

**Item No. 824S  
Traffic Signs**

**824S.1 Description**

This item shall govern furnishing and placement of Traffic Signs including excavation, posts, hardware and signs.

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.

**824S.2 Submittals**

The submittal requirements of this specification item include:

- A. Identification of the types of materials proposed for traffic sign, i.e. faces, posts, clamps, etc.,
- B. Results of any State or Federal tests (reflectance, diffuse day color, specific intensity brightness, Weather-O-meter, etc.) performed on their products,

**824S.3 Materials**

The following ASTM Standards and documents, of the issue in effect on the date of Invitation for Bid, form a part of this specification to the extent herein.

- A. ASTM B 209 Specification for Aluminum and Aluminum Alloy Sheet and Plate
- B. ASTM D 523 Standard Method for Test for Specular Gloss
- C. ASTM D 4956 Standard Specification for Retroreflective Sheeting for Traffic Control
- D. ASTM E 284 Standard Definition of Terms Relating to Appearance of Materials
- E. ASTM E 308 Computing the Colors of Objects by Using the CIE System
- F. ASTM E 810 Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting
- G. ASTM E 1164 Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation
- H. CIE Publication Number 39-2, Recommendation for Surface Colors for Visual Signaling
- I. FP-92 Standard Specifications for Construction of Roads and Bridges on Federal Highway Project
- J. Substrate. This shall be aluminum alloy 5052-H38 or 6061-T-6 and otherwise in conformance with ASTM B-209.
  - 1. Metal working. The aluminum shall be free of burrs and pits on both sides, including edges and holes, and shall be made ready for applications of the sheeting.

The aluminum shall be new and corrosion-free with holes drilled or punched, corners rounded to the radii shown in the standard detail sheet, and all edges smoothed prior to application of sheeting.

2. Size. The dimensions of substrate applications for regulatory, warning, and guide signs shall be as specified by the Engineer and as shown on the plans.
- K. Background, Legends, Symbols, and Colors. These shall be in accordance with the Standard Highway Sign Designs (SHSD) for Texas and with the Texas Manual of Uniform Traffic Control Devices (TMUTCD).
1. Retroreflective Materials. Retroreflective materials shall comply with Texas Department of Transportation Departmental Materials Specification 8300, Sign Face Materials. The materials requirements for Reflective Sheeting must meet all the requirements of ASTM D 4956.
    - a. Retroreflective Sheeting. Type III (High Intensity Prismatic): The materials as listed in these specifications shall comply with Texas Department of Transportation Departmental Materials Specification 8300, Sign Face Materials. The materials requirements for Reflective Sheeting must meet all the requirements of ASTM D 4956. Colors shall be as specified in specifications for Standard Highway Sign Colors (FHWA, HTO-21).
    - b. Retroreflective Sheeting. Type IX (Fluorescent yellow green): The materials shall comply with ASTM 4956. Designed to provide higher nighttime sign brightness in the legibility distance and brightness at high entrance angles. The minimum fluorescence luminance factor (YF) for new sheeting shall be 35%.
  2. Electronically Cuttable Film. Electronically cuttable film shall consist of flexible, transparent, durable acrylic colored films coated with a transparent pressure sensitive adhesive protected by a clear removable liner. These films are designed to be applied to retroreflective materials for the creation of traffic control signs and devices by either cutting by knife over roll (sprocket fed or friction fed) and flat bed electronic cutting machines. The films shall be available in standard traffic colors, be dimensionally stable, and be designed to optimally cut, weed, lift, and transfer. Use of electronic cuttable films will not require the release of any volatile organic compounds.

When electronic cuttable film is applied to retroreflective sheeting, the resulting color of the composite sheeting will conform to Texas Department of Transportation Departmental Materials Specification 8300, Sign Face Materials. The materials requirements for Reflective Sheeting must meet all the requirements of ASTM D 4956.

Only signage utilizing electronically cuttable film will be allowed. Silk screened sign faces will not be accepted.

- a. Color Test. Conformance to color requirements shall be determined by instrumental method in accordance with ASTM E 1164 on sheeting applied to aluminum test panels. The values shall be determined on a HunterLab Labscan 6000 0/45 Spectrocolorimeter with option CMR 559 [or approved equal 0/45 (45/0) instrument

with circumferential viewing (illumination)].

