

**City of Sioux Falls**  
**Standard Specifications**  
**for**  
**Traffic Signs and Delineators**  
**Section 632**

Revised: October 6, 2010

City of Sioux Falls  
Public Works/Engineering  
224 West Ninth Street  
P.O. Box 7402  
Sioux Falls, SD 57117-7402

**632.1 DESCRIPTION**

This work consists of furnishing materials, making and preparing traffic signs and delineators, and performing incidental work, including erection and installation of signs, hardware, and posts.

**632.2 MATERIALS**

**A. Traffic Signs**

1. **Sheet Aluminum:** Sheet aluminum shall meet the requirements of ASTM B 209 for alloy 5052-H38 or 6061-T6. The aluminum shall be properly degreased and etched or treated with a light, tight, amorphous chromate coating. Sheet aluminum thickness requirements shall be based on the maximum horizontal in place dimension of each sheet aluminum sign in accordance with the following:

HORIZONTAL DIMENSION OF IN PLACE SIGN BLANK	REQUIRED SIGN BLANK THICKNESS
(English Units)	
18" and less	0.080"
Over 18" through 30"	0.080"
Over 30"	0.100"
Street Name Signs	0.125"

**B. Perforated Tube Posts and Flanged Channel Posts**

Post material shall meet impact performance (change in momentum) requirements for small sign supports contained in the current AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals."

Anchor plates for Perforated Tube Posts and Flanged Channel Posts shall be galvanized in accordance with ASTM A123, or painted with a dark green high quality enamel. The steel plates shall be trapezoidal in shape with bases of 6 and 12 inches, a depth of 6 inches, and shall be either 10 gauge, 1/8 inch, or 1/4 inch in thickness. The steel shall meet the requirements of ASTM A36 or ASTM A1011 Structural Steel Grade 36. Bolt holes of 3/8 inch shall be provided centered on the plate with a spacing of 4 inches.

1. **Perforated Tube Posts:** Perforated tube posts shall conform to ASTM A1011 Structural Steel Grade 50.

Posts shall be a square tube formed of 12 gauge steel, 0.105 inch thick, rolled to size. The tubing shall be molded so the weld or flash does not interfere with telescoping. The posts shall be hot dipped galvanized with a 1.25 ounce per square foot coating conforming to ASTM A653. As an alternate, the post shall be given a triple coated protection by application of hot dip galvanized zinc conforming to ASTM A 53, followed by a chromate conversion coating and a

polyurethane exterior coating, with inside surfaces given corrosion protection by in-line application of zinc base organic coating after fabrication.

The posts shall be punched, bored, or have knockouts with 7/16-inch diameter holes on 1-inch centers of all four sides for the entire length of the posts. The post sections shall be straight, with a smooth uniform finish and a minimum amount of play between telescoping sections. Holes and cutoff ends shall be free of burrs and ragged edges. Bolts, nuts, and washers shall conform to ASTM A 307 and shall be galvanized.

- 2. Flanged Channel Posts:** Posts and bases shall be a flanged channel section fabricated from either hot rolled carbon steel bars or carbon steel bars and shapes produced from standard rail steel. The posts and bases shall meet the minimum physical properties of ASTM A499, Grade 60 except that the minimum yield strength shall be 70,000 psi. The post shall meet chemical properties of ASTM A1 for rails 30 pounds per foot and heavier.

The weight of posts shall be as specified and shall be 2.00 (Post) or 3.00 (Base) pounds per foot plus or minus 5.0 percent before punching. The posts and bases shall be painted with a high quality baked on dark green enamel. All punching, boring, cutting, or shearing shall be performed prior to painting. The posts shall be punched with continuous 3/8-inch diameter holes on 1-inch centers for the entire length of the post. The first hole shall be 1 inch from the top.

The post may consist of two parts, a sign post and a base post. The sign post lengths shall be supplied in 1-foot increments up to 10 feet. The base posts shall be 42 inches in length and have holes in the base post, starting 1 inch from the top and continuing in 1 inch increments.

The posts shall be machine straightened and have a smooth uniform finish, free from defects affecting strength, durability, or appearance. The allowable tolerance for straightness shall be 1/4 inch in 5 feet.

The splice hardware shall consist of two fully threaded, 5/16 inch by 1 1/2 inch, Grade 9, plated hex head bolts, with flat washers and hex nuts per post. In addition, two 3/4-inch by 5-inch by 1/2-inch plated spacers shall be used per post to stiffen the splice connection. Each spacer shall be drilled and tapped with 5/16 inch by 18 UNC threads. The spacer shall be fabricated from hot rolled carbon steel bars conforming to ASTM A 36 or AISI M 1020. A Grade G flanged lock nut (5/16-inch, 18 thread) may be substituted for the lock washer and hex nut.

