1060 - PERMANENT TRAFFIC CONTROL SIGNING

1060.1 DESCRIPTION

a. Work

The Contractor shall furnish and install permanent traffic control signing materials at the locations shown on the plans, in conformance with the details, and the material specifications included herein. Permanent traffic control signing materials shall include, but not be limited to, sign sheeting, aluminum sign blanks, sign posts, breakaway base assemblies, mounting brackets and hardware.

b. Timing

The permanent traffic control signing shall be installed before the roadway is open to construction unless prior approval is received by the Engineer or City Inspector. The installation of all regulatory signs is the first priority. If the permanent signs cannot be installed and thus the roadway would be unsigned overnight, temporary regulatory signs shall be installed and remain until the permanent signs can be installed. The contractor shall make every possible effort to remove the temporary signs and install permanent signs within 48 hours. Only under extreme circumstances and at the approval of the signing inspector or the engineer, will the duration of the temporary signs be extended.

All temporary and permanent traffic control signs shall be in conformance with the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD) Part II. The temporary signs shall be removed prior to installation of the permanent signs.

1060.2 MATERIALS

All materials used in the fabrication or assembly of the items listed below shall comply with the applicable parts of Section 1703, "Electric Lighting and Traffic Signal Equipment" of the "standard Specifications" with the additions as stated herein. Unless specifically noted otherwise, all RRFB equipment shall be new and similar to the best grade of this type of equipment, and shall be approved by the Traffic Engineer.

a. Applicable Documents

The following documents form a part of this specification to the extent specified herein:

(1) ASTM B209 Specification for Aluminum and Aluminum Alloy Sheet and Plate
(2) ASTM D523 Standard Method for Test for Specular Gloss
(3) ASTM D4956-09 Standard Specification for Retroreflective Sheeting for Traffic Control
(4) ASTM E284 Terminology of Appearance
(5) ASTM E308 Practice of Computing the Colors of Objects by Using the CIE System
(6) ASTM E810 Test Method for Coefficient of Retro-reflection of Retroreflective Sheeting Utilizing the Coplanar Geometry
(7) ASTM E1164 Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation
(8) CIE Publication Number 39-2 Recommendation for Surface Colours for Visual Signaling

FP-03 Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects

b. Approved Materials List

All material for permanent traffic control signs used by the Contractor shall be from the City's Approved Materials List. It is important that users be completely knowledgeable of all application requirements and procedures prior to product application. It is the responsibility of the installer to contact the supplier of all materials if questions regarding applications procedures or conditions arise.

c. Super-High Efficiency Full Cube Retroreflective Sign Sheeting

This specification covers flexible white or colored, Super-High Efficiency Full Cube Retroreflective Sheeting, tape and related processing materials designed to enhance nighttime visibility of traffic control signs and objects. The sheeting shall consist of full cube prismatic lens elements with a distinctive interlocking diamond or hexagonal seal pattern visible from the face of a smooth surface. The sheeting shall have a pre-coated adhesive protected by an easily removable liner. This sheeting shall be

used for all permanent traffic control signs as listed in the "Sign Information Table" on the Overland Park Standard Details.

(1) Classification and Conformance

The sheeting shall conform to ASTM D 4956-09 as modified by this specification for a Type XI classification.

(2) Colors

The manufacturer of the sheeting shall manufacture and offer a single line of standard traffic colors recommended for the sheeting to meet the performance requirements of this specification. No process color inks, or silk screenings are allowed. All signs shall be made from a combination retroreflective sheeting background with electronic cuttable film applied to the surface.

(3) Test Panels and Test Conditions

Unless otherwise specified herein, sheeting shall be applied to test panels in accordance with ASTM D 4956-09, section 7.2 and test conditions shall conform to ASTM D 4956-09 section 7.1.

(4) Color Requirements

Color shall be as specified and shall conform to the requirements of ASTM D 4956-09, Table 11. Luminance factors shall conform to ASTM Type XI.

(5) Color Processing

The sheeting shall be heat resistant and permit force curing without staining of applied or unapplied sheeting at temperatures recommended by the sheeting manufacturer.

(6) Shrinkage

The retroreflective sheeting shall comply with the shrinkage requirements contained in ASTM D 4956-09 section 6.6.

(7) Adhesive

The retroreflective sheeting shall comply with the liner removal and adhesion requirements contained in ASTM D 4956-09 sections 6.8 and 6.9 respectively.

(8) Coefficient of Retro-reflection

Conformance to minimum requirements for Retro-reflectance is determined as follows:

- Three 8 in. x 8 in. samples spaced evenly across and down a representative piece of sheeting shall be taken. The Coefficient of Retro-reflection shall be determined for each of the three samples per ASTM E810. The average of the three values shall comply with the stated minimum table value and no single sample shall be less than 80% of the table value.
- The observation angles shall be 0.2°, 0.5°, and 1.0°. The entrance angles shall be -4° and 30°. For transparent colored overlay films on white sheeting, the coefficients of retro-reflection shall not be less than the minimum requirements of ASTM D 4956-09 Table 10.

