testing and Materials.

1. ASTM D2444 – Standard Test Method for Determination of Impact Resistance of Thermoplastic Pipe and Fittings by means of a Tup (Falling Weight).
2. ASTM E808 – Standard Practice for Describing Retroreflection.
3. ASTM E809 – Standard Practice for Measuring Photometric Characteristics of Retroreflectors.

B. CFTS – City of Friendswood Technical Specifications.

C. Federal Specification L-P-380C – Plastic Molding Material Methacrylate.

D. TxDOT – Texas Department of Transportation.

1. TxDOT Material Specification DMS-4100 – Jiggle BarTile.
2. TxDOT Material Specification DMS-6130 – Bituminous Adhesive for Pavement Markers.

1.4 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 in this Section.
- D. Submit details of manufacturer's replacement policy for each type and class of marker.

1.5 DELIVERY AND STORAGE

- A. Deliver markers in cartons of one hundred (100) units and epoxy adhesive in one gallon (1 Gal) pails. Ship like materials in like-sized containers to facilitate storage.
- B. Store material in cool, dry conditions until application.

PART II: PRODUCTS

2.1 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 a minimum wall thickness of sixty-five hundredths of an inch (0.65 In).
- B. Marker configuration shall be as specified in Table 4.1 – RAISED PAVEMENT MARKER CONFIGURATION FOR TYPES I, II AND III.
- C. Optical performance for Type I or II Raised Pavement Markers shall be as specified in Table 4.2 – RAISED PAVEMENT MARKER OPTICAL PERFORMANCE FOR TYPES I AND II.
- D. Optical performance for Type III Raised Pavement Markers shall be as specified in Table 4.3 – RAISED PAVEMENT MARKER OPTICAL PERFORMANCE FOR TYPES III.
- E. Testing Procedure: Locate randomly selected test marker with center of reflecting face five feet (5 Ft) from uniformly bright light source with effective diameter of two-tenths of an inch (0.2 In). Use photocell width of five hundredths of an inch (0.05 In) for Type I markers and photocell with annular ring of thirty-seven hundredths of an inch by forty-six hundredths of an inch (0.37 In x 0.46 In) for Type II markers; shield to eliminate stray light. Distance from light source to photocell center of twenty-one hundredths of an inch (0.21 In). Modify source receiver dimensions and distance between source and receiver proportionally to test distance change for test distances other than five feet (5 Ft). Lots containing more than four percent (4%) reflecting face failures shall be rejected according to ASTM E808 and ASTM E809.

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- F. Physical requirements shall be in accordance with following test procedures:
1. Type I and Type III Markers: Select three (3) random markers per lot. Center marker over open end of vertically positioned one inch (1 In) long hollow metal cylinder with three inch (3 In) inside diameter and twenty-five hundredths of an inch (0.25 In) wall thickness. Apply load slowly to top of marker through one inch (1 In) diameter by one inch (1 In) high metal plug centered on marker. Breakage or appreciable deformation of test sample at a load less than two thousand pounds (2000 Lbs) shall be cause for lot rejection.
 2. Type II Markers: Select twenty (20) random markers per lot. Condition markers in convection oven at one hundred thirty degrees Fahrenheit (130° F) for one hour (1 Hr). At elevated temperature, impact reflective face by dropping ninety gram (90 g) dart, fitted with twenty-five hundredth of an inch (0.25 In) radius spherical head, six inches (6 In) perpendicularly onto center of reflective surface. Cracks in impact surface area shall be generally concentric in appearance. Small radial cracks less than twenty-five hundredth of an inch (0.25 In) in length shall be allowed. Lot shall be acceptable when eighteen (18) test samples meet testing requirements. The failure of four (4) test samples shall cause lot rejection. Retest additional twenty (20) markers when three (3) samples from the first (1st) group fail. The failure of one (1) lens of re-sample group shall cause lot rejection.
- G. Impact Resistance: Test in accordance with ASTM D2444 Tup A.
- H. 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 two (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 for installation of jiggle bar shall be as recommended by manufacturer.

2.2 ADHESIVE

- A. Obtain two (2) component epoxy adhesive from reflective pavement marker manufacturer which conforms to manufacturer's requirements for installation for Class A, B, C and D markers on Portland cement concrete pavements.
- B. Provide bituminous adhesive per TxDOT Material Specification D-9-6130 and which conforms to manufacturer's requirements for installation for Class A, B, C and D markers on bituminous pavements.

PART III: EXECUTION

3.1 PREPARATION

- A. Accurately locate and install approved markers to conform to classes and colors indicated on the Drawings.
- B. Clean and repair surfaces to receive markings. Remove loose material, dust and contaminants such as oil, curing membrane or polished aggregates.
- C. Blast clean surfaces indicated on the Drawings or where directed by the Project Manager in accordance with requirements of Section 02850 – Blast Cleaning of Pavement. Do not clean Portland cement concrete pavements by grinding. Mechanical wire brushing may be used to remove curing membranes.

3.2 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 two square foot (2 Sf) sheet of clear plastic or tar paper on road surface and hold in place for twenty minutes (20 Min). 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 sufficient 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 surface temperature is below sixty degrees Fahrenheit (60° F) or above one hundred twenty degrees Fahrenheit (120° 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 and parallel to centerlines of street.
- E. Prepare surfaces to which markers are to be attached by adhesive by a method to ensure that surface is free of dirt, curing compound, grease,

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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 inch (1 In) per two hundred feet (200 Ft) of roadway. A maximum deviation shall not exceed two inches (2 In) nor shall deviation be abrupt. Remove and replace markings that are out of alignment or proper 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. Adhesive or other materials that impair functional reflectivity shall not be acceptable.
- K. Place markers immediately after adhesive is applied and set into adhesive. Pavement markers shall not be in contact with pavement surface but shall be seated on continuous layer of adhesive. One hundred percent (100%) 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 forty degrees Fahrenheit (40° F). Do not heat Bituminous adhesive to temperature greater than four hundred degrees Fahrenheit (400° F). Agitate Bituminous adhesive immediately to ensure even heat distribution.
- M. Prime pavement surface and apply markings as recommended by manufacturer.

3.3 CLEANING

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

3.4 WARRANTY

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

PART IV: TABLES

4.1 RAISED PAVEMENT MARKER CONFIGURATION FOR TYPES I, II AND III.

RAISED PAVEMENT MARKER CONFIGURATION			
MARKER	NOMINAL DIMENSIONS	REFLECTING FACE SLOPE	REFLECTING FACE SURFACE AREA
Type I	4" x 4" x 0.75 high	30°	3.25 sq. in.
	3" x 5" x 0.70 high	30°	4.00 sq. in.
Type II	2" x 4" x 0.40 high	30°	1.87 sq. in.
Type III	3" x 5" x 0.70 high	30°	4.00 sq. in.

4.2 RAISED PAVEMENT MARKER OPTICAL PERFORMANCE FOR TYPES I AND II.

TYPE I AND II RAISED PAVEMENT OPTICAL PERFORMANCE			
SPECIFIC INTENSITY, SI, MIN.	WHITE	YELLOW	RED
Entrance Angle = 0°	15.0	9.0	3.5
Entrance Angle = 20°	6.0	3.6	1.2

4.3 RAISED PAVEMENT MARKER OPTICAL PERFORMANCE FOR TYPES III.

TYPE III RAISED PAVEMENT OPTICAL PERFORMANCE			
SPECIFIC INTENSITY, SI, MIN.	WHITE	YELLOW	RED
Entrance Angle = 0°	15.0	9.0	3.5
Entrance Angle = 20°	6.0	3.6	1.2

END OF SECTION