### **C. Reflective Sheeting:**

- 1. Grade:** All Stop Signs, Yield Signs and Street Name Signs shall use DG3 (Diamond Grade Cubed) sheeting material.

All warning signs shall use Florescent DG3 sheeting material.

All school signs shall use Florescent Yellow/Green DG3 sheeting material.

All other signs shall use HIP (High Intensity Prismatic) sheeting material.

2. **General Characteristics:** The reflective sheeting shall be free from ragged edges, cracks, and extraneous materials. There shall be no splices in the reflective sheeting.
3. **Fabrication:** The background for signs shall be sheet reflective material applied to aluminum backing. The preparation of the aluminum surface and the sheeting application shall be in complete compliance with the recommendations of the manufacturer.
4. **Application:** Reflective sheeting shall be applied to properly prepared aluminum (degreased and etched or treated with a light, tight, amorphous chromate coating) with mechanical equipment in a manner prescribed by the sheeting manufacturer.
5. **Legend:** Message and borders shall be type, reflective material, and color specified. Nonremovable copy may be screen processed or direct applied.
  - a. **Nonremovable Copy:** (For use on sheet aluminum signs.)
    - 1) **Screen Process:** Message and borders shall be processed on reflective sheeting using mechanical equipment, materials, and operational methods and procedures as prescribed by the sheeting manufacturer. Processing shall be accomplished by the direct or reverse screen method using opaque or transparent processing material as required. Screening may be accomplished either before or after application of the sheeting to the base panels, conditional upon the method recommended by the sheeting manufacturer. Freehand painting will not be permitted on any part of the finished sign face.
    - 2) **Direct Applied:** Cut-out message and borders shall be reflective sheeting or opaque lettering film applied directly to clean, dust free, reflective sheeting background. Message and borders shall be applied in accordance with the operational methods and procedure prescribed by the sheeting manufacturer. The finished letters, numerals, symbols, and borders shall be cut with smooth regular outline, free from ragged or torn edges.

Mounting holes will not be drilled or punched in any part of the nonremovable copy.
6. **Color:** The reflective sheeting shall meet the color specification limits and luminance factors listed in Tables 1–4 when tested in accordance with ASTM E1347 or ASTM E1349. Fluorescent retroreflective materials shall be

tested in accordance with ASTM E991. The reflective sheeting shall maintain the colors and luminance factors provided in the appropriate tables throughout its service life.

**Table 1**

Color	Chromaticity Coordinates (corner points)							
	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
White	0.303	0.300	0.368	0.366	0.340	0.393	0.274	0.329
Red	0.648	0.351	0.735	0.265	0.629	0.281	0.565	0.346
Orange	0.558	0.352	0.636	0.364	0.570	0.429	0.506	0.404
Brown	0.430	0.340	0.430	0.390	0.518	0.434	0.570	0.382
Yellow	0.498	0.412	0.557	0.442	0.479	0.520	0.438	0.472
Green	0.026	0.399	0.166	0.364	0.286	0.446	0.207	0.771
Blue	0.078	0.171	0.150	0.220	0.210	0.160	0.137	0.038

Daytime Color Specification Limits for Retroreflective Material with CIE 2° Standard Observer and 45/0 (0/45) Geometry and CIE Standard Illuminant D65.

**Table 2**

Color	Chromaticity Coordinates (corner points)							
	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
White	0.475	0.452	0.360	0.415	0.392	0.370	0.515	0.409
Red	0.650	0.348	0.620	0.348	0.712	0.255	0.735	0.265
Orange	0.595	0.405	0.565	0.405	0.613	0.355	0.643	0.355
Brown	0.595	0.405	0.540	0.405	0.570	0.365	0.643	0.355
Yellow	0.513	0.487	0.500	0.470	0.545	0.425	0.572	0.425
Green	0.007	0.570	0.200	0.500	0.322	0.590	0.193	0.782
Blue	0.033	0.370	0.180	0.370	0.230	0.240	0.091	0.133

Nighttime Color Specification Limits for Retroreflective Material with CIE 2° Standard Observer and Observation Angle of 0.33°, Entrance Angle of +5° and CIE Standard Illuminant A.