Computations shall be done in accordance with ASTM E 308 for the 2° observer.

- b.** Coefficient of Retroreflection  $R^{\wedge}$ . When electronic cuttable film is applied to retroreflective sheeting, the composite will conform to the percentage retained of the minimum coefficient of retroreflection specified by the using agency and the manufacturer for the retroreflective sheeting when the retroreflective sheeting is screen processed. The coefficient of retroreflection shall be determined in accordance with ASTM E 810. Coefficients of retroreflection  $R^{\wedge}$  shall be specified in units of candelas as per foot candle per square foot (candelas per lux per square meter). The observation angles shall be 0.2 and 0.5 degrees unless otherwise specified. The entrance angles shall be -4 and 30 degrees unless otherwise specified. The electronic cuttable film shall have and 85° specular gloss of not less than 50 when tested in accordance with ASTM D 523.
- c.** Processing and Cuttability. The electronic cuttable film shall permit cutting, weeding, masking with transfer tape, lifting, and application to retroreflective sheeting when used in accordance with manufacturer's recommendations at temperatures between 65° and 95° F and relative humidifies between 30% and 70%. The film shall lay flat with minimal edge curl and be dimensionally stable.
- d.** Adhesive Liner. The protective liner attached to the adhesive shall be removable by peeling without soaking in water or other solutions, without breaking, tearing, or removing any adhesive from the electronic cuttable film. The liner shall have a controlled release from the adhesive coated film sufficient to allow cutting without the film popping off from the liner while still allowing the liner to easily be peeled from the film.
- e.** Film. Film with punched edges for use on sprocket fed knife over roll cutters shall be edge scored and weeded to remove film in the punched area as a means of eliminating adhesive build up on the sprockets.
- f.** Resistance to Accelerated Outdoor Weathering. When electronic cuttable film is applied to retroreflective sheeting, the surface of the film shall be weather resistant and show no appreciable cracking, blistering, crazing, or dimensional change after 2 years unprotected outdoor exposure, facing the equator and inclined 45° from the vertical. Following weather exposure, panels shall be washed in a 5% HCl solution for 45 seconds, rinsed thoroughly with clean water, blotted dry with a soft cloth and brought to equilibrium at standard conditions.

After cleaning, the coefficient of retroreflection shall not be less than the value specified by the using agency for the retroreflective sheeting when the retroreflective sheeting is screen processed. Show no appreciable evidence of cracking, scaling, pitting, blistering, edge lifting or curling or more than 1/32 inch shrinkage or expansion. Show good color fastness or better when tested. The electronic cuttable film shall not be removable from the retroreflective sheeting without damage.

- 3.** Application Methods. The method of application of sheeting, letters, numbers, and symbols shall be precisely as prescribed in writing by the manufacturer.

  - a.** Legend Spacing and Layout. Spacing and layout for all traffic control signs shall

conform to the Texas SHSD.

- L. Sign Posts. Steel post shall conform to the standard specification for hot rolled carbon sheet steel, structural quality, ASTM designation A570, Grade 50. Average minimum yield strength after cold forming is 60,000 psi. The cross section of the post shall be square tube formed steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding or equivalent process and externally scarified to agree with corner radii. Sign posts shall be hot dipped galvanized conforming to ASTM A653, G90.

- 1. Sizes. Perforated sign posts, anchors and sleeves shall be of the following size:

Size	USS Gauge	Weight
1 3/4" X 1 3/4"	14	1.71
2" X 2"	12	2.42

On square tubing, holes shall be on centerline of each side in true alignment and opposite each other directly and diagonally. The length of each post shall have a permissible length tolerance of  $\pm 1/4$ ".

The finished posts shall be straight and have a smooth, uniform finish. It shall be possible to telescope all consecutive sizes of square tubes freely and for not less than ten feet of their length without the necessity of matching any particular face to any other face. All holes and ends shall be free from burrs and ends shall be cut square.

- a. Tolerance on Outside Sizes

Nominal Outside Dimension	Outside Tolerances at Corners
1 3/4" X 1 3/4"	$\pm 0.008$ "
2" X 2"	$\pm 0.008$ "

Note: Measurement from outside dimensions shall be made at least 2 inches from the end of the tube.

Permissible variation in wall thickness is  $+0.011$ ",  $-0.005$ ".

