



## Florida Department of Transportation

**CHARLIE CRIST**  
GOVERNOR

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SECRETARY

June 29, 2009

Monica Gourdine  
Program Operations Engineer  
Federal Highway Administration  
545 John Knox Road, Suite 200  
Tallahassee, Florida 32303

Re: Office of Design, Specifications  
Section 700  
Proposed Specification: 7000000 Highway Signing.

Dear Ms. Gourdine:

We are submitting, for your approval, two copies of the above referenced Supplemental Specification.

These changes were proposed by Chester Henson to specify all signs are to be aluminum to be consistent with the Department's Design Standards; to delete references to u-channel sign supports as they are only allowed for temporary construction (temporary construction sign supports were moved to the maintenance of traffic section); and to provide language for drilled shaft foundations in addition to spread footing foundations because shafts are used on overhead sign assemblies.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to ST986RP or rudy.powell@dot.state.fl.us.

If you have any questions relating to this specification change, please call Rudy Powell, State Specifications Engineer at 414-4280.

Sincerely,

Rudy Powell, Jr., P.E.  
State Specifications Engineer

RP/dt

Attachment

cc: Gregory Jones, Chief Civil Litigation  
Florida Transportation Builders' Assoc.  
State Construction Engineer

**HIGHWAY SIGNING.****(REV 65-291713-09)**

SECTION 700 (of the Supplemental Specifications) is deleted and the following substituted:

**700-1 Description.**

Furnish and erect aluminum ~~or steel~~ roadway signs, with supporting posts or columns, at the locations shown in the plans, in accordance with the details shown in the plans. Reflecterize all signs, and, when so specified in the plans, provide overhead signs with lighting. *All overhead cantilever and truss mounted signs are to be lighted unless otherwise noted in the plans. Signs shall be retroreflective unless otherwise specified.*

The Department designates Ground Traffic Signs as all signs erected on the shoulders, slopes, or medians, but not extending over the traveled roadway.

The Department designates signs erected partially or completely over the traveled roadway or mounted on bridges as Overhead Traffic Signs, and may further classify some of these signs as Overhead Cantilever Traffic Signs.

**700-2 Sign Assembly Design Requirements.**

**700-2.1 General:** Sign assemblies as specified in the plans fall into two general categories: ground sign assemblies, and overhead sign assemblies.

~~Use any combination of sign materials described below. The Contractor may utilize different combinations for each type of sign assembly. However, ensure that the material combination used for each type is the same within the Contract.~~

**700-2.2 Sign Panels:** All sign panels shall be aluminum. ~~unless otherwise designated in the plans.~~

~~If using galvanized steel for the sign panels, provide the same dimensions, including the thickness, as those shown in the Contract Documents for aluminum.~~

Fabricate standard sign panel messages in accordance with details included in the Standard Highway Signs Manual published by the U.S. Department of Transportation. The Engineer will not require the submittal of shop drawings for these signs or for non-standard sign panels and messages fabricated in accordance with details shown in the plans. Submit seven copies of shop drawings indicating detailed layout of the sign legend, spacing, and border for all other signs to the Engineer prior to fabrication.

If the size of a sign is not specified in the plans, provide the size sign for conventional roadways as shown in the MUTCD.

**700-2.3 Breakaway Support Mechanisms:**

**700-2.3.1 Frangible Supports:** Provide posts for all frangible sign assemblies consisting of aluminum tubes up to 3 1/2 inches outside diameter with 3/16 inch wall thickness; ~~or galvanized steel U-Channel up to 3 lb/ft as and listed on the Qualified Products List (QPL).~~ *Alternatives to the round aluminum tubes shall meet the requirements of NCHRP 350, Structures Manual for wind load requirements and be listed on the Qualified Products List (QPL).*

**700-2.3.2 Slip Bases:** For posts with slip base assemblies, use ~~either aluminum or galvanized steel~~ in accordance with the requirements in the Design

Standards. Alternative slip plane, plastic hinge, fracture elements, or combination sign support systems meeting the requirements of NCHRP 350 and Structures Manual wind load requirements may be used, subject to approval by the Department and listing on QPL. The QPL shall classify these systems as directional or omni-directional systems.