**Table 3**

Color	Chromaticity Coordinates (corner points)								Luminance Factor (Y %)	
	1		2		3		4		Min	Max.
	X	Y	X	Y	X	Y	X	Y		
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355	25	None
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442	45	None
Fluorescent Yellow/Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540	60	None
Fluorescent Green	0.210	0.770	0.232	0.656	0.320	0.590	0.320	0.675	20	30

Daytime Color Specification Limits and Luminance Factors for Fluorescent Retroreflective Material with CIE 2° Standard Observer and 45/0 (0/45) Geometry and CIE Standard Illuminant D65.

**Table 4**

Color	Chromaticity Coordinates (corner points)							
	1		2		3		4	
	X	Y	X	Y	X	Y	X	Y
Fluorescent Orange	0.625	0.375	0.589	0.376	0.636	0.330	0.669	0.331
Fluorescent Yellow	0.554	0.445	0.526	0.437	0.569	0.394	0.610	0.390
Fluorescent Yellow-Green	0.480	0.520	0.473	0.490	0.523	0.440	0.550	0.449
Fluorescent Green	0.007	0.570	0.200	0.500	0.322	0.590	0.193	0.782

Table 4: Nighttime Color Specification Limits for Fluorescent Retroreflective Material With CIE 2° Standard Observer and Observation Angle of 0.33°, Entrance Angle of +5° and CIE Standard Illuminant A.

**D. Delineators:**

- Description:** Delineators shall be adhesive coated reflective sheeting permanently bonded to sheet aluminum backing.

The aluminum shall be 6061-T6 (ASTM B 209) 0.063-inch-thick sheet properly degreased and etched, or treated with a light, tight, amorphous chromate coating.

Type I Object Marker shall consist of a yellow 18" x 18" reflector unit.

Type II Object Marker shall consist of a 4" x 8" or size specified reflector unit.

Type III Object Marker shall consist of a 12" x 36" reflector unit.

- Reflective Sheeting:** The reflective sheeting shall be Florescent DG3 sheeting.

In exception to the requirements stated above, the reflective sheeting shall maintain the colors provided in the appropriate tables contained in Section 982.2.G.6 throughout its service life.

- Fabrication:** The aluminum shall be 6061-T6 or 5052-H38 0.063-inch-thick sheet conforming to ASTM B 209. The aluminum shall be properly degreased and etched or treated with a light, tight, amorphous chromate coating.

The reflective sheeting shall be applied to properly treated base panels with mechanical equipment in a manner specified by the sheeting manufacturer.

- Shape and Holes:** Delineators shall be punched or sheared to size with 3/4-inch radius corners. Mounting holes shall be as follow:

- a. The 4 x 8-inch delineators shall have two 1/4-inch holes, 5 inches center to center along the vertical axis.
5. **General Requirements:** The finished delineators shall be free of burrs, scratches, or damaged reflective sheeting and shall have essentially a plane surface.
6. **Delineator Posts:** Posts shall be flanged channel section fabricated from hot rolled carbon steel bars or carbon steel bars and shapes produced from standard rail steel. The posts shall meet the minimum physical properties of ASTM A499, except that the minimum yield strength shall be 70,000 psi. The posts shall meet the physical properties of ASTM A499 and the chemical properties of ASTM A1 for rails 30 pounds per foot and heavier.

The posts shall be coated with a high quality dark green material. All punching, boring, cutting, or shearing shall be done prior to coating. Prior to any punching or boring, the weight of the post shall be a minimum of 1.12 pounds per foot with a tolerance of plus or minus 5 percent. The post length shall be as specified within a tolerance of plus or minus 1 inch. The delineator post shall be punched or bored with thirty 3/8-inch diameter holes on 1.0 inch centers beginning 1.0 inch from the top of the post.

The bottom of the post shall be pointed for ease of installation. The posts shall be machine straightened and have a smooth uniform finish, free from defects affecting strength, durability, or appearance. The allowable tolerance for straightness shall be 1/4 inch in 5 foot.

### 632.3 CONSTRUCTION REQUIREMENTS

Highway signs and delineators shall comply with the most current MUTCD and Standard Highway Signs, issued by the U.S. Department of Transportation, FHWA.

#### A. Remove or Salvage Signs and Delineators

1. **Remove Traffic Sign:** The Contractor shall be responsible to remove traffic or other signs as specified in the contract. The signs and the associated posts and bases will be removed and disposed of by the Contractor.
2. **Salvage Traffic Sign:** The Contractor shall be responsible to salvage traffic signs as specified in the contract. The signs, posts, and bases will be removed; disassembled and returned to the Sioux Falls Traffic Maintenance Shop in the same condition they were prior to the project. All signs must be removed from the post prior to the removal of the post and base. Care shall be taken to prevent damage to any of the reflective sheeting. Any signs, posts, or bases damaged during transportation will be replaced at the expense of the Contractor.