(9) Fungus Resistance

The retroreflective sheeting shall comply with the supplementary requirements contained in section S1 of ASTM D 4956-09.

(10) General Characteristics and Packaging

The retroreflective sheeting as supplied shall be of good appearance, free from ragged edges, cracks and extraneous materials and shall be furnished in either rolls or sheets.

When furnished in continuous rolls, the number of splices shall not be more than two per 50 yards (45.7 m) of material, with a maximum of three pieces in any 50-yard (45.7 m) length. Splices shall be butted or overlapped and shall be suitable for continuous application as furnished.

The sheeting shall be packaged in accordance with commercially accepted standards. Each carton shall clearly stipulate the brand, quantity, size, lot or run number, color and type adhesive. Stored under normal conditions the retroreflective sheeting as furnished shall be suitable for use for a minimum period of one year.

(11) Durability

The retroreflective sheeting shall comply with the supplementary requirements contained in section S3 of ASTM D 4956-09. It shall be weather resistant and show no appreciable cracking, scaling, pitting, blistering, edge lifting or curling when tested in accordance with section 7.6 of ASTM D4956-09,

and shall meet the minimum coefficient of retro-reflection after weathering as specified in ASTM D 4956-09 Table 12.

(12) Certifications

The sheeting manufacturer shall submit with each lot or shipment, a certification that states the material supplied will meet all the requirements listed herein.

(13) Field Performance Requirements for Ordinary Colors

Sheeting manufactured of standard colors and processed and applied to sign blank materials in accordance with sheeting manufacturer's recommendations, shall perform effectively for at least 12 years. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retro-reflection is less than the minimum specified for that sheeting during that period listed as follows:

80% of values listed in ASTM D 4956-09 Table 10 up to 7 years and
70% of values listed in ASTM D 4956-09 Table 10 up to 12 years

Failure of overlay films provided and/or sold for use on recommended sheeting shall constitute a failure of entire sign and shall be replaced.

For transparent colored overlay films on white sheeting, the coefficients of retro-reflection shall not be less than 70% of the values for the corresponding integral color. All measurements shall be made after sign cleaning according to sheeting manufacturer's recommendations.

Natural causes include effects of exposure to weather. Natural causes exclude (without limitation) damage from exposure to chemicals, abrasion and other mechanical damage (such as from fasteners used to mount the sign, collisions or mishandling), vandalism, or malicious mischief.

(14) Field Performance Requirements for Fluorescent Colors

Fluorescent colored sheeting processed and applied to sign blank materials in accordance with sheeting manufacturer's recommendations shall perform effectively for at least 10 years. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retro-reflection is less than the minimum specified for that sheeting during that period listed as follows:

80% of values listed in ASTM D 4956-09 Table 10 up to 7 years and
70% of values listed in ASTM D 4956-09 Table 10 up to 10 years

Failure of overlay films provided and/or sold for use on recommended sheeting shall constitute a failure of entire sign and shall be replaced. All measurements shall be made after sign cleaning according to sheeting manufacturer's recommendations.

Natural causes include effects of exposure to weather. Natural causes exclude (without limitation) damage from exposure to chemicals, abrasion and other mechanical damage (such as from fasteners used to mount the sign, collisions or mishandling), vandalism, or malicious mischief.

(15) Sheeting Manufacturer's Replacement Obligation for Ordinary Colors

Where it can be shown that retroreflective signs, supplied and used according to the sheeting manufacturer's recommendations, have not met the field performance requirements as indicated above, the sheeting manufacturer shall cover restoration costs as follows for sheeting shown to be unsatisfactory:

- For the entire 12 years, the sheeting manufacturer will replace the sheeting required to restore the sign surface to its original effectiveness.
- In addition, during the first seven years the sheeting manufacturer will cover the cost of restoration of the sign surface to its original effectiveness at no cost to the City of Overland Park for materials and labor. Replacement sheeting shall carry the unexpired warranty of the sheeting it replaces.

(16) Sheeting Manufacture's Replacement Obligation for Fluorescent Colors

Where it can be shown that retroreflective signs, supplied and used according to the sheeting manufacturer's recommendations, have not met the field performance requirements as indicated above, the sheeting manufacturer shall cover restoration costs as follows for sheetings shown to be unsatisfactory:

If the failure occurs within the first 7 years from the date of fabrication, the sheeting manufacturer shall, at its expense, restore the sign surface to its original effectiveness. If the failure occurs in the 8th through the 10th year from the date of fabrication, the sheeting manufacturer will furnish the necessary amount of sheeting to restore the sign surface to its original effectiveness. Replacement sheeting shall carry the unexpired warranty of the sheeting it replaces.

(17) City of Overland Park Obligation

The City of Overland Park shall be responsible for requiring the dating of all signs at the time of application. That date constitutes the start of the field performance obligation period.

d. Electronic Cuttable Film

This specification covers flexible, transparent, durable, acrylic films designed to be applied to retroreflective materials for the creation of traffic control signs and devices. The electronic cuttable film shall have a match component warranty equivalent to the retroreflective sheeting and be from the same manufacturer. Mixing one electronic cuttable film product with another manufacturer's retroreflective sheeting shall not be allowed.

