

TRAFFIC CONTROL SECTION 1100

1110 Barricades, Signs and Traffic Handling

1111 General Description

This item shall consist of providing, installing, moving, replacing, maintaining, cleaning and removing temporary or permanent street closure barricades, signs or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform Traffic Control Devices for Street and Highways and as indicated or directed by the City Engineer.

1112 Construction Methods

Prior to commencing construction, suitable "Barricades, Signs and Traffic Handling" devices shall be installed to protect the workers and the public.

The Contractor shall be responsible for installing all markers, signs and barricades conforming to the Manual on Uniform Traffic Control Devices and/or as indicated. If, in the opinion of the City Engineer, additional markers, signs or barricades are needed in the interest of safety, the Contractor will install such as are required or as directed by the Engineer.

1112 Maintenance

It shall be the Contractor's responsibility to maintain, clean, move and replace if necessary, barricades, signs and traffic handling devices during the time required for construction of the project. Permanent barricades shall be constructed as required after the completion of the street by drilling holes to place the posts and concrete foundations. Foundation concrete shall be cured before the rails are attached. When no longer needed all temporary Barricades, Signs and Traffic Handling Devices shall be removed and the area restored to its original condition or as directed by the City Engineer.

1113 Measurement

This item will be measured by the unit of measure "month" as indicated on the plans.

1120 Markings

1121 Work Zone Pavement Markings

1121.01 Description. This item shall govern the placement and maintenance of work zone pavement markings of the colors, types and sizes indicated on the Drawings.

1121.02 General. Work zone pavement markings shall consist of guide marks, short-term markings and/or standard pavement markings. All streets, which are to be opened to traffic, shall be marked with short-term markings or standard markings, as shown on the Drawings, at the end of each day of operation.

When inclement weather prohibits the application of short-term markings or standard markings indicated on the Drawings, guide marks may be considered as temporary short-term markings for asphaltic surfaces, upon approval by the Engineer. The placement of pavement markings as shown on the Drawings may be delayed until the time that weather conditions allow the application of pavement markings.

1121.03 Materials. All non-removable markings shall be thermoplastic, unless otherwise indicated on the Drawings. Thermoplastic markings shall have a thickness of 90 mils unless indicated otherwise on the

Drawings. All non-removable work zone markings shall conform to the requirements of Specification Item 871S, "Reflectorized Pavement Markings", except for performance period, measurement and period.

Unless otherwise shown on the Drawings or indicated in the Contract Documents, the materials used for the work zone pavement markings shall be thermoplastic, paint and beads, raised pavement markers, prefabricated pavement marking material, temporary flexible-reflective street marker tabs mother materials approved by the Engineer.

Thermoplastic or paint and beads applications shall not be used for removable markings.

Unless otherwise shown on the Drawings or indicated in the Contract Documents:

The Contractor shall have the option to use raised pavement markers to simulate standard markers in accordance with the Drawings. Longitudinal lines wider than four (4) inches may be simulated by the side-by-side placement of markers to increase the apparent line width in multiples of four (4) inches.

Removable work zone pavement markings on final pavement surfaces shall be removable tape conforming to TX DOT Departmental Materials Specification DMS8241.

When raised reflective pavement markers are required on the Drawings to supplement the removable pavement markings, a marker shall be applied to the top of the tape at the approximate mid-length of tape used for broken lines and at approximate 20-foot spacing for solid lines.

Raised pavement markers will not be allowed for words, symbols, shapes and diagonal or transverse lines.

The paint shall be water-based and shall conform to Standard Specification Item 860S, "Pavement Marking Paint".

The beads shall conform to Standard Specification Item 860S, "Pavement Marking Paint".

The thermoplastic type materials shall conform to TxDOT Departmental Materials Specification Item DMS-8220, "Thermoplastic Pavement Markings".

1121.04 Performance Requirements. The markings in construction areas shall remain in proper alignment and shall be distinctly visible when dry from a minimum distance of 300 feet in daylight hours and distinctly visible from a minimum distance of 120 feet at night, when illuminated by automobile low-beam headlights. The visibility distances will be determined when viewed from an automobile traveling on the street.

The daytime color and the nighttime reflected color of the markings shall be distinctly white or yellow as shown on the Drawings. The markings shall exhibit uniform retroreflective characteristics.

1121.05 Maintenance of Markings. The Contractor shall be responsible for maintaining all work zone pavement markings for 30 calendar days after installation. Pavement markings, that fail to meet the requirements of this specification for 30 calendar days from the date of installation, shall be removed and replaced by the Contractor at the Contractor's expense. The 30-calendar maintenance requirement will be required for replaced markings from the time the original markings were installed.

1121.06 Construction Methods

(1) **Placement and Maintenance.**

The Contractor shall exercise due diligence in the election of materials and placement of work zone pavement markings. The Contractor at its own expense shall maintain work zone

pavement markings to the satisfaction of the Engineer or designated representative in accordance with this Specification Item.

Unless approved otherwise in writing by the Engineer or designated representative, all Portland cement concrete surfaces shall have standard markings in place prior to opening to traffic.

All asphaltic Surfaces, which are scheduled for opening, to traffic, shall be marked with guidemarks immediately following placement and final rolling of any course. Guidemarks shall consist of a single temporary flexible-reflective street marker tab or a single temporary construction raised reflective pavement marker at 20-foot spacing.

Guidemarks shall be placed in proper alignment with the final location of future standard markings. Any guidemarks, which are not in alignment with standard markings, shall be removed by the Contractor at its own expense.

The standard pavement markings shall be installed in accordance with the TxDOT Manual on Uniform Traffic Control Devices for Streets and Highways (TMUTCD) and as shown on the Drawings.

Surfaces to receive surface treatments shall be marked in accordance with the Drawings. Unless otherwise shown on the Drawings, the standard pavement markings shall be placed in accordance with TMUTCD, no sooner than three (3) days nor later than two (2) weeks after the placement of the surface treatment.