~~700-2.4 Temporary Construction Sign Supports: Provide steel flanged U-channel consisting of rerolled rail steel or an equivalent billet steel, meeting the mechanical requirements of ASTM A 499, Grade 60, and meeting the chemical requirements of ASTM A 1. For each U-channel, punch or drill 3/8 inch diameter holes on 1 inch centers through the center of the post, starting approximately 1 inch from the top and extending the full length of the U-post. Ensure that the weight per foot of a particular manufacturer's U-channel size does not vary more than  $\pm 3\frac{1}{2}\%$  of its specified weight per foot. Taper the bottom end of the U-channel post for easier installation. Machine straighten the U-channel to a tolerance of 0.4% of the length. U-channel sign supports are listed on QPL.~~

~~Provide steel components that have been galvanized after fabrication in accordance with ASTM A 123 and have a smooth uniform finish free from defects affecting strength, durability, and appearance.~~

~~Attach the sign to the structural member using hardware meeting the manufacturer's recommendations and as specified in the Design Standards. Use attachment hardware (nuts, bolts, clamps, brackets, braces, etc.) of a non-corrosive metal, aluminum, or galvanized steel, meeting the vendor requirements specified on the QPL Drawings.~~

#### **700-2.54 Overhead Sign Structures:**

**700-2.54.1 Department's Design:** When the overhead sign structure is detailed in the plans, submit shop drawings to the Department for approval as specified in Section 5. Prior to the submittal of the shop drawings, determine the actual length of support columns for all sign structures on the basis of existing field conditions and include these lengths on the shop drawings.

**700-2.54.2 Contractor's Design:** When the overhead sign structure is not detailed in the plans, submit to the Department a foundation design and a sign structure design utilizing steel structural members. Meet the requirements of this Section and the FDOT Structures Manual.

Have designs and shop drawings prepared by a Specialty Engineer or the Contractor's Engineer of Record, and submit them to the Department for review and approval in accordance with Section 5.

Determine the actual length of support columns for all sign structures on the basis of existing field conditions, and include these lengths in the shop drawings and calculations.

**700-2.54.3 Installation:** Install nuts on anchor bolts in accordance with 649-5 and 649-6. Use ASTM A325 bolt, nut and washer assemblies for all installations other than anchor bolts as follows. Use bolt, nut and washer assemblies that are free of rust and corrosion and that are lubricated properly as demonstrated by being able to easily hand turn the nut on the bolt thread for its entire length. Tighten nuts to the full effort of an ironworker using an ordinary spud wrench to bring the faying surfaces of the assembly into full contact which is referred to as snug tight condition. After bringing the faying surfaces of the assembly into full contact and to a snug tight condition, tighten nuts to

achieve the minimum torque as specified in Table 700-1 unless the connection is an alternate splice connection of a span sign structure, in which case, tighten nuts in accordance with the turn-of-nut method of Table 460-7 of Section 460. Maintain uniform contact pressure on the faying surfaces during snugging and the subsequent final tightening process, by using a bolt tightening pattern that balances the clamping force of each bolt, as closely as possible, with the equal clamping force of a companion bolt. Within 24 hours after final tightening, the Engineer will witness a check of the minimum torque using a calibrated torque wrench for 3 bolts or a minimum of 10% of the bolts, whichever is greater, for each connection; however, do not perform this check on alternate splice connections of span sign structures.