(1) Description

Electronic cuttable films shall consist of transparent, durable, acrylic, colored films coated with a transparent pressure sensitive adhesive protected by a removable liner. The films are designed to be cut on 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 release any volatile organic compounds.

(2) Test Conditions

Unless otherwise specified herein, all applied and unapplied test samples and specimens shall be conditioned at the standard conditions of 73º $\pm$ 3ºF (23º $\pm$ 1.5ºC) and 50 $\pm$ 5% relative humidity for 24 hours prior to testing.

(3) Test Panels

Unless otherwise specified herein, when tests are to be performed using test panels, the specimens of retroreflective and / or overlay films shall be applied to smooth aluminum cut from ASTM B-209 Alloy 5052-H36, 5052-H38, 5154-H38, or 6061-T6 sheets on 0.020 inch (0.051cm), 0.040 inch (0.102cm) or 0.063 inch (0.160cm) thicknesses. The aluminum shall be degreased and lightly acid etched

before the specimens are applied. The specimens shall be applied in accordance with the recommendations of the reflective sheeting and electronic cuttable film manufacturer.

(4) Color Requirements

When electronic cuttable film is applied to retroreflective sheeting, the resulting color of the composite sheeting will conform to Federal Specification FP-03, Section 718.01 and ASTM D 4956.

(5) Color Test

Conformance to color requirements shall be determined by instrumental method in accordance with ASTM E1164 on sheeting applied to aluminum test panels. The values shall be determined on a HunterLab Labscan 6000 0/45 Spectrocolorimeter with option CMR 559. Computations shall be done in accordance with ASTM E308 for the 2 degree observer

(6) Coefficient of Retro-reflection

When electronic cuttable film is applied to retroreflective sheeting, the composite will conform to the percentage retained of the minimum coefficient of retro-reflection specified by these specifications and the manufacturer for the retroreflective sheeting when the retroreflective sheeting is screen processed. The coefficient of retro-reflection shall be determined in accordance with ASTM E810.

Coefficients of retro-reflection shall be specified in units of candelas per foot candle per square foot (candelas per lux per square meter). The observation angles shall be 0.2º and 0.5º unless otherwise specified. The entrance angles shall be -4° and 30° unless otherwise specified. Retroreflective sheetings with datum marks shall be tested in the orientation specified by the manufacturer. If no datum mark is supplied, the sheeting shall be rotated to determine the minimum coefficient of retro-reflection which shall be reported without averaging.

(7) Specular Gloss

The electronic cuttable film shall have an 85° specular gloss of not less than 50 when tested in accordance with ASTM D523.

(8) 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 (18.3° and 35.0°C) and relative humidities between 30% and 70%. The film shall lay flat with minimal edge curl and be dimensionally stable.

(9) 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. 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.

(10) 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 clean cloth and brought to equilibrium at standard conditions. After cleaning, the coefficient of retro-reflection shall not be less than the value specified for the retroreflective sheeting when the retroreflective sheeting is screen processed.

It shall show no appreciable evidence of cracking, scaling, pitting, blistering, edge lifting or curling or more than 1/32" (0.08cm) shrinkage or expansion. It shall show good color fastness or better when tested as in S-1.2.4.11. The retained reflectivity shall be the same as that specified for screen processed retroreflective sheeting of the type being tested. The film shall not be removable from the retroreflective sheeting without damage.

Retroreflective performance measurements made after weather exposure shall be made only at angles of 0.2° observation and -4° entrance. Where more than one panel of a color is measured, the coefficient of retro-reflection shall be the average of all determinations.

(11) Colorfastness

One specimen, exposed and prepared as specified herein shall be wet cut with a mild detergent and water solution and compared with a similarly treated unexposed specimen under natural daylight or artificial daylight having a color temperature of 7600°K. The colorfastness shall be evaluated as follows:

Excellent	- No perceptible change in color
Good	- Perceptible but no appreciable change in color
Fair	- Appreciable change in color

Appreciable change in color means a change that is immediately noticeable in comparing the exposed specimen with the original comparison specimen. If closer inspection or a change of angle of light is required to make apparent a slight change in color, the change is not appreciable.

(12) General Characteristics and Packaging

When supplied as roll goods, the electronic cuttable film shall be of good appearance, free from ragged edges, cracks and extraneous materials. The maximum number of splices in each roll shall be three per 50 yards of material. Splices shall be butted. The sheeting shall be packed snugly in corrugated fiberboard cartons, in accordance with commercially accepted standards. Each carton shall clearly stipulate the brand, quantity, size, lot or run number, and color. Stored under normal conditions, the film shall be suitable for use for a minimum period of one year.

When supplied as a finished sign face or mounted sign, the sign face, made of electronic cuttable film and retroreflective sheeting, shall comply with the appearance, specification, and good workmanship for sign faces constructed of a screen processed retroreflective sheeting of the same type.