3. **Salvage Traffic Sign for Reset:** The Contractor shall be responsible to salvage and store traffic signs to be reset by the Contractor as specified in the contract. The Contractor shall remove the sign prior to removal of the post and base. The post and bases shall be returned to the Sioux Falls Traffic Maintenance Shop unless otherwise specified. Special care shall be taken by the Contractor to prevent damage to any of the reflective sheeting during storage. Any signs, posts, or bases damaged during storage or transportation will be replaced at the expense of the Contractor.
4. **Salvage Delineator or Object Marker:** The Contractor shall be responsible to salvage delineators or object markers as specified in the contract. The delineators or object markers and associated posts and bases will be removed undamaged and returned to the Sioux Falls Traffic Maintenance Shop. Any delineators, object markers, or associated posts and bases damaged during transportation will be replaced at the expense of the Contractor.

#### **B. Traffic Sign Installation:**

1. **Location and Position:** The location of each sign shall be established by a stake bearing the sign number as determined from the plans.

Traffic signs shall be installed on posts, light poles, or mast arms as specified in the contract. The Contractor will be responsible to furnish the necessary stainless steel mounting hardware for each sign.

All R7 and R8 series signs with arrows shall be installed at a 45 degree angle to the street.

2. **Sign mounting hardware**

- a. All bolts and washers used for mounting signs shall be stainless steel and minimum of 5/16" diameter.
- b. Plastic / nylon washers shall be inserted between the sign face and the stainless washer.
- c. Stainless washers must meet MS 813 standards.
- d. Zinc coated nyloc nuts shall be used to secure signs to the posts

**C. Object Markers:** Object markers of the type specified shall be erected as shown in the plans.

**D. Delineators:** Delineators shall be mounted as shown in the plans.

**E. Perforated Tube Posts and Flanged Channel Posts:** Post size will be specified in the contract for each type of sign. Sign post lengths shown in the contract are estimates for bidding purposes only. The exact post lengths will be determined during construction. Posts shall be in a plumb position. Unless otherwise specified all signs, including those salvaged for reset by the Contractor will be placed on new posts.



**632.4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

- A. Remove Traffic Sign:** Removed signs will be measured per each sign removed. Multiple signs removed on the same post will be measured as one. Removed signs will be paid for at the contract unit price per each. Payment will be full compensation for all labor and incidentals to remove and dispose of the sign and associated posts and bases.
- B. Salvage Traffic Sign, Salvage Traffic Sign for Reset, and Salvage Delineator or Object Marker:** Salvaged signs will be measured per each sign salvaged. Multiple signs salvaged on the same post will be measured as one. Salvaged signs will be paid for at the contract unit price per each. Payment will be full compensation for all labor, materials, and incidentals including transporting and storing the signs, delineators, and object markers.
- C. Furnish Sign with Reflective Sheeting:** Signs will be measured to the nearest 0.1 foot and the area computed to the nearest 0.1 square foot of the sign face for each sign furnished. Deduction will not be made for rounded corners. Sheet aluminum signs will be paid for at the contract unit price per square foot of the type of sign furnished. Payment will be full compensation for furnishing materials, including borders, legend, and edge trim.
- D. Install Traffic Signs:** Install signs will be measured per each sign installed including Contractor furnished signs, salvaged signs, and City-furnished signs based upon their type of installation location. Multiple signs placed on the same post will be measured separately. Install signs will be paid at the contract unit price per each for the respective type of installation location. Payment will be full compensation for all labor, materials including mounting hardware, and incidentals. Separate measurement and payment will be made for perforated tube posts and flange channel posts.
- E. Object Markers:** Object markers quantities will be determined by count of each type. Object markers will be paid for at the contract unit price per each. Payment will be full compensation for furnishing and installing materials, including posts, reflective panels, and hardware.
- F. Delineators:** Delineator quantities will be determined by count of each type. Delineators will be paid for at the contract unit price per each. Payment will be full compensation for furnishing and installing materials, including posts, reflectors, and hardware.
- G. Perforated Tube Posts and Flange Channel Posts:** Post quantities for steel posts, other than those used for delineators and object markers, will be measured to the nearest 0.1 foot. Perforated tube posts and flange channel posts will be paid for at the contract unit price per foot. Payment will be full compensation for all labor, materials, and incidentals including post anchors, anchor sleeves, mounting hardware, telescoped inner post sections, and anchor plates.