Bolt Diameter (in.)	Minimum Torque (ft.-lbs.)
3/8	15
1/2	37
5/8	74
3/4	120
7/8	190
1	275
1 1/8	375
1 1/4	525

**700-2.65 Sign Background *Retroreflective Sheeting*:** Meet the requirements of Section 994. Use Type III, IV, V or VII sheeting for background sheeting, white legends, borders and shields on all signs, excluding STOP, DO NOT ENTER, and WRONG WAY. Use Type VII sheeting for STOP, DO NOT ENTER and WRONG WAY signs. Use Type III, IV, V or VII yellow-green fluorescent sheeting for S1-1 school advance signs and supplemental panels used with S1-1, S3-1 and S4-5 school signs. Do not mix signs having fluorescent yellow-green sheeting with signs having yellow *retro*reflective sheeting.

Use fluorescent orange Type VI or VII for all orange work zone signs.

Mesh signs shall meet the color, daytime luminance and nonreflective property requirements of Section 994, Type VI.

### 700-3 Materials.

**700-3.1 General:** Meet the materials requirements shown below and any additional requirements which the plans might show.

**700-3.2 Concrete:** ~~For footings, u~~ Use concrete meeting the requirements of Section 346.

**700-3.3 Reinforcing Steel:** For reinforcing steel in footings, meet the requirements of Section 415.

#### 700-3.4 Aluminum Materials:

**700-3.4.1 General:** For aluminum materials, meet the general provisions of 965-1.

**700-3.4.2 Sheets and Plates:** For aluminum sheets and plates for sign panels, meet the requirements of ASTM B 209, Aluminum Association Alloy 6061-T6, 5154-H38 or 5052-H38 and those shown in the plans.

**700-3.4.3 Extruded Tubing:** For extruded aluminum tubing, meet the requirements shown in the plans.

**700-3.4.4 Castings:** Provide aluminum castings of the alloys shown in the plans. For aluminum alternates the Engineer will allow a cast base, provided the Contractor submits test reports giving evidence that the base to be used for each pole size is as strong as the pole with which it is to be used. Perform physical tests and submit certified reports for one base to be used with each pole size. Use Alloy A 356-T6 for the castings. Use aluminum bolts for connecting parts of the cast base.

**700-3.4.5 Channels:** For aluminum channels, meet the requirements of ASTM B 308 for the alloys shown in the plans.

**700-3.4.6 Bolts, Nuts, and Lockwashers:** For aluminum bolts, nuts, and lockwashers, meet the requirements shown in the plans. Ensure that finished bolts and washers are given an anodic coating of at least 0.0002 inch in thickness and are chromate-sealed.

#### **700-3.5 Steel:**

**700-3.5.1 General:** Only use structural steel, including bolts, nuts, and washers, that have been hot dip galvanized or metalized after fabrication. Perform hot dip galvanizing in accordance with ASTM A 123 or ASTM A 153 and metalizing in accordance with Section 562. For galvanized steel members, ~~except plate for sign panels,~~ meet the general requirements of Section 962 and the specific requirements of 962-9. ~~For steel plate for use as sign panels, meet the requirements of ASTM A 283 for either Grade C or Grade D.~~

**700-3.5.2 Specific Uses of Aluminum and Galvanized Steel:** Use aluminum bolts, nuts, and hardware to connect parts of the cast base.

Use galvanized steel anchor bolts for anchoring base plates to concrete bases and for the nuts and washers.

For all other metal parts *of the cast base*, the Engineer will allow galvanized steel as an alternate to aluminum.

**700-3.6 Bearing Pads:** For bearing pads, meet the requirements of 932-2.

**700-3.7 Retroreflective Sheeting:** All retroreflective sheeting must be listed on the QPL and meet the retroreflective sheeting requirements of Section 994.

**700-3.8 Process Colors:** Use transparent and black opaque process colors listed on the QPL meeting the requirements of 994-4 on retroreflective and nonreflective sheeting.

#### **700-4 Preparation of Sign Blanks.**

##### **700-4.1 De-greasing and Etching for Aluminum Sign Blanks:**

**700-4.1.1 General:** Prior to the application of *retro*reflective sheeting, use any of the methods shown below to de-grease and etch the aluminum sign blanks.