(13) Certification

The film manufacturer shall, upon request, submit with each lot or shipment, a certification which states that the material supplied will meet all of the requirements listed herein.

(14) Field Performance Requirements

The electronic cuttable film applied to retroreflective sheeting, both materials applied in accordance with the manufacturer's recommendations, shall as a composite perform with the same effective performance life as specified for that type of retroreflective sheeting when screen processed. The composite sign will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retro-reflection is less than the minimum specified for that sheeting when screen processed.

e. Aluminum Sign Blanks

This specification covers aluminum sign blanks for flat sheet signs for permanent traffic control signs.

(1) Material

Sign blanks shall be manufactured from aluminum ASTM B209(H) alloy 6061-T6 or 5052-H38. The aluminum blank shall be degreased and lightly acid etched.

(2) Thickness

All sign blanks for overhead street name signs shall be 0.125" thick. All other traffic control signs shall be 0.08" thick unless otherwise specified in the standard details.

(3) Mounting Holes

Mounting holes in the sign blanks shall be the size and location as stipulated in the standard detail drawings.

f. Steel Sign Posts

(1) Material

Steel posts shall conform to the standard specification for hot rolled carbon sheet steel, structural quality, ASTM designation A570, Grade 50. Yield strength after cold-forming is 60,000 psi minimum.

(2) Shape

The cross section of the sign post shall be square tube formed of 12 gauge (0.105` U.S.S. gauge) steel. The cross section of the post anchor and anchor sleeve shall be square tube formed of 12 gauge (0.105 U.S.S. gauge) steel. All posts, post anchors and anchor sleeves shall be carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding and externally scarfed to agree with corner radii. All ends shall be cut square.

(3) Finish

Sign posts, post anchors and anchor sleeves shall be manufactured from hot-dipped galvanized steel conforming to ASTM A653, G90, Structural Quality, Grade 50, Class 1. The corner weld is zinc coated after scarfing operation. The steel is also coated with a chromate conversion coating and a clear organic polymer topcoat. Both the interior and the exterior of the post shall be galvanized.

(4) Cross Section

Perforated sign posts, post anchors and anchor sleeves shall be of the following sizes:

Description	Size	U.S.S. Gauge	Weight (lbs./foot)
Sign Post	1 ¾" x 1 ¾"	12	2.06
Post Anchor	2" x 2"	12	2.42
Anchor Sleeve	2 ¼" x 2 ¼"	12	2.77

(5) Telescoping Properties

The finished posts, post anchor and anchor sleeve 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.

(6) Tolerances

Tolerances shall be as indicated in the following table:

Tolerance Description	1 ¾" x 1 ¾"	2" x 2"	2 ¼" x 2 ¼"
Outside Tolerances at Sides at Corners[1]	± 0.008"	± 0.008"	± 0.010"
Wall Thickness Tolerances	± 0.0011", -0.005	+ 0.011", -0.005	+ 0.011", -0.005
Convexity and Concavity Tolerances[2]	± 0.010"	± 0.010"	± 0.010"
Squareness of Sides Tolerances[3]	± 0.010"	± 0.012"	± 0.014"
Permissible Twist in 3' Length	0.062"	0.062"	0.062"
Straightness Tolerances in 3' Length	1/16"	1/16"	1/16"
Corner Radii	5/32" ± 1/64"	5/32" ± 1/64"	5/32" ± 1/64"

Notes:

[1]Measurements from outside dimensions shall be made at least 2 inches from the end of tube.

[2]Measured in the center of the flat sides determined at the corner.

[3]A sample shall be considered to fail if its sides are not 90 degrees to each other within the squareness tolerance listed above.

(7) Holes

Holes shall be 7/16" ± 1/64" in diameter on one inch centers on all four sides down the entire length of the post, post anchor and anchor sleeve. Holes shall be on centerline of each side in true alignment and opposite each other directly and diagonally. All holes shall be drilled or punched and all welds, cuts, burrs, and sharp edges are to be smoothed off before application of finish.

(8) Post Length

Posts shall be ordered in 2' increments and cut to length. One single sign post long enough to support all signs shall be installed. Two separate lengths of post joined with a sleeve to achieve the necessary post length shall not be allowed.

(9) Breakaway Performance

The breakaway base design shall meet the requirements of the National Cooperative Highway Research Program Report (NCHRP) No. 350 or Manual for Assessing Safety Hardware (MASH).

g. Mounting Brackets, Hardware and Banding

This specification covers various mounting brackets, hardware and banding for sign installation as indicated by the standard details.

(1) Steel Banding, Brackets and Buckles on Tubular Supports

Banding for signs mounted on tubular posts shall be ¾" wide by 0.030" Type 201 stainless steel. Buckles shall also be Type 201 stainless steel with ear-lock design and teeth for maximum clamping strength.

The mounting bracket shall be stainless steel with a flared leg, supplied with stainless steel hex head bolt and stainless steel washer. The bracket shall be fully threaded and shall require no nuts to fasten. A flat, plastic or fiber washer shall be installed contacting the sign face prior to the installation of the stainless steel washer.