Convexity and concavity shall be measured in the center of the flat sides, tolerance in  $\pm 0.010$ ", determined at the corner.

- b. Squareness of Sides and Twist Permissible in 3" Length.

Nominal Outside Dimension	Squareness Tolerance	Twist
1 3/4" X 1 3/4"	$\pm 0.010$ "	0.062"
2" X 2"	$\pm 0.012$ "	0.062"

Permissible variation in straightness is 1/16 of an inch in 3 feet. The standard outside corner radius shall be 5/32 of an inch  $\pm 1/64$  inch.

2. Installation. The square end of the post shall not be modified or pointed.
    - a. Mount Base. When sign post installation is required over building basements, bridges and cavities, a galvanized cast iron surface mount coupler shall be used. The square post surface mount base must be a NCHRP 350-Compliant breakaway system for use with 1 3/4 - inch square post.
    - b. Hardware. All ground mounted signs shall be attached to posts using 3/8" aluminum drive rivets. Stainless steel banding material, brackets and clips will be used for signs installed on light standards or mast arms.
    - c. Construction.
      1. Concrete specifications: Insert a 2" square x 30" 12 gauge into concrete with 1-2 inches exposed above ground. Make sure the anchor assembly is level. Attach the sign to the 1 3/4" square 14 gauge post (length varies with installation) at a minimum height of seven feet using drive rivets and nylon washers. Insert the post 6-8 inches into the anchor assembly. Bolt the signpost to the anchor assembly using a corner bolt and flange nut.
      2. Soil specifications: Drive a 2" square x 30" 12 gauge omni-directional anchor sleeve into soil with 1-2 inches exposed above ground. Make sure the anchor assembly is level. Attach the sign to the 1 3/4" square x 14 gauge post (length varies with installation) at a minimum height of seven feet using drive rivets and nylon washers. Insert the post 6-8 inches into the anchor assembly. Bolt the signpost to the anchor assembly using a corner bolt and flange nut.
- M. Maker's Mark Decals. Each sign shall be permanently marked on the lower right corner of the back side with the month and year of installation, and name of manufacturer.

Table 1  
 Minimum Coefficient of Retroreflectivity  
 [0.2° observation angle and -4° entrance angle]

<b>Type III Sheeting: 10 Year Life Span</b>	
<b>Sheeting Color</b>	<b>Candelas per Foot-Candle per Sq. Ft.</b>
White	250
Yellow	170
Green	45
Red	45
Blue	20
Brown	12

Table 2  
 Minimum Coefficient of Retroreflectivity  
 [0.2° observation angle and -4° entrance angle]

Type IX Sheeting: 7 Year Life Span	
Sheeting Color	Candelas per Foot- Candle per Sq. Ft.
Fluorescent Yellow Green	300

**824S.4 Equipment**

Provide machinery, tools, and equipment necessary for proper execution of the work.

**824S.5 Construction:**

Construction shall be high quality with no visible defects in the finished product. Fabrication shall be in accordance with these specifications. Street name signs shall always be supplied and installed at each project intersection whether signs previously existed at the location or not.

- A. Unsignalized Intersection. At unsignalized intersections, ground-mounted street name signs of 9 inch height with 6 inch letters and 3 inch suffix and block numbers are required. Lettering on street name signs must be in upper/lower case letters.
- B. Signalized Intersection.
  - 1. Ground Mounted Street Signs  
If a signalized intersection has either mast arms or span- wire on which overhead street name signs can be attached, no ground mounted streets name signs are required at that intersection.
  - 2. Overhead Street Signs  
Signs shall be strapped to the mast arm or span wire. Attachments to mast arms shall be by means of a 3/4 inch stainless steel strap and a stainless steel flared strap bracket.
    - a. Letter Heights  
Overhead street name signs shall be 18 inches high. Street name signs must be 8 inch (or larger) upper/lower case letters. The suffix and block numbers shall be at least 4 ½ inches high.
- C. Existing Signs.  
The removal of existing signs shall be coordinated with the Austin Transportation Department to assure required signage is in place during all construction phases. When existing signs are to be removed, they will be removed from their post by hand and delivered to the Traffic Sign Shop (974 - 4055).
- D. No Parking Signs  
No Parking signs with horizontal dimensions wider than 15" shall not be used unless specifically authorized in advance by the City. For 24 hour parking restriction see the attached detail for the typical No Parking sign.