Short-term markings required by the, Drawings shall conform to the TMUTCD and details shown on the Drawings. Unless otherwise shown on the Drawings, short-term markings shall be removed immediately prior to placement of the final pavement markings.

(2) Marking Removal.

Any work zone pavement markings placed by the Contractor that conflict with any succeeding work zone markings shall be removed by the Contractor at -its own expense in accordance with Specification Item 874S, "Eliminating Existing Pavement Markings and Markers", except for measurement and payment.

Removable marking materials shall leave minimal evidence of the existence of the marking upon removal.

1121.07 Measurement. This Standard Specification Item will be measured by the lineal foot of standard marking or short-term marking, by each guidemark, by each word, shape or symbol, by each temporary flexible-reflective street marker tab on surface treatments or by any other unit as shown on the Drawings. Raised pavement markers used to simulate a stripe will be measured by the lineal foot of simulated stripe or each raised pavement marker as shown on the Drawings. Where double stripes are placed, each stripe will be measured separately.

1122 Barricades, Signs and Traffic Handling

1122.01 Description. This item shall consist of providing, installing, moving, replacing, maintaining, cleaning and removing temporary or permanent street closure barricades, signs or other devices required to handle the traffic in conformance with the current edition of the Texas Manual of Uniform Traffic Control Devices for Street and Highways and as indicated or directed by the City Engineer.

1122.02 Construction Methods. Prior to commencing construction, suitable "Barricades, Signs and Traffic Handling" devices shall be installed to protect the workers and the public.

The Contractor shall be responsible for installing all markers, signs and barricades conforming to the Manual on Uniform Traffic Control Devices and/or as indicated. If, in the opinion of the City Engineer, additional markers, signs or barricades are needed in the interest of safety, the Contractor will install such as are required or as directed by the Engineer.

1122.03 Maintenance. It shall be the Contractor's responsibility to maintain, clean, move and replace if necessary, barricades, signs and traffic handling devices during the time required for construction of the project. Permanent barricades shall be constructed as required after the completion of the street by drilling holes to place the posts and concrete foundations. Foundation concrete shall be cured before the rails are attached. When no longer needed all temporary Barricades, Signs and Traffic Handling Devices shall be removed and the area restored to its original condition or as directed by the City Engineer.

1122.04 Measurement. The work performed and the materials furnished by this item as indicated, except for barricades, will not be measured for payment but will be considered subsidiary to the work.

1130 Traffic Signs

1130.01 Description. This item shall govern furnishing and placement of Traffic Signs including excavation and backfill, p.c. concrete, reinforcement, posts, hardware and signs. Regulatory signs within the public street will be installed and maintained by the City of Kerrville. Traffic Signs within a gated community shall conform to this section and the TxDOT - Texas Manual on Uniform Traffic Control Devices. The placement of regulatory signs within the gated community is the responsibility of the Engineer on Record for the project. Installation and maintenance of signs within a gated community is the responsibility of the owner.

1130.02 Submittals. The submittal requirements of this specification include:

- A. Identification of the types of materials proposed for traffic sign, i.e. faces, posts, clamps, etc.,
- B. Construction details (p.c. concrete mix, reinforcing steel, etc.) for p.c. foundation,
- C. Conformance to TxDOT or ASTM Specifications.

1130.03 Construction Methods. Any excavation required for the sign installation shall be constructed using the Standard Specifications. Sign posts, are not to be imbedded in drilled shaft foundations. The signpost shall be screwed into a NPT nipple embedded into the concrete foundation.

Electrical conduit, where required, and anchor bolts of the size, length and number as indicated on the Drawings, shall be positioned before the Portland cement concrete is placed. Anchor bolt groups shall be set and maintained in position with a template during the placement of that portion of Portland cement concrete where anchor bolts are embedded. Care shall be taken to obtain the orientation of the anchor bolts and spacing of the anchor bolt groups as indicated on the Drawings.

1140 Pavement Marking

1141 Reflectorized Paint

1141.01 Description. This item shall govern the installation of reflectorized paint pavement marking. The width of the line shall be 4 inches and the color as indicated on the Drawings.

1141.02 Submittals. The submittal requirements of this specification item include:

- A. Proposed paint color(s), brand names, raw materials and products for traffic paint.

- B. Sampling and testing procedures and specific test results for pigment, calcium carbonate, acrylic resins and other materials used in the traffic paints.
- C. Proposed shipping requirements including container type(s) (drums and/or buckets), and labeling.
- D. Manufacturer's recommendations for mixing, storage and application of the traffic glass beads and traffic paint.
- E. All applicable Materials Safety data Sheets for the traffic paint.

1141.03 Construction Methods. The Contractor shall use a crew, that is experienced in the work of installing pavement markings and in the necessary traffic control for such operations on the roadway surface, and shall supply all the equipment, personnel, traffic control and materials necessary for the placement of the pavement markings as indicated on the Drawings or directed by the Engineer or designated representative. All work shall conform to the current edition of the Texas Manual of Uniform Traffic Control Devices (TMUTCD).

1141.04 Measurement. Work for Pavement Marking Paint lines will be measured by the lineal foot of the various widths. Work for pavement marking, paint letter or figures will be measured by the square foot.

1142 ReflectORIZED Pavement Markings

1142.01 Description. This item shall govern furnishing and placement of reflectORIZED pavement markings of the colors, types, shapes, sizes, widths and thickness indicated on the Drawings.

1142.02 Materials

(1) Type I Marking Material.

Type I markings are thermoplastic type materials that require heating to elevated temperatures for application. Type I marking materials shall conform to TxDOT Departmental Materials Specification Item DMS-8220, "Thermoplastic Pavement Markings". Each container of Type I Marking Material shall be clearly marked to indicate the color, weight (mass), type of material, manufacturer's name and lot/batch number.

(2) Type II Marking Material.