(2) Hardware for Steel Post Mounted Signs

Bolts for fastening the telescoping sign post, post anchor and anchor sleeve shall be a zinc plated steel corner bolt with zinc plated hex head lock nut and zinc plated flat washers as dimensioned in the standard details. The corner bolt is designed to prevent distortion of the opposite wall of the sign posts which can occur when conventional through-bolts are over-tightened.

Bolts for fastening the sign to the 1 ¾" x 1 ¾" sign post shall be a straight stainless steel hex head bolt with stainless steel washer and stainless steel hex head lock nut. A flat, plastic or fiber washer shall be installed contacting the sign face prior to the installation of the stainless steel washer.

All bolts, nuts, and washers shall comply with section 1616 of the Kansas Department of Transportation Standard Specifications for State Road and Bridge Construction (current edition).

h. Mast Arm Sign Mounting Brackets

The mast arm sign mounting brackets shall be used to mount R10 Series MUTCD designated signs and overhead street name signs to signal pole mast arms. It shall consist of a high tensile cast 356 aluminum alloy clamp kit, U-bolts, extruded aluminum extension tube (length based on sign length), aluminum mounting channels (number required based on manufacturer's recommendation), clamp saddle, swivel bracket and high strength stainless steel aircraft cable and stainless steel fittings or ¾" stainless steel banding and stainless steel buckles. It shall be supplied complete with all necessary attaching hardware including stainless steel hex head bolt, hex nut, split lock washer and flat washer.

i. Tubular Support Street Name Sign Wing Bracket

The wing bracket shall be used to mount street name signs to tubular supports such as light poles. The bracket shall be a single piece L-shaped cantilever of T-beam frame made from 380-3 aluminum alloy construction as indicated in the standard details. The length shall be as specified in the standard details based on the length of the sign. The mounting plate shall have set screws for sign attachment.

j. Concrete Surface Mount Sign Post Anchor

All components of the concrete surface mount sign post anchor shall be reusable after impact, except for the shear bolt. It shall allow for 360 degree indexing, via the meshing of serrated teeth on the upper and lower portions, for proper sign orientation after the anchor portion is permanently set. After impact, the portion of the base to remain in place shall not exceed 3" in height above finished grade. The anchor assembly shall be FHWA accepted, meeting current AASHTO and NCHRP 350 requirements or Manual for Assessing Safety Hardware (MASH).

(1) Materials

The top half of the post receiver and concrete surface mount anchor base shall be cast from Ductile Iron ASTM A 536, Class 65-45-12. The post locking wedge shall be Forged Steel ASTM A1035. The shear bolt hardware set shall be 5/8"-11 grade 8 bolt (SAE J429), 5/8"-11 grade 8 flanged nut (SAE J995) and 5/8" ANSI 18.21.1 split ring lock washer. The rubber bushing shall be made from ASTM D 2000-86E EPDM, 85 durometer, shore A. The top half of the surface mount anchor base and the post

locking wedge shall be hot dip galvanized to ASTM A153. The shear bolt hardware shall be zinc plated to ASTM B633.

k. Paver Stone Sign Post Anchor and Sleeve

All components of the concrete surface mount sign post anchor shall be reusable after impact, except for the shear bolt. It shall allow for 360 degree indexing, via the meshing of serrated teeth on the upper and lower portions, for proper sign orientation after the anchor portion is permanently set. After impact, the portion of the base to remain in place shall not exceed 3" in height above finished grade. The anchor assembly shall be FHWA accepted, meeting current AASHTO and NCHRP 350 requirements or Manual for Assessing Safety Hardware (MASH). The 2 ¼" x 2 ¼" anchor sleeve shall meet the requirements of Steel Sign Posts, above.

(1) Materials

The top half of the post receiver and the stem of the flush mount anchor bottom shall be cast from Ductile Iron ASTM A 536, Class 65-45-12. The post locking wedge shall be Forged Steel ASTM A1035. The shear bolt hardware set shall be 5/8"-11 grade 8 bolt (SAE J429), 5/8"-11 grade 8 flanged nut (SAE J995) and 5/8" ANSI 18.21.1 split ring lock washer. The rubber bushing shall be made from ASTM D 2000-86E EPDM, 85 durometer, shore A. The receiver, anchor and the post locking wedge shall be hot dip galvanized to ASTM A153. The shear bolt hardware shall be zinc plated to ASTM B633.

1060.3 CONSTRUCTION REQUIREMENTS

The proposed permanent traffic control signs shall be fabricated and installed by the contractor in conformance to the plans, standard details and these specifications. The signs shall meet all applicable requirements of the "Manual on Uniform Traffic Control Devices for Streets and Highways," U.S. Department of Transportation, Federal Highway Administration, latest revision as adopted, hereinafter referred to as "MUTCD", except as modified on the Plans and as described herein.

a. Preparation of Aluminum Sign Blanks

This specification covers the preparation of aluminum sign blanks prior to application of retroreflective sheeting.