**700-4.1.2 Hand Method:** Under this method, de-grease and etch the blanks in one operation, using steel wool (medium grade) with any of the following combinations of materials:

(1) An abrasive cleanser of a commercial grade kitchen scouring powder.

(2) Acid and a suitable detergent solution.

(3) An alkaline solution.

Thoroughly rinse the blanks with clean water following all hand de-greasing operations.

**700-4.1.3 Power-Washer Method:** Under this method, de-grease the blanks with an inhibited alkaline cleanser, by spraying for 90 seconds with the solution between 135 and 249°F, the exact temperature to be as recommended by the manufacturer of the cleanser. After the spraying, rinse the blanks with clean water. Then etch the blanks by immersing them in a 6 to 8% solution of phosphoric acid at a temperature of 100 to 180°F for 60 seconds. After immersion, rinse the blanks in clean water.

**700-4.1.4 Immersion Method:** Under this method, de-grease the blanks by immersing them in a solution of inhibited alkaline cleanser at a temperature between 160 and 180°F for three to five minutes, and then rinsing with clean water. Then etch blanks by immersing them in a 6 to 8% solution of phosphoric acid at a temperature of 100°F for three minutes. After immersion, rinse the blanks in clean water.

**700-4.1.5 Vapor De-greasing Method:** Under this method, de-grease the blanks by totally immersing them in a saturated vapor of trichloroethylene. Remove trademark printing with lacquer thinner or a controlled alkaline cleaning system.

**700-4.1.6 Alkaline De-greasing Method:** De-grease the blanks by totally immersing them in a tank containing an alkaline solution, controlled and titrated in accordance with the solution manufacturer's directions. Adapt immersion time to the amount of soil present and the thickness of the metal. After immersion, thoroughly rinse the blanks with running water.

**700-4.1.7 Etching Method when De-greasing is Separate Operation:** If using either of the de-greasing methods described under 700-4.1.5 and 700-4.1.6, accomplish etching by one of the following alternate methods:

(1) Acid Etch: Etch well in a 6 to 8% phosphoric acid solution at 100°F, or in a proprietary acid etching solution. Rinse thoroughly with running cold water, which may be followed by a hot water rinse.

(2) Alkaline Etch: Etch aluminum surfaces in an alkaline etching material that is controlled by titration. Meet the time, temperature, and concentration requirements specified by the solution manufacturer. After completing etching is complete, rinse the panel thoroughly.

**700-4.2 Drying:** Dry the panels using a forced-air drier. Use a device or clean canvas gloves, to handle the material between all cleaning and etching operations and the application of *retro*reflective sheeting. Do not allow the metal to come in contact with greases, oils or other contaminants prior to the application of *retro*reflective sheeting.

**700-4.3 Fabrication of Sign Blanks:** Fabricate all metal parts to ensure a proper fit of all sign components. Complete all fabrication, with the exception of cutting and punching of holes, prior to metal de-greasing and applying the *retro*reflective sheeting. Cut metal panels to size and shape and keep free of buckles, warp, dents, burrs, and defects resulting from fabrication. Provide all sign panels with a flat surface. ~~Where signs are to be fabricated from galvanized steel, cut the plates to the required size and drill prior to galvanizing.~~

## **700-5 Fabrication of *Retro*reflectORIZED Sign Faces.**

**700-5.1 Application of Sheeting:** Apply *retro*reflective sheeting to the base panels with mechanical equipment in a manner specified for the manufacture of traffic control signs by the sheeting manufacturer. Ensure that sheeting applied to extruded aluminum sections adheres over and around the side legs of all panels to a minimum distance of 1/16 inch beyond the radius of top edge.

Match sign faces comprising two or more pieces of *retro*reflective sheeting for color and *retro*reflectivity at the time of sign fabrication. Reverse and apply consecutively alternate successive width sections of either sheeting or panels to ensure that corresponding edges of sheeting lie adjacent on the finished sign. The Engineer will not accept nonconformance that may result in non-uniform shading and an undesirable contrast between adjacent widths of applied sheeting.