Type II markings are paint- type materials that are applied at ambient temperature or slightly elevated temperatures. Type H marking materials shall conform to Specification Item No. 860S, "Pavement Marking Paint".

1142.03 Construction Methods

(1) General.

When required by the Engineer, the Contractor and the Engineer shall review the sequence of Work to be followed and the estimated progress schedule.

Markings may be placed on streets either free of traffic or open to traffic. On streets already open to traffic, the markings shall be placed under traffic conditions that exist with a minimum interference to the operation of the facility. Traffic control shall be as shown on the Drawings or as approved in writing by the Engineer or designated representative. All markings placed under open-traffic conditions shall be protected from traffic damage and disfigurement. On streets open to traffic with 3 lanes of travel in one direction, all markings shall be placed from the outside lanes only, unless otherwise approved in writing by the Engineer or designated representative.

Guides to mark the lateral location of pavement markings shall be established as shown on the Drawings or as directed by the Engineer or designated representative. The Contractor shall establish the pavement marking guide and the Engineer or designated representative will verify the location of the guides.

Markings shall be placed in proper alignment with the guides. The deviation rate in alignment shall not exceed 1 inch per 200 feet of street. The maximum deviation shall not exceed 2 inches nor shall any deviation be abrupt.

Markings shall essentially have a uniform cross-section. The density and quality of markings shall be uniform throughout their thickness. The applied markings shall have no more than Five (5) percent, by area, of holes or voids and shall be free of blisters.

Markings, in place on the street, shall be reflectorized both internally and externally. Glass beads shall be applied to the materials at a uniform rate sufficient to achieve uniform and distinctive retroflective characteristics when observed in accordance with TxDOT Test Method Tex-828-13.

Contractor personnel shall be sufficiently skilled in the Work of installing pavement markings.

Markings placed that are not in alignment or sequence, as shown on the drawings or as stated in the Standard Specification Item, shall be removed by the Contractor at its expense. Removal shall be in accordance with Specification Item 874S, "Eliminating Existing Pavement Markings and Markers", except for measurement and payment, Guides placed on the street for alignment purposes shall not establish a permanent marking on the street.

Unless otherwise shown on the Drawings, pavement markings may be applied by any method that will yield markings meeting the requirements of the Specification Item.

(2) Surface Preparation

New Portland cement concrete surfaces shall be cleaned in accordance with Specification Item 875S, "Pavement Surface Preparation for Markings" to remove curing membrane, dirt, grease, loose and/or flaking existing construction markings and other forms of contamination.

Older Portland cement concrete surfaces and asphaltic surfaces that exhibit loose and/or flaking existing markings shall be cleaned in accordance with Specification Item 875S, "Pavement Surface Preparation for Markings" to remove all loose and flaking markings.

Pavement to which material is to be applied shall be completely dry. Pavements shall be considered dry if, on a sunny day after observation for 15 minutes, no condensation occurs in the underside of a 1 foot square piece of clear plastic that has been placed on the pavement and weighted on the edges.

(3) Application of Type I Markings.

New Portland cement concrete surfaces shall be further prepared for Type I markings, after cleaning, by placing a Type H marking as a sealer in accordance with the Specification Item. When placing Type I markings in new locations on asphaltic surfaces 3 years old or older or any Portland cement concrete surfaces, a Type 11 marking shall be used as a sealer. Unless otherwise shown on the Drawings, existing Portland cement concrete and asphaltic surfaces to be restriped will not require Type 11 markings as a sealer; existing markings may be used as a sealer in lieu of Type 11 markings. Type H markings shall be placed a minimum of 2 and, a maximum of 30 calendar days in advance of placing Type I markings. Type I markings which become dirty due to inclement weather or street conditions shall be cleaned by washing, brushing, compressed air or other means approved by the Engineer, prior to application of Type I markings. If Washing is

used, the surface of Type 11 markings shall become thoroughly dry before placing Type I markings. Color, location and configuration of Type 11 markings shall be the same as that of Type I markings.

Type I pavement marking material shall be applied within temperature limits recommended by the material manufacturer. Application of Type I pavement markings shall be done only on clean, dry pavement having a surface temperature above 50°F (10°C). Pavement temperature shall be measured in accordance with TxDOT Test Method Tex-829-B.

When Type I pavement marking application is by spray, and operations cease for 5 minutes or more, the spray head shall be flushed by spraying pavement marking material into a pan or similar container until the pavement marking material being sprayed is at the proper temperature for application.

Unless otherwise directed by the Engineer in writing, Type I pavement marking materials shall not be placed on streets between September 30 and March 1, subject to temperature and moisture limitations specified herein.

Unless otherwise shown on the Drawings, the minimum thickness of Type I marking shall be 0.060 inches for edgeline markings and 0.090 inches for stop-bars, legends, symbols, gore and center-line/no-passing barrier-line markings, when measured in accordance with TxDOT Test Method Tex-854-B. The maximum thickness of all Type I markings shall be 0.180 inches.

The thickness of Type I markings at the time of placement will, be measured above the plane formed by the pavement surface. The Engineer will supply a device to measure the thickness of the applied markings. The markings shall be of uniform thickness throughout their lengths and widths.

(4) Application of Type 11 Markings

The application of Type H marking materials shall be done only on surfaces with a minimum surface temperature of 50°F (10°C).

The application rate for Type 11 marking material shall be between 15 and 20 gallons per mile of solid 4 inch line and between 30 and 40 gallons per mile of solid 8 inch line. For new surface treatment projects the application rate shall be between 25 and 30 gallons per mile of solid four (4) inch, line and between 40 and 50 gallons per mile of solid 8 inch line.

Pavement markings for new surface treatment projects shall be applied in two applications, each approximately one-half the application rate. The first application shall not contain glass beads. The interval between the first and second application shall be a minimum of 1 hour.