(1) Size and Tolerances

Signs shall be of the length and width as specified on the plans or standard details. The tolerance for the length and width of the sign blank shall be within $\pm$ 1/8" from that shown on the plans or standard details. The sign blanks shall be free from buckles, warp, dents, cockles, burrs and other defects caused by fabrication.

(2) Cleaning

Following fabrication, the aluminum to which the sheeting is to be applied shall be cleaned of all aluminum oxide and prepared with a class 2 chromate conversion coating as outlined in ASTM B449, "Standard Recommended Practice for Chromate Treatments on Aluminum" or ASTM B-921 to resist corrosion and aluminum oxide. It should be a consistent weight (nominally 10-35 mg/sq ft.) and no darker than pale yellow. The coating should be well bonded to the metal and coherent within itself showing no dusting of the surface.

(3) Etching

Etching shall be performed using specially designed chemical conversion tanks and either an acidic or alkaline etch solution. Time, temperature, and concentration may vary depending on the type of solution. Contact the solution manufacturer for details. Always rinse thoroughly using a high pressure wash with clean water and allow complete drying.

(4) Blank Handling

The aluminum shall not be handled except by a mechanical device or with clean canvas gloves between the cleaning and etching operation and the application of retroreflective sheeting. There shall be no opportunity for the aluminum to come in contact with greases, oils, or other contaminants prior to the application of sheeting or film. Immediately prior to the application of the sheeting, should it be necessary to remove any residue wipe the surface of the substrate with a solvent in the following manner:

- Saturate a clean cloth with an alcohol based solvent, mineral spirits, or a similar commercial solvent making sure the solvent is absolutely clean. Continual use from the same solvent container can result in contamination.
- Wipe the surface thoroughly, including areas near the edges where handling occurs.
- With a dry, clean, lint-free cloth wipe the surface clean before the solvent evaporates.

(5) Cleanliness Tests

There are two types of tests to verify that the aluminum substrate has not become soiled during handling prior to application of the sheeting. The tests should be conducted as follows:

- Tape Snap Test — Press onto the surface a 3"- 5" length of common transparent self-adhesive tape. After several seconds, lift it off quickly at a right angle and inspect for evidence of transferred material or indications of a contaminated surface for metal substrates.
- Water-Break Test — Minute traces of grease, oil or wax can be detected by pouring clean water onto the surface. On a clean surface, water tends to hold a uniform film. On a contaminated surface, the water beads up into many small droplets.

b. Application of Sheeting

(1) Temperatures

Retroreflective sheeting shall not be applied when the ambient air temperature, the temperature of the aluminum sign blank and the sheeting is below 65º F (18.3ºC).

(2) Pressure Sensitive Adhesive

The retroreflective sheeting material shall be applied according to the manufacturer's recommendations. The sheeting shall be applied to the sign substrate by mechanical squeeze roll applicator, hand squeeze roll applicator or hand application.

(3) Screen Processing

Screen processed signs are not allowable.

(4) Electronic Cuttable Film

Cutting of film and fabrication of the sign shall conform to manufacturer's recommended practices. The film may be applied to the sheeting either before or after the sheeting has been applied to the substrate. Use of a hand squeeze roll laminator is recommended to ensure satisfactory results. Use the "split liner method" starting in the middle of the sheet and remove half the liner to ensure proper alignment.

c. Sign Installation

This specification covers the field installation of permanent traffic control signs, consisting of retroreflective sheeting mounted on an aluminum substrate. Signs will either be installed on a square, steel, breakaway sign post assembly as herein specified or streetlight or traffic signal pole or mast arm according to the plans.

(1) General Requirements

The Contractor shall locate the signs in the field in accordance with the Plans, the Manual on Uniform Traffic Control Devices (latest edition), and subject to the approval of the Engineer. Dimensions on the detailed drawings on the Plans shall take precedence. The Contractor will be responsible for orientation, elevation, offset and level of all signs erected. All sign posts shall be plumb. Any post that is leaning shall be replaced. The Contractor shall verify, prior to erecting any sign, that underground utilities will not be damaged as a result of placing the sign post.

Ground mounted signs shall be erected so the sign face is truly vertical and at 93 degrees away from the center of the lane(s) which the sign serves, and the direction of travel unless otherwise shown on the Plans or directed by the Engineer. Signs mounted on the mast arm of a traffic signal pole shall be angled down 3 degrees toward the pavement surface.

The height of the sign, measured from the finished ground surface or pavement to the bottom of a single sign, shall be 7'-0" unless otherwise indicated in the standard details. Exceptions would be for object markers which should be mounted 4'-0" above the finished ground surface or pavement to the bottom of the sign. If a secondary sign is mounted below another sign, the height, measured from the

finished ground surface to the bottom of the secondary sign may be 6'-0". In the case where a sign is located in a pedestrian walkway or the sign face extends more than 4'-0" into a pedestrian walkway, the height to the bottom of the lowest mounted sign shall not be less than 80" measured from the finished surface of the walkway.

