

ITEM 663

TRAFFIC BUTTONS AND PAVEMENT MARKERS

663.1 Description. This Item shall govern for furnishing and installing traffic buttons and reflectorized pavement markers and jiggle bars at the locations and of the type and color designated on the plans.

663.2 Design & Shape

A. Non-reflectorized Traffic Buttons: The traffic buttons shall be round and dome-shaped with a uniform curvature. Each button shall be $4" \pm 1/8"$ in diameter at the roadway surface and the height of the button shall be $11/16" \pm 1/16"$. The base of the button shall not deviate from a flat plane by more than $1/16"$. The top and sides of the buttons shall be smooth and free from surface irregularities, pits, cracks, checks, chipping, discoloration and any other defects which adversely affect appearance and application. The bottom of the buttons shall be rough-textured, free from gloss, glaze or any other substance that may reduce its bond to the adhesive.

B. Reflectorized Pavement Markers: The reflectorized markers shall be either round traffic buttons or square pavement markers, as shown on plans or designated in special specifications.

1. The round traffic buttons shall be dome-shaped with a flat area on the top and an acrylic rod lens reflector(s) inserted in a protective ramp and adhered to a recess in the base providing mono-directional and/or bi-directional reflection. Each mono-directional traffic button shall be $4" \pm 1/8"$ in diameter at the base. Each bi-directional button shall be an oval shape $4" \pm 1/8"$ wide by $4-3/4$ inches $\pm 1/8"$ long. Height of the button shall be $3/4" \pm 1/16"$. The base of the button shall not deviate from a flat plane by more than $1/16"$. The reflector lens shall be a single acrylic rod reflector, approximately $1-3/4$ inches in length for each reflector.

The bottom of the buttons shall be rough-textured, free from gloss, glaze or any other substance that may reduce its bond to the adhesive.

2. The square pavement markers shall have a base width of $4.0" \pm 1/2"$ and a minimum area exposed to traffic 12.5 square inches. The maximum height shall be $3/4"$. The maximum slope of the reflective face or faces shall be not more than 30 degrees from the horizontal.

The outer surface of the marker shall be smooth and all corners and edges exposed to traffic must be rounded.

The button surface of the marker shall not be grooved such that air will be trapped in the grooves when it is pressed into the epoxy adhesive.

3. The reflectorized pavement markers shall be of the following types:
- Type I-A shall contain one face that reflects amber light and the body other than the reflective face shall be yellow.
 - Type I-C shall contain one face that reflects white light and the body other than the reflective face shall be white, silver white or light gray.
 - Type I-R shall contain one face that reflects red light and the body other than the reflective face shall be white, silver white or light gray.
 - Type II-A-A shall contain two reflective faces each of which shall reflect amber light and the body other than the reflective faces shall be yellow.
 - Type II-C-C shall contain two reflective faces, each of which shall reflect white light and the body other than the reflective faces shall be white, silver white or light gray.
 - Type II-A-C shall contain two reflective faces one of which shall reflect amber light and one of which shall reflect white light; the body other than the reflective faces shall be white, silver white or light gray or may be one-half yellow on the side that reflects amber light and one-half white, silver white or light gray on the side that reflects white light.
 - Type II-A-R shall contain two reflective faces, one of which reflects amber light and one of which reflects red light; the body other than the reflective faces shall be one-half yellow on the side which reflects amber light and one-half red on the side which reflects red light or may be all white, silver white or light gray.
 - Type II-C-R shall contain two reflective faces, one of which reflects white light and one of which reflects red light; the body other than the reflective faces shall be white, silver white or light gray or may be one-half white, silver white or light gray on the side that reflects white light and one-half red on the side that reflects red light.

The reflective faces of the Type II markers shall be located so that the direction of reflection from one face shall be directly opposite to the direction of reflection of the other face.

663.3 Materials. The traffic buttons, and pavement markers shall be made from ceramic, glass or plastic material conforming to this Item and as called for by the plans and/or specifications. All buttons and/or pavement markers used on any project shall be of the same material and manufacturer.

Traffic buttons, and pavement markers shall have the following physical requirements:

- A. Water Absorption: The water absorption of the button shall not exceed 1.0 percent of the original dry weight when tested in accordance with ASTM C373.
- B. Autoclave Test (does not apply to Plastic Traffic Buttons). The glazed surface of the button shall not craze, spall or peel when subjected to one cycle of the Autoclave test at 250 psi (ASTM C424).
- C. Strength Requirements: A random sample of 5 buttons shall be subjected to the compressive load test. The average compressive strength of the 5 buttons shall not be less than 1500 pounds and no individual button shall have a compressive strength less than 1200 pounds when tested in accordance with Test Procedure Tex-434-A. The square pavement markers shall withstand a 200 lb. falling-ball impact of 5 feet without breaking, cracking, or being significantly deformed when tested according to Test Procedure Tex-430-A.
- D. Impact Test (applies to Plastic Traffic Buttons only). The button shall not break or crack when subjected to the impact test in accordance with Test Procedure Tex-435-A.
- E. Color. The color of the buttons and pavement markers (base and reflector) shall be as designated on the plans, shall be uniform and shall be determined by visual comparison with calibrated standards having C.I.E. Chromaticity Coordinate limits determined in accordance with Federal Methods of Tests TT-T-141, Method 4252 falling within an area having the following corner points:

	1		2		3		4		Brightness (%MgO)
	X	Y	X	Y	X	Y	X	Y	
White	.290	.316	.310	.296	.330	.321	.310	.342	80 Min.
Yellow	.470	.460	.515	.485	.545	.455	.490	.425	40 Min.

Color Combinations

Base	White	YellowWhite
Reflector	White	AmberRed and/or White

- F. Glaze Thickness (applies to Ceramic Traffic Buttons only). The glazed surface shall have a mean thickness not less than 0.005 inch when measured not closer than 1/4" from the edge of the button. The glaze thickness shall be measured on a fractured edge of the button to the nearest 0.001 inch by a calibrated scale microscope.
- G. Hardness (applies to Plastic Traffic Buttons only). The Shore Durometer Hardness (Type D) when determined in accordance with ASTM D2240, shall be a minimum of 86 when measured at room temperature and a minimum of 83 when measured at 150°F.
- H. Heat Test. The buttons and markers shall show no change in shape or color when subjected to the requirements of Test Procedure Tex-846-B. The temperature shall be 140° F. with the marker in a vertical position.
- I. Adhesion Requirements. The buttons and markers shall comply with the adhesion requirements of Test Procedure Tex-611-J.

663.4 Optical Requirements

- A. Definitions. Horizontal entrance angle shall mean the angle, in a plane parallel to the base of the marker, between a line in the direction of the incident light and a line perpendicular to the leading edge of the reflective surface.

Divergence angle at the reflector shall be between observer's line of sight and the direction of the light incident on the marker.

Specific intensity shall mean candlepower of the returned light at the chosen divergence and entrance angles for each foot candle of incident light per reflective face.

Test Procedure Tex-842-B will be used to determine specific intensity.

- B. Optical Performance. The reflective lens of the traffic buttons and markers shall be capable of providing Mono-directional and/or Bi-Directional Reflection of amber, red or white light as required by the plans and/or specifications. The specific intensity of the reflecting surface at 1/5 degree divergence angle shall be not less than the following when the incident light is parallel to the base of the button or marker:

<u>Horizontal Entrance Angle, Degrees</u>	<u>Specific Intensity</u>		
	<u>Crystal</u>	<u>Amber</u>	<u>Red</u>
0	3.0	2.0	0.4
20	1.5	1.0	0.2

The specific intensity of the button or marker shall be not less than 80 percent of the above minimum values after being subjected to the heat test required above.

663.5 Epoxy Adhesives. The adhesive used to bond the traffic buttons and markers to the roadway surface shall conform to the requirements of the Section 663.7.

663.6 Construction Methods. The traffic buttons, and pavement markers shall be placed at locations and spacing indicated on the plans. The reflectorized buttons and markers shall be oriented in such a way that the color of the reflected light is in accordance with the plans or as directed by the Engineer.

The portion of the roadway surface to which the marker is attached by the adhesive shall be prepared in accordance with Item 669 "Pavement Surface Preparation for Markings."

The wet epoxy adhesive shall be spread on the bonding surface so that 100 percent of the bonding area of the marker will be covered. The wet adhesive applications shall be of sufficient thickness so that when the markers are pressed into adhesive, excess adhesive shall be forced out around the entire perimeter of the pavement markers. All excess adhesive shall be removed from the front of the reflective faces, or the marker shall be replaced.

When the project is complete the markers shall be firmly bonded to the pavement, lines formed by the marker shall be true and the entire installation shall present a neat appearance.

663.7 Epoxy Adhesive. The following is set forth as the requirements for the epoxy adhesive to be used to bond traffic buttons, lane markers and other devices to concrete paved roadway and bridge surface.

A. General Requirements. The epoxy adhesive shall be furnished in two components, herein referred to as the epoxy resin component and the hardener component, the two components to be mixed just prior to use.

The epoxy adhesive must be suitable for use when the structure or pavement temperature is between 60° and 120° F. and the atmospheric temperature is between 60° and 105° F.

B. Component Properties: Any pigments, fillers and/or thixotropic agents present in either the resin component or the hardener component must be sufficiently dispersed that no appreciable separation or settling will occur during storage.