When, in the case of impending inclement weather, the Engineer or designated representative directs the Contractor to apply water-based traffic paint and the markings are subsequently damaged by rain, sleet, hail, etc., the Contractor will be paid for the initial placement and the replacement markings. However, if the Contractor places the markings at his option, the Contractor is responsible for all costs associated with the replacement markings.

1142.04 Measurement. This Specification Item will be measured by the lineal foot by each of the various words, shapes or symbols, or by any other unit as shown on the Drawings.

Where double stripes are placed, each stripe will be measured separately.

Type II pavement markings requiring 2 applications on new surface treatments (Specification Item No.320S) will be measured as 1 marking.

Type II pavement marking materials, when used as a sealer for Type I markings will be measured as Type H markings.

1143 Temporary Removable Pavement Markings

1143.01 Description. This item shall govern furnishing, placement and removal of prefabricated removable pavement markings of the types, colors, shapes and sizes indicated on the Drawings or as directed by the Engineer or designated representative.

1143.02 Submittals. The submittal requirements of this specification item include:

- A. List of temporary, removable, pavement markings, shapes, words, etc. with associated manufacturer.
- B. Manufacturer's recommended preparation, cleaning, placement and installation instructions.
- C. Type of adhesive and application recommendations.

1143.03 Construction Methods

A. **General**

Guides to mark the lateral location of pavement markings shall be established as indicated on the Drawings or as directed by the Engineer or designated representative. The Contractor shall establish the pavement marking guides and the Engineer or designated representative will verify the location of the guides prior to installation of final striping.

The pavement markings shall be placed in proper alignment with the guides. The deviation rate in alignment shall not exceed one (1) inch per 200 feet of roadway. The maximum deviation shall not exceed two (2) inches nor shall any deviation be abrupt.

B. **Dimensions**

Markings shall be in accordance with the color, length, width, shape and configuration indicated on the Drawings. The alignment and location shall be as indicated on the Drawings or as directed in writing by the Engineer or designated representative.

C. **Methods**

All material placement shall be in accordance with the material manufacturer's instructions, unless otherwise directed in writing by the Engineer or designated representative. In addition to the manufacturer's instructions, material placement shall be in accordance with surface condition, moisture and temperature requirements specified within this item.

D. **Surface Preparation**

Surface preparation shall be accomplished by any cleaning method, approved by the Engineer or designated representative, that effectively removes contaminants and loose materials and corrects existing conditions considered deleterious to proper adhesion. Surface preparation utilizing blast cleaning will only be required if indicated on the Drawings.

Surfaces shall be further prepared after cleaning by scaling or priming, as recommended by the manufacturer of the temporary pavement marking materials or as directed in writing, by the Engineer or designated representative.

E. Moisture

The pavement surface on which the marking material is to be placed shall be completely dry. A pavement shall be considered dry, if on a sunny day after observation for 15 minutes, condensation does not develop on the underside of a one (1) foot square piece of clear plastic, which has been placed on the pavement and weighted down on the edges.

F. Temperature

The pavement and ambient air temperature requirements, which are recommended by the material manufacturer, shall be followed. If no temperature requirements are established by the material manufacturer, the material shall not be placed if the pavement surface temperature is below 50°F or above 130°F.

1143.06 Performance Requirements

A. Adhesion

Installed pavement markings shall not lift, shift, smear, spread, flow or tear by traffic action.

B. Appearance

Pavement markings shall present a neat, uniform appearance, free of excessive adhesive, ragged edges and irregular lines or contours.

C. Visibility

Installed pavement markings shall have uniform and distinctive retro-reflectance.

1143.07 Measurement. Measurement of the markings shall be made for each color by the lineal foot of the various widths; by each for word(s), shape or symbol or by any other unit as indicated on the Drawings, complete in place.

1144 Reflectorized Pavement Markers

1144.01 Description. This item governs reflectorized pavement markers to be used to delineate traffic lanes or fire hydrants.

1144.02 Submittals. The submittal requirements of this specification item include:

- A. List of specific application(s) [i.e. type: (reflectorized Type I-A, I-C or II-A-A, IIB-B or II-C-R) and applicable epoxy system and adhesive types [867S.5].
- B. Specific manufacturer with test results and technical specifications for proposed pavement markers.
- C. Manufacturer's recommendations for surface preparation, cleaning, placement temperatures and installation instructions.
- D. Adhesive components and mixing recommendations.

1144.03 Materials

A. Design and Shape

The outer surface of the marker shall be smooth and all corners and edges exposed to traffic must be rounded. The base of the marker shall have a width of 4.0 inches + 1/2 inch and shall have a minimum area exposed to traffic of 12.5 square inches. The maximum height shall be 3/4 inch. The maximum slope of the reflector face or faces shall be not more than 30 degrees from the horizontal.

The bottom surface of the markers shall be of a design for adhesion with epoxy adhesives.

B. Pavement Marker Types

Pavement markers shall be of the following types:

1. Type I-A shall contain an approach face that reflects amber light. The body, other than the reflective face, shall be yellow.
2. Type I-C shall contain an approach face that reflects white light. The body, other than the reflective face, shall be white, silver white or light gray.
3. Type II-A-A, shall contain two reflective faces (approach and trailing), each of which shall reflect amber light. The body, other than the reflective faces, shall be yellow.
4. Type H-B-B shall contain two reflective faces (approach and trailing) with glass covered pneumatic reflective faces, each of which shall reflect blue light. The body, other than the reflective faces, shall be blue. Blue markers' color will conform to Fire Department requirements.
5. Type H-C-R shall contain two reflective faces (approach and trailing), one of which reflects white light and one of which reflects red light. The body, other than the reflective faces, shall be either white, silver white or light gray or 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 from one face shall be directly opposite the direction of reflections of the other face.

1144.04 Construction Methods. The Contractor shall use a crew experienced in the work of Installing reflectorized pavement markers and in the necessary traffic control for such operations on the roadway surface and shall supply all the equipment, personnel, traffic control and materials necessary for the placement of the pavement markings as indicated on the Drawings or as directed by the Engineer or designated representative. All work shall conform to the current edition of the Texas Manual of Uniform Traffic Control Devices (TMUTCD).