**700-5.2 Finish:** Seal *retro*reflective sheeting splices and sign edges with materials the sheeting manufacturer supplies in a manner the sheeting manufacturer specifies for traffic control signs.

**700-5.3 Screening-on Message:** Screen message and borders on *retro*reflective sheeting in accordance with the recommendations of the ink or overlay manufacturer. Process either before or after applying the sheeting to the base panels.

**700-5.4 Finished Sign Face:** Provide finished signs with clean cut and sharp messages and borders. Ensure that finished background panels are essentially a plane surface.

**700-5.5 Stenciling:** For permanent roadway signs, mark the back of all finished panels at the bottom edge with "FDOT", the date of fabrication, the date of installation, and the fabricator's initials. ~~For construction signs, mark the back of all finished panels at the bottom edge with the date of fabrication and the fabricator's initials.~~ Make the markings unobtrusive, but legible enough to be easily read by an observer on the ground when the sign is in its final position. Apply the markings in a manner that is at least as durable as the sign face.

~~**700-5.6 Product Changes:** If changes in the formulation of the sheeting occur, submit new samples for re-evaluation for continued approval.~~

## **700-6 Acceptance of Signs.**

**700-6.1 Manufacturer's Certification and Recommendations:** Ensure that the sign manufacturer certifies that the delivered signs conform to this Section and provides recommendations for storing and repairing signs.

**700-6.2 Packaging and Shipping:** Have the manufacturer package and ship the signs in a manner which will minimize possible damage.

**700-6.3 Storage of Signs:** If signs are stored prior to installation, store them in accordance with the manufacturer's recommendations.

**700-6.4 Sign Inspection:** Do not install signs until the Engineer inspects them for conformance with this Section. Provide all manufacturer certifications and recommendations prior to the Engineer's inspection. The Engineer will inspect the signs upon delivery to the storage or project site and again at the final construction inspection. Repair and replace signs deemed unacceptable by the Engineer at no expense to the Department.

**700-6.5 Imperfections and Repairs:** Repair and replace signs containing imperfections or damage regardless of the kind, type, or cause of the imperfections or

damage. Make repairs according to the manufacturer's recommendations and to the satisfaction of the Engineer. Ensure that completed repairs provide a level of quality necessary to maintain the service life warranty of the sign and are satisfactory in appearance to the Engineer.

## **700-7 Footings for Signs, Posts and Supports Foundations.**

### **700-7.1 Footings**

**700-7.1.1 Excavation and Backfilling:** Perform excavation and backfilling for the footings in accordance with Section 125, with the exceptions that no specific density is required and that the backfill may be tamped in 4 inches maximum layers. Use material that is at near optimum moisture and neither dry or saturated, and tamp to the extent directed by the Engineer. The Department may require that the backfilling be done with poured concrete.

Install spread footings which support sign structures overhanging the roadway as required in 455-25 through 455-37.

**700-7.1.2 Mixing and Placing Concrete:** For batching and mixing of concrete for footings, meet the requirements of Section 346, except that the Engineer will allow hand mixing by approved methods where the quantity to be mixed does not exceed 1/2 yd<sup>3</sup>. Use cast-in-place or precast concrete for the footings. Obtain precast concrete footings from a plant that is currently on the list of Producers with Accepted Quality Control Programs. Producers seeking inclusion on the list shall meet the requirements of 105-3.

**700-7.1.3 Forms:** The Engineer will not require forms when the ground is sufficiently firm, in which case, sufficiently moisten the adjacent earth to prevent it from absorbing the moisture from the concrete. Where forms are required and the soil is not moist, place sufficient water, as directed by the Engineer, in the hole, and pour the concrete as soon as the water has been absorbed. Place at least 4 inches of loose earth, free from clods or gravel, over the top of the footing to effect curing.

**700-7.1.4 Finishing Concrete:** Trowel the top of the concrete to a smooth finish.

**700-7.2 Drilled Shafts:** Meet the requirements of Section 455