The ratio of the resin and hardener components to be mixed together to form the finished adhesive shall be specified by the

manufacturer and the components packaged in the proper proportions.

C. Properties of the Mixed Adhesive: The adhesive mixture shall be of such a consistency that it may be applied to the surfaces which are to be bonded without difficulty. The adhesive must be capable of wetting the surfaces which are to be bonded so that a good bond will be obtained. The adhesive must have a minimum resistance to flow, or thixotrophy, as specified below.

1. Thixotrophy: The degree of thixotrophy shall be determined as described herein. (the ambient temperature and the temperature of the materials used in this test shall be 75° F.) The two components of the epoxy adhesive shall be stirred together for approximately 5 minutes and then applied to a smooth clean steel plate to form a panel of epoxy material 2 inches wide, 4 inches in length, and 0.10 inch (100 mils) in thickness. A removable form of the proper dimensions may be used in placing the epoxy on the steel plate. The epoxy may be poured into the form and the excess struck off level with the top edge and then the form removed. Immediately after forming the epoxy adhesive, the steel panel shall be placed in a vertical position, the 4 inch dimension of the epoxy panel perpendicular to the horizontal. Not more than 7 minutes shall elapse between the initiation of mixing and the placing of the steel panel in the vertical position.

2. Requirements. The adhesive must be sufficiently resistant to flow that an average thickness of 0.03 inch (30 mils) of cured material will remain on the test panel.

D. Physical requirements of the cured adhesive: The following tests shall be performed on the specimens cured for 7 days between 70° and 80° F.

1. Adhesive Shear Strength: Steel to Steel (ASTM D1002) - 2000 psi minimum.

The surface of the test specimens used in the adhesive shear strength test shall be prepared by blasting to white metal. The blasted surfaces shall be washed with methyl ethyl ketone and allowed to dry before applying the adhesive. The test specimens shall have a prepared surface of equivalent "anchor pattern" to that which would be obtained by abrasive blasting the surfaces to be bonded with a gun of 50 to 75 psi using a 1/4 inch diameter nozzle and employing Garnet Blasting Abrasive "Gem Blast", 60 mesh (No. 45 to No. 74 U.S. Standard Screens), as marketed by Clemtex, Incorporated, P.O. Box 15214, Houston, Texas 77020.

2. Cleavage Strength: Steel to Steel (ASTM D1062) - 800 psi minimum. Surface preparation shall be as outlined in Adhesive Shear Strength. Water gain - 24 hour immersion at 23° C - (ASTM D570 Modified) 0.3 percent by weight maximum.

The given ASTM procedure shall be modified in that the specimens shall be prepared by casting disks of the epoxy adhesive 2-3/4 inches in diameter and approximately 3/8 inch thick. Prior to testing, the plane surfaces of the disks shall be ground to machine flat and parallel. The machining or grinding must be done in such a way as to not heat the disks above 100° F. The thickness of the disks after preparing the surfaces shall be 0.30 ± 0.02 inch.

3. Impact Strength: (70° - 80° F.) - Falling Ball Method - 6-1/2 foot-pounds minimum.

For this test the specimens shall be prepared as outlined in Water Gain. The finished specimens shall be placed on a concrete slab and a one pound steel ball dropped onto the center of the disks from an initial height of 5 feet. The height shall be increased by 1/2 foot for each successive drop until the specimen fails by cracking or shattering. The height of drop at which failure occurs shall be recorded as the impact strength in foot pounds. A minimum of three specimens shall be tested and the average reported to the nearest 1/2 foot pound.

663.8 Adhesive For Asphalt Pavement. The adhesive used to bond buttons and pavement markers to asphalt pavements shall conform to the requirements of the Latest Edition of TxDOT's Material Specification, DMS-6130, "Bituminous Adhesive For Pavement Markers"; stipulating that only the use of flexible bituminous marker adhesive will be allowed.

663.9 Testing. When required, by the Engineer, certified test results from an approved testing laboratory shall be submitted to Harris County, indicating that the traffic buttons and pavement markers have been tested and found to meet the requirements as outlined herein.

663.10 Measurement. Traffic buttons, jiggle bars and pavement markers will be measured as each button, jiggle bar or marker complete in place. Workzone Pavement Markings installed for temporary use shall be measured in accordance with Item 665 "Work Zone Pavement Markings".

663.11 Payment. Unless otherwise specified, the work performed and material furnished as prescribed by this Item measured as provided under "Measurement", will be paid for at the unit price bid, which price shall include all labor, epoxy adhesive and all other materials and services necessary to complete the work.

There are line code(s), description(s), and unit(s) for this Item.

NOTE: This Item requires other Standard Specifications

Item 665 "Work Zone Pavement Markings"

Item 669 "Pavement Surface Preparation for Markings"

END OF ITEM 663