All reflectorized pavement markers shall be from the same manufacturer. Surfaces to which markers are to be attached by an adhesive shall be prepared by any method approved by the Engineer or designated representative to ensure that the surface is free of dirt, curing compound, grease, oil, moisture, loose or unsound pavement markings and any other material which would adversely affect the adhesive bond. Unless indicated otherwise on the Drawings, surface preparation for installation of raised reflectorized pavement markers will not be paid for directly, but shall be considered subsidiary to this specification item.

Guides to mark the lateral location of pavement markings shall be established as indicated on the Drawings or as directed by the Engineer or designated representative. The Contractor will establish the pavement marking guides and the Engineer or designated representative will verify the location of the guides prior to final installation.

The pavement markers shall be placed in proper alignment with the Guides. The deviation rate in alignment shall not exceed 1 inch per 200 feet of roadway. The maximum deviation shall not exceed 2 inches nor shall any deviation be abrupt.

Markers placed which are not in alignment indicated on the Drawings shall be removed by the Contractor at the Contractor's expense. Guides placed on the roadway for alignment purposes shall not establish a permanent marking on the roadway.

The Reflectorized Pavement Markers shall be applied using an approved epoxy adhesive to the lines and spacings as indicated on the Drawings or as directed by the Engineer or designated representative. The adhesive shall be applied in sufficient quantity to ensure that 100 percent of the bonding area of the pavement markers shall be in contact with the adhesive. The adhesive shall be applied in accordance with the manufacturer's recommendations.

Pavement markers shall be placed immediately after the adhesive is applied and shall be firmly bonded to the pavement. Adhesive or any other material that impairs functional reflectivity will not be acceptable.

When deemed necessary by the Engineer or designated representative, the Contractor, at his expense, shall place any additional pilot markings required to facilitate the placement of the permanent markings in the alignment specified. Any and all additional markings placed on the roadway for alignment purposes shall be temporary in nature and shall not establish a permanent marking on the roadway. Materials used for pilot markings and equipment used to place such markings shall be approved by the Engineer or designated representative.

1144.05 – Measurement. Reflectorized Pavement Marker will be measured as per each, complete in place.

1145 Non-Reflectorized Traffic Buttons

1145.01 Description. This item shall govern furnishing of "Non-Reflectorized Traffic Buttons" complete in place in conformity with details indicated on, the Drawings.

1145.02 Submittals. The submittal requirements of this specification item include:

- A. Specific applications and color of traffic buttons.
- B. Specific manufacturer with test results and technical specifications for proposed traffic buttons.
- C. Manufacturer's recommendations for surface preparation, cleaning, placement temperatures and installation instructions.
- D. Applicable epoxy system and adhesive types [867S.5], adhesive components and mixing recommendations.

1145.03 Materials. The outer surface of the button shall be round and dome-shaped with a uniform curvature. The topsides 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 surface of the markers shall be of a design for adhesion with epoxy adhesives and shall be rough textured, free from gloss, glaze or any other substance that may reduce its bond to the adhesive. The buttons shall be made of a ceramic material meeting the following specifications:

1145.04 Construction Method. The Contractor shall use a crew experienced in the work of installing traffic buttons and in the necessary traffic control for such operations on the roadway surface and shall supply all the equipment, personnel, traffic control and materials necessary for the placement of the traffic buttons as indicated on the Drawings or as directed by the Engineer or designated representative. All work shall conform to the current edition of the Texas Manual of Uniform Traffic Control Devices (MUTCD), The City of Austin Transportation Criteria Manual and Standard Detail 865S-1.

The traffic buttons shall be placed in accordance with the Drawings or as directed by the Engineer or designated representative. The portion of the highway surface to which the button is attached by the adhesive shall be prepared by any method approved by the Engineer or designated representative in order to be free of dirt, curing compound, grease, oil, moisture, loose or unsound pavement and any other material which would adversely affect the bond of the adhesive. The wet epoxy shall be applied in sufficient quantity so as to insure the following:

- A. 100 percent of the bonding area of the button shall be in contact with epoxy.
- B. The button itself shall not contact the pavement but shall sit on the epoxy "cushion".
- C. When the button is pressed onto the pavement, adhesive shall be forced out around its entire perimeter.

Unless indicated otherwise on the Drawings, the epoxy adhesive shall be machine mixed and applied in accordance with the manufacturer's recommendations.

Any excess adhesive or other foreign material on or in front of the reflective face(s) of the button shall be removed so that reflectivity will not be impaired.

When the project is complete, the button shall be firmly bonded to the pavement, lines formed by the buttons shall be true and the entire installation shall present a neat appearance. Any individual button placed that does not conform to the requirements of this specification and/or plans shall be removed and replaced with buttons conforming to these requirements at the Contractor's expense.

1145.05 Measurement. Non-Reflectorized Traffic Buttons will be measured per each, complete in place.

1146 Abbreviated Pavement Markings

1146.01 Description. This item shall govern the placement, maintenance and removal of temporary abbreviated markings, which are to be placed on all roadways, that are open to traffic and that do not have standard markings in place.

1146.02 Submittals. The submittal requirements of this specification item include:

- A. Specific applications and color of traffic markings.
- B. Specific manufacturer with test results and technical specifications.
- C. Manufacturer's recommendations for surface preparation, cleaning, placement temperatures and installation instructions.

1146.03 Materials. The pavement-marking material shall consist of an adhesive-backed reflective tape, which can be applied to the pavement. Markings shall be of good appearance, have straight, unbroken edges and have a color that complies with all federal regulations.

- A. Color
The markings, as well as retroreflected light from the markings, shall be white or yellow as indicated on the Drawings or provided in writing by the Engineer or designated representative.
- B. Visibility

The pavement markings (during daylight hours) shall be distinctively visible for a minimum of 300 feet unless sight distance is restricted by geometric roadway features.