(2) Sign Installation on a Square, Steel, Breakaway Sign Post

The sign post anchor shall be driven partially into the ground using a drive cap with sledge hammer or power equipment. The method of driving shall not substantially alter the cross-sectional dimensions of the posts or materially damage the coating. All areas where the galvanizing has been removed or damaged shall be cleaned and painted with zinc rich paint. Battered tops will not be permitted. If rock is encountered, where the anchor cannot be driven at least 3' deep, the contractor shall be required to core the hole and backfill the anchor with concrete, at the inspector's discretion. The anchor sleeve shall then be slipped over the anchor and driven into the ground together with the sign post anchor. The sign post should then be slipped into the post anchor and bolted in place using the corner bolt as indicated in the detail drawings. The first hole above the finished grade level in all three post components shall be lined up in order to correctly insert the corner bolt. One single sign post long enough to support all signs shall be installed. Two separate lengths of post joined with a sleeve to achieve the necessary post length shall not be allowed.

The sign shall generally be installed on the post with the top of the sign one inch above the top of the sign post. Exceptions to this would be when street name signs are installed above the traffic sign as indicated in the standard details. The mounting holes in the sign shall be located 3" in from the top and bottom of the sign face. Signs should be mounted on the square post with a hex head bolt extending through the entire post cross section and fastened with a stainless steel washer and hex head lock nut as indicated in the standard details. Signs shall require both a flat plastic or fiber washer and a stainless steel washer with the plastic or fiber washer being placed against the sign face

(3) Sign Installation on Round Signal or Streetlight Poles

Signs located on the vertical shaft of signal poles or streetlight poles shall be attached with flared leg stand-off brackets and ¾" stainless steel banding and buckle as indicated in the standard details or unless otherwise indicated in the plans. The number of brackets and banding is based on the size of the sign. Refer to the standard details for more information. The mounting holes in the sign face for attachment to the mounting brackets shall be offset from the edge of the sign a minimum of 2". Exceptions for ground mounted street name signs and overhead mounted street name signs are indicated in the following section. Signs located on the mast arm of traffic signal poles shall have the holes in the sign face located such that the sign is level.

(4) Installation of Signs on Traffic Signal Mast Arms

All R10 series signs, as designated by the MUTCD, and overhead street name signs shall be mounted to mast arms with cable mount or ¾" stainless steel banding mount sign brackets as detailed in the standard details and specified herein. Signs shall require both a flat plastic or fiber washer and a stainless steel washer with the plastic washer being placed against the sign face. The sign mounting hardware on the back side of the sign shall include a flat stainless steel washer and stainless steel hex head lock nut.

Overhead street name signs shall have mounting holes placed along the horizontal dimension of the sign blank. Holes should be located at least 12" in from the edge of the sign and placed such that the sign, when mounted on a mast arm with an upward rake, is level with the horizon. For signs greater than 2,000 square inches, an additional clamp shall be used.

Overhead street name signs shall generally be located on the mast arm between the vertical pole shaft and the first through vehicle signal head on the mast arm, according to the standard details. The location of the overhead street name sign and the vehicle pre-emption device shall be coordinated during construction such that the pre-emption device is not located behind the sign.

(5) Installation of Ground Mounted Street Name Signs

Ground mounted street name signs shall be attached either to square steel tubular posts or round street light poles as indicated in the plans and according to the standard details. The street name sign for the major street shall be mounted above the street name sign for the minor street.

When installed on square, steel tubular posts, two signs shall be provided and mounted on opposite sides of the post and be fastened with a hex head bolt that extends through the post and both signs and terminated with a hex head lock nut. A stainless steel washer and a flat plastic or fiber washer shall be installed on each side of the post with the flat plastic or fiber washer installed adjacent to the finished sign face. The mounting holes shall be located at the center of the sign and placed 1" from the top and bottom edge of the sign. Holes shall also be located on each end of the sign ½" in from the edge of the sign for a tubular PVC spacer and aluminum pop rivet to provide stability for the dual sign blanks.

At skewed intersections, the contractor shall install two "round to square" post couplers and indicated in the standard details and orient the signs at the appropriate angle to match each street. The minimum mounting height, measured from the finished ground surface to the bottom of the lowest street name sign shall be 10'-6" or as indicated in the standard details. One single sign post long enough to support all signs shall be installed. Two separate lengths of post joined with a sleeve to achieve the necessary post length shall not be allowed.

When installed on a round street light pole, the sign blank shall be fabricated with sheeting on both sides and installed with a L-shaped wing bracket as indicated in the standard details. The wing bracket shall be mounted to the round pole by two ¾" stainless steel bands and buckles. One wing bracket shall be installed per each sign. Cross brackets shall not be permitted.

(6) Concrete Surface Mount Sign Post Anchor

Signs to be ground mounted on concrete surfaces such as concrete median noses, concrete bridge deck medians, etc. shall be installed with a reusable breakaway concrete surface mount anchor as indicated in the standard details. Anchors shall be installed using ½" x 6" long concrete wedge type anchors. Galvanized steel washers may be used as shims on sloped concrete surfaces for leveling.