**824S.6 Measurement**

Traffic signs shall be measured as each complete sign constructed and placed as indicated on the Drawings.

**824S.7 Payment**

The work performed and materials furnished as prescribed by this item will be paid for at the unit bid price for "Traffic Signs" per each complete in place. The unit bid price shall include full compensation for furnishing all materials, completing the excavation, placing p.c. concrete and reinforcing steel, setting posts in p.c. concrete and for all labor, tools, equipment and incidentals necessary to complete the work.

Payment will be made under:

**Pay Item No. 824S:** Traffic Signs Per Each.

**End**

<b><u>SPECIFIC CROSS REFERENCE MATERIALS</u></b>	
Specification Item No. 824S, "Traffic Signs"	

City of Austin Standard Specifications

<u>Designation</u>	<u>Description</u>
Item No. 401S	Structural Excavation and Backfill
Item No. 403S	Concrete for Structures
Item No. 406S	Reinforcing Steel
Item No. 410S	Concrete Structures
Item No. 411	Surface Finishes for Concrete
Item No. 722	Paint and Painting

Texas Department of Transportation Manual of Testing Procedures:

<u>Designation</u>	<u>Description</u>
Tex-839-B	Determining Color in Reflective Materials
Tex-842-B	Method for Measuring Retroreflectivity

Texas Department of Transportation; Departmental Materials Specifications

<u>Designation</u>	<u>Description</u>
DMS-8300	Flat Surface Reflective Sheeting

American Society for Testing and Materials (ASTM):

<u>Designation</u>	<u>Description</u>
A-36/A-36M	Specification for Structural Steel
A-307	Specification for Carbon Steel Externally Threaded Standard Fasteners
A-320	Specification for Alloys-Steel Bolting Materials For Low-Temperature Service
A-513	Specification for Electric Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
B-26	Specification for Aluminum-Alloy Sand Castings
B-108/B-108M	Specification for Aluminum-Alloy Permanent Mold Castings
B-221/B-221M	Specification for Aluminum-Alloy Extended Bars, Rods, Wire, Shapes, and Tubes
D-523	Test Method for Specular Gloss

<b><u>SPECIFIC CROSS REFERENCE MATERIALS- Continued</u></b>	
Specification Item No. 824S, "Traffic Signs"	

American Society for Testing and Materials (ASTM):

<u>Designation</u>	<u>Description</u>
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- D 822 Recommended Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Testing Paint, Varnish, Lacquer, and Related Products
- D 828 Test Method for Tensile Breaking Strength of Paper and Paperboard
- E 97 45-degree, 0-degree Directional Reflectance Factor of Opaque Specimens by Broad-Band Filter Reflectometry
- G 23 Recommended Practice for Operating Light- and Water-Exposure Apparatus (Carbon-Arc Type) for Exposure of Nonmetallic Materials

Other Specifications

- Federal Specification A-G-90
- Federal Test Method 8801
- Federal Specification O-G-93 (stick only)
- Federal Specification TT-P-64lb.

<b><i>RELATED CROSS REFERENCE MATERIALS</i></b>
Specification Item No. 824S, "Traffic Signs

Texas Department of Transportation Technical Documents:

<u>Designation</u>	<u>Description</u>
(TMUTCD)	Texas Manual on Uniform Traffic Control Devices

City of Austin Standard Details

<u>Designation</u>	<u>Description</u>
824S-1	Standard Street-End Markers

Texas Department of Transportation: Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges

<u>Designation</u>	<u>Description</u>
Item No. 445	Galvanizing
Item No. 636	Aluminum Signs (Type A)
Item No. 637	Aluminum Signs (Type G)
Item No. 642	Aluminum Signs (Type O)
Item No. 646	Small Roadside Sign Supports
Item No. 647	Large Roadside Sign Supports
Item No. 656	Foundations for Signs, Traffic Signals and Roadway Illumination Assemblies

Texas Department of Transportation: Departmental Materials Specifications

<u>Designation</u>	<u>Description</u>
DMS-7110	Aluminum Sign Blanks
DMS-7120	Sign Hardware
DMS-8310	Flexible Roll-up Reflective Signs
DMS-8320	Vinyl, Non-reflective Decal Sheeting