The pavement markings (when illuminated by automobile low beam headlights at night) shall be distinctively visible for a minimum of 160 feet unless sight distance is restricted by geometric roadway features.

The day and night visibility requirements, which are specified above, shall be met when viewed from an automobile traveling on the roadway.

1146.04 Construction Methods. The Contractor shall use a crew experienced in the work of installing pavement markings and in the necessary traffic control for such operations on the roadway surface and shall supply all the equipment, personnel, traffic control and materials necessary for the placement of the pavement markings as indicated on the Drawings or as directed by the Engineer or designated representative. All work shall conform to the current edition of the Texas Manual of Uniform Traffic Control Devices (MUTCD).

Abbreviated markings, which meet all specification requirements, shall be in place on all roadways on which traffic is allowed and where suitable standard pavement marking is not in place. The transverse location of the line(s) formed by the markings shall be as indicated on the Drawings or determined by the Engineer or designated representative.

Unless otherwise indicated, the abbreviated markings shall be placed as follows:

Condition	Spacing	Length of Stripe
Straight	20 feet approximately	24 inch
Curve greater than 2 degrees	20 feet maximum	24 inch
Curve less than or equal 2 degrees	10 feet	24 inch

Pavement markings shall be a minimum of 3 7/8 inches wide. Lengths and spacings will be in accordance with these specifications.

The spacing of stripes may be modified by the Engineer or designated representative. However, the maximum spacing specified above shall not be exceeded in any case.

The Contractor will be responsible for maintaining the abbreviated pavement markings until standard pavement markings are in place.

Abbreviated pavement markings shall be removed after all permanent markings have been placed.

1147 Jiggle Bar Tile

1147.01 Description. This item shall govern the materials, composition, quality, sampling and testing of jiggle bar tile of either ceramic or plastic resin body construction, reflectorized or nonreflectorized types as described herein.

1147.02 Submittals. The submittal requirements of this specification item include:

- A. List of specific application(s) [i.e. designation and type: (reflectorized Type IA, I-C or R-A-A; nonreflectorized- Type W or Y)] and applicable epoxy system and adhesive types [Standard Specification, Item Section 867S.5].
- B. Specific manufacturer with test results and technical specifications for proposed jiggle bar tile
- C. Manufacturer's recommendations for surface preparation, cleaning, placement temperature and instructions.
- D. Adhesive components and mixing recommendations.

1147.03 Materials. Jiggle bar tiles shall be either ceramic body or plastic resin body construction and shall be either reflectorized or nonreflectorized as indicated on the Drawings. Jiggle bar tiles furnished for any one project shall be of the same material and manufacturer, The Jiggle Bar Tile shall comply with TxDOT Departmental Materials Specifications DMS-41 00.

A. Types of Jiggle Bar Tile

A. Reflectorized jiggle bar tiles shall be of the following types:

- (a) Type I-A shall contain an approach face that reflects amber light and the body other than the reflective face shall be yellow.
- (b) Type I-C shall contain an approach face that reflects white light. The body, other than the reflective face, shall be white.
- (c) Type II-A-A shall contain 2 reflective faces (approach and trailing) each of which shall reflect amber light. The body, other than the reflective faces, shall be yellow. The direction of the reflection of the trailing face shall be directly opposite to the direction of reflection of the approach face.

B. Nonreflectorized jiggle bar tiles shall be of the following types:

- (a) Type W shall have a white body.
- (b) Type Y shall have a yellow body.

B. Appearance Requirement

The top and sides of the jiggle bar tile 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 jiggle bar tile may be of a rough texture, free from gloss, glaze or any other substance that may reduce its bond to the adhesive. It shall be shaped such that any air, which may be entrapped during installation, will not impair adhesion. Exclusive of any irregularities that are intentionally manufactured as functional characteristics of the tile, the bottom shall not deviate from a true plane by more than 1/ 16 inch.

1147.04 Construction Methods. The Contractor shall use a crew experienced in the work of installing jiggle bar tile and in the necessary traffic control for such operations on the roadway surface and shall supply all the equipment, personnel, traffic control and materials necessary for the placement of the pavement markings as indicated or as directed by the Engineer or designated representative. All work shall conform to the current edition of the Texas Manual of Uniform Traffic Control Devices (TMUTCD).

The jiggle bar tile shall be installed to the lines and spacings where indicated on the Drawings or as directed by the Engineer or designated representative. Guides to mark the lateral location of jiggle bar tile shall be established as indicated on the Drawings or as directed by the Engineer or designated representative. The Contractor will establish the pavement marking guides and the Engineer or designated representative will verify the location of the guides prior to final installation.

The pavement markers shall be placed in proper alignment with the Guides, The deviation rate in alignment shall not exceed 1 inch per 200 feet of roadway. The maximum deviation shall not exceed 2 inches nor shall any deviation be abrupt.

Markers placed which are not in alignment indicated on the Drawings shall be removed by the Contractor at the Contractor's expense. Removal shall be in accordance with Specification Item 874S except for measurement and payment. Guides placed on the roadway for alignment purposes shall not establish a permanent marking on the roadway.

When deemed necessary by the Engineer or designated representative, the Contractor, at his expense, shall place any additional pilot markings required to facilitate the placement of the permanent markings in the alignment specified. Any and all additional markings placed on the roadway for alignment purposes shall be temporary in nature and shall not establish a permanent marking on the roadway. Materials used for pilot markings and equipment used to place such markings shall be approved by the Engineer or designated, representative.

The surface on which tiles are to be placed shall be dry and shall be prepared by any method approved by the Engineer or designated representative to remove all forms of grease, oil, dirt and other materials deleterious to proper adhesion. Unless indicated otherwise on the Drawings, surface preparation for installation of jiggle bar tile will not be paid for directly but shall be considered subsidiary to this specification item.