(7) Concrete Paver Stone Sign Post Anchor and Sleeve

Signs to be ground mounted in medians or islands that have paver stone surfaces shall be installed with a reusable breakaway anchor and sleeve as indicated in the standard details. The anchor sleeve shall be installed in a PVC sleeve through the concrete paver stone and concrete base such that the top of the lower half of the coupler, when inserted into the anchor sleeve, will be flush with the finished concrete paver stone surface. After installation, the PVC sleeve shall be backfilled with concrete.

d. Existing Signs

The Contractor shall preserve all existing traffic control signs in useful condition so as to provide traffic control during construction. All existing signs shall be maintained in order to provide proper warning, guidance or regulatory information to the traveling public until new signs are erected according to the plans. All existing traffic signs except those signs to be removed shall be reused and relocated, as shown on the plans, after construction. All existing signs that are to be removed after construction shall be carefully protected and shall be returned to the City according to the "Instructions for Disassembly and Return of Traffic Sign Equipment" as listed in the standard details. There will be no direct measurement or payment for this work.

e. Pre-Qualification

Manufacturers interested in pre-qualifying material under this specification shall submit a sample of the material along with a complete materials specification for each item to be considered. The sample will be reviewed for compliance with all requirements of this specification. No material shall be used unless the material has been pre-qualified. A complete list of pre-qualified materials is maintained by the Traffic Engineering Division of the Department of Public Works.

1060.4 MEASUREMENT AND PAYMENT

(1) The Engineer will measure permanent traffic control signs by the square foot, including the retro-reflective sheeting of the appropriate type as listed in the proposal and indicated in the plans, installed on a properly prepared aluminum substrate.

(a) One Sided Signs

Measurement for a single sided sign shall be based on the size of the exposed sign face.

(b) Double Sided Signs

Measurement for a double sided ground mounted street name sign will be based on one sign blank, sized according to plan, with two times the area for sheeting.

(2) The Engineer will measure the 1 ¾" x 1 ¾" sign posts by the linear foot, according to the length as specified in the plans for each sign installation.

(3) The Engineer will measure the 2" x 2" sign post anchor by the linear foot.

(4) The Engineer will measure the 2 ¼" x 2 ¼" anchor sleeves by the linear foot.

(5) The Engineer will measure the concrete surface mount anchors per each.

(6) The Engineer will measure the concrete paver stone anchor and sleeve per each.

Payment for "Permanent Traffic Control Signs", "1 ¾" x 1 ¾" Sign Posts", "2" x 2" Sign Post Anchors", "2 ¼" x 2 ¼" Anchor Sleeves", "Concrete Surface Mount Anchor" and "Concrete Paver Stone Anchor and Sleeve" at the contract unit prices bid, which includes all labor, materials, tools and equipment necessary to fully complete the installation according to the plans and specifications, is full compensation for the specified work. No separate payment will be made for the removal of or reinstallation of existing signs to maintain traffic during construction prior to installing new signs in approximately the same location. No separate payment will be made for any mounting brackets, banding or miscellaneous hardware. Such work shall be considered subsidiary to other bid items.

a. Lump Sum

The Engineer will measure the permanent traffic control signing as indicated on the plans, complete-in-place and accepted as a unit lump sum quantity for all work necessary.

Payment for "Permanent Traffic Control Signs" at the contract lump sum price bid is full compensation for the specified work. No measurement shall be made for the removal of existing traffic control signs prior to installing new signs in the same location. Such work shall be considered subsidiary to "Permanent Traffic Control Signs"

b. Unit Bid Prices

(1) The Engineer will measure permanent traffic control signs by the square foot, including the retro-reflective sheeting of the appropriate type as listed in the proposal and indicated in the plans, installed on a properly prepared aluminum substrate.

(a) One Sided Signs

Measurement for a single sided sign shall be based on the size of the exposed sign face.

(b) Double Sided Signs

Measurement for a double sided ground mounted street name sign will be based on one sign blank, sized according to plan, with two times the area for sheeting.

(2) The Engineer will measure the 1 ¾" x 1 ¾" sign posts by the linear foot, according to the length as specified in the plans for each sign installation.

(3) The Engineer will measure the 2" x 2" sign post anchor by the linear foot.

(4) The Engineer will measure the 2 ¼" x 2 ¼" anchor sleeves by the linear foot.

(5) The Engineer will measure the concrete surface mount anchors per each.

(6) The Engineer will measure the concrete paver stone anchor and sleeve per each.

Payment for "Permanent Traffic Control Signs", "1 ¾" x 1 ¾" Sign Posts", "2" x 2" Sign Post Anchors", "2 ¼" x 2 ¼" Anchor Sleeves", "Concrete Surface Mount Anchor" and "Concrete Paver Stone Anchor and Sleeve" at the contract unit prices bid, which includes all labor, materials, tools and equipment necessary to fully complete the installation according to the plans and specifications, is full compensation for the specified work. No separate payment will be made for the removal of or reinstallation of existing signs to maintain traffic during construction prior to installing new signs in approximately the same location. No separate payment will be made for any mounting brackets, banding or miscellaneous hardware. Such work shall be considered subsidiary to other bid items.