Epoxy adhesive shall conform to the requirements of City of Austin Specification Item 8676S. The wet epoxy shall be machine mixed and applied in sufficient quantity so as to insure the following:

100 percent of the bonding area of the tile shall be in contact with the epoxy.

The tile itself shall not contact the pavement surface but shall sit on an epoxy "cushion".

When the tile is pressed onto the pavement, adhesive shall be forced out around its entire perimeter.

Any excess adhesive or other foreign material on or in front of the reflective face(s) of the tile shall be removed so that reflectivity will not be impaired. Any individual jiggle bar tile placed that does not conform to the requirements of this specification and/or as indicated on the Drawings shall be removed and replaced with tile conforming to these requirements at the Contractor's expense.

1147.05 Measurement. Jiggle Bar Tile will be measured as each jiggle bar tile complete in place.

1148 Eliminating Existing Pavement Markings and Markers

1148.01 Description. This item shall govern the elimination of existing raised pavement markings of various types and sizes, and raised pavement markers as shown on the Drawings or as directed, in writing, by the Engineer or designated representative.

1148.02 Materials. All surface treatment material application rates shall be as directed by the Engineer or designated representative. Unless otherwise shown on the Drawings, surface treatment materials shall conform to the requirements of Specification Item 301, "Asphalts, Oils and Emulsions", and Specification

Item 302S, "Aggregates for Surface Treatment". Testing of surface treatment materials may be waived by the Engineer or designated representative.

Asphalt and aggregate types and grades shall be as shown on the Drawings or as approved by the Engineer or designated representative,

1148.03 Construction Methods. Elimination of existing pavement markings and markers shall be accomplished by one or more of the following methods as approved by the Engineer or designated representative.

A. Markings on Asphaltic Surfaces.

1. Placement of a surface treatment a minimum of two (2) feet wide to cover the existing marking.
2. Placement of a surface treatment, thin overlay or microsurfacing a minimum of one (1) lane in width in areas where directional changes of traffic are involved or other areas as directed by the Engineer or designated representative. Construction methods for surface treatments shall conform to Specification Item 320S, "Two Course Surface Treatment"

B. Markings on Concrete Surfaces.

Removal by an approved burning method.

C. Markings on Asphaltic or Concrete Surfaces.

Removal by water, water-sand blasting techniques or any other method(s) proven satisfactory to the Engineer.

D. Markers on Asphaltic or Concrete Surfaces.

Removal by any mechanical method to remove marker and adhesive.

Existing pavement markings and markers on both concrete and asphaltic surfaces shall be removed in such a manner that color and/or texture contrast of the pavement surface will be held to a minimum.

Removal of pavement markings on concrete surfaces by blast cleaning shall be accomplished in accordance with Specification Item 875S, "Pavement Surface Preparation for Markings", except for measurement and payment. Blast cleaning shall be performed in such a manner that damage to the Portland cement concrete surface is held to a minimum.

When thermoplastic pavement markings or prefabricated pavement markings are encountered, the application of heat may be used to remove the bulk of the marking material prior to blast cleaning. When heat is used, care shall be taken to prevent spalling of Portland cement concrete surfaces.

A burner may be used for complete removal of pavement markings. Broom removal or light blast cleaning may be used for removal of minor residue.

Damage to asphaltic surfaces, such as spalling, shelling, etc., that is greater than 1/4 inch in depth and is caused by the removal of pavement markers shall be repaired by the application of a two (2) foot wide surface treatment for longitudinal markers with no directional change or a minimum of one (1) lane width surface treatment in areas where directional changes of traffic are involved.

Grinding is not an acceptable method of marker or marking removal. However, equipment utilizing special milling flails is considered acceptable in the removal of markings and markers on asphalt and Portland cement concrete surfaces.

1148.04 Measurement. This Specification Item will be measured by the square yard of surface treatment, thin overlay or microsurfacing (full lane width) placed; by each word, symbol or shape eliminated; by the lineal foot of markings eliminated; or by any other unit as shown on the Drawings, as each raised pavement marker.

1149 Pavement Surface Preparation For Markings

1149.01 Description. This item shall govern the surface preparation of pavement surface areas prior to placement of pavement markings or raised pavement markers.

This specification is applicable for projects or work involving either inch-pound or SI units. Within the text the inch-pound units are given preference followed by SI units shown within parentheses.

1149.02 Materials. Abrasive blasting medium, when used, shall be a quality commercial product capable of producing the specified surface cleanliness without the deposition of deleterious materials on the cleaned surface. Water used in blasting operations shall be potable.

1149.03 Equipment. Equipment shall be maintained in good condition. Air compression equipment shall utilize moisture and oil traps, in working order, of sufficient capacity to remove contaminants from blasting air and prevent the deposition of moisture, oil or other contaminants on the street surface.

1149.04 Construction Methods. Widths, lengths and shapes of the prepared surfaces shall be of sufficient size to include the full area of pavement markings or raised pavement markers shown on the Drawings.

Surface preparation of Portland cement concrete surfaces shall be sufficient to remove contaminants. Damage to the street due to over-blasting shall be held to a minimum. Asphaltic surfaces shall be cleaned by brushing, washing, compressed air, high pressure water or any combination thereof to remove all forms of contamination and loose materials. All other surfaces to be cleaned by blast cleaning shall be cleaned sufficiently to remove loose and flaking materials from the street surface.

When existing markings are encountered, they shall be cleaned sufficiently to remove all loose and flaking materials. Small spots of old markings or contaminants of up to 0.5 square inch (320 MM²) in area may remain if the contaminant is not removed by the following test:

Firmly press a 10 inch long, two-inch wide strip of monofilament tape onto the surface to be tested, leaving approximately 2 inches free. Grasp the free end and remove the tape with a sharp pull.

Blasting pressure and technique shall be controlled to prevent damage to the pavement surface. Portland cement concrete surfaces shall not be cleaned by grinding..

1149.05 Measurement. This Specification Item will be measured by the lineal foot of the various widths, by each of the various words, symbols or shapes, or by any other unit as shown on the Drawings.

1150 Miscellaneous

1151 Pullboxes

1151.01 Description. This item shall govern the construction of pull-boxes by methods indicated on the Drawings and in conformity with this specification item.

1151.02 Submittals. The submittal requirements of this specification item include:

- A. Identification of the number and types of pull boxes proposed, Construction details (mortar, reinforcing steel, etc.) for the pull box and supporting foundation.

1151.03 Materials. Non-traffic type pull-boxes, of the size specified on the Drawings, shall be precast concrete with cast iron (24 inches) Non-Traffic Type Pull Box", and shall be equal to precast concrete Traffic type pull-boxes, of the size specified on the Drawings.

1151.04 Construction Methods. Pull-boxes shall be constructed in accordance with the lines, grades, details and dimensions indicated on the Drawings or established by the Engineer or designated representative.

Pull-boxes, which are exposed to view, as in sidewalks, shall be accurately set to the finished grade and anchored.

Masonry work for the lower portion of the pull-boxes shall be accurately cut around the conduits and a smooth accurate bed shall be provided for the precast concrete upper portion of the pull-box. The precast section shall be set in mortar upon the lower masonry course. The inside of pull-boxes shall be left clean and the joints shall be wiped.

1151.05 Measurement. Pullboxes shall be measured as each item complete in place.

1152 Electrical Conduit Ducts

1152.01 Description. This item shall govern all materials furnished and all applicable work undertaken in construction of electrical conduit ducts for Traffic Control projects, including clearing, excavation, bedding, jointing, backfill materials and tests, prescribed under this standard specification item.

The ducts shall be of the sizes, types, class and dimensions indicated on the Drawings and shall include all joints or connections to new or existing ducts, pull-boxes or other structures that may be required to complete the work to the specified lines and grades in accordance with details indicated on the Drawings and appropriate specifications and standard published practices of the trade associations for the material specified.

1152.02 Submittals. The submittal requirements of this specification item include:

- A. Identification of the number, types (i.e. 1 pipe, 2 pipes, etc.) and sizes of duct;
- B. Construction details.

1152.03 Materials

- A. Electrical Conduit Pipe
Polyvinyl Chloride (PVC) Pipe and fittings used for ducts shall conform to National Electrical Code (NEC).
- B. Joints
Joints shall be sealed with a solvent meeting the requirements of the NEC to assure leak proof joints. The ends of ducts shall be projected into the pull-boxes and sealed as indicated on the Drawings.

1152.04 Construction Methods

- A. Construction

Shall conform to the Standard Specifications Section 600. Section 600 cover requirements shall be revised to include at least the minimum cover requirements of the NEC based upon line voltage/amp capacity.

B. Conduit Bedding

Where not otherwise provided on the Drawings, all ducts shall be placed in a continuous envelope of bedding sand. The bedding material shall extend from 6inches below to 6-inches above the outer parts of the pipe, fittings and accessories for ducts.

C. Laying Duct

The duct shall not be placed in the trench until:

- excavation has been completed,
- the bottom of the trench, compacted and
- The trench completed as indicated on the Drawings.

All duct shall be 'stringed' for ease in pulling the cable through the PVC duct pipe after construction is complete. A continuous line of string shall extend throughout the pipe and be mechanically tied at each end outside the pipe. The string shall be nylon string with a tensile strength of at least 300 pounds, unless otherwise indicated on the drawings. The ends of the duct pipe shall be projected into pull-boxes and sealed as indicated on the Drawings.

1152.05 Measurement. Duct will be measured by the lineal foot along the centerline of the duct for the various sizes and classes of duct in place, conforming to these specifications, for which all work including excavation and backfill is complete and accepted by the Engineer or designated representative.

1160 Project Signs

1161 Description

1161.01 Description. This item shall govern furnishing, fabricating and erecting Project Signs on Capital Improvement Projects (C.I.P) and for project identification at other construction sites, when required on the Drawings. The C.I.P. signs shall be constructed as indicated on the Drawings.

1162 Materials

A. Sign Face

Sign face shall be manufactured on standard exterior waterproof plywood sheets or other suitable material approved by the Engineer. Unless indicated otherwise on the Standard Details or Drawings, the thickness of the plywood sheet shall be a minimum of 1/4inches.

B. Posts

Lumber posts, of the size indicated on the Standard Details or on the Drawings, shall be pressure treated with pentachlorophenol.

C. Paint

Exterior oil base paint, colors as indicated on the Standard Details or on the Drawings.

1163 Installation

The signs shall be erected at each major entrance to the project for maximum public identification and exposure. At locations where construction is confined to a specific area, the installed sign size shall be 4 x 8 foot. At locations where roadway construction is in progress, such as a street paving or construction of a sidewalk, the sign shall be 2 x 3 foot. The signs shall be posted on portable wood frames or stanchions and

will be located in the proximity of the work area as construction progresses. All lumber shall be painted with 2 coats of paint as indicated herein, on the Standard Details or in the Drawings.

In special cases the size of the sign may be changed to meet special requirements, but general proportions shall be maintained.

It shall be the responsibility of the Contractor to maintain and relocate signs, if necessary during the progression of the project. Care shall be exercised to assure that placement of the signs does not interfere with or cause sight obstruction to vehicular and pedestrian traffic.

The Contractor may install, at his own expense, company signs to identify the Contractor, architectural firm, etc. Signs are to be securely attached to the posts at locations indicated on the Drawings and shall not be larger than 18 x 36 inches.

1164 Measurement

The work performed and the materials furnished as prescribed by this item as indicated on the Drawings will not be measured for payment but will be considered subsidiary to the various items included in the contract unless included as a separate pay item in the contract. When included in the contract, signs shall be measured by lump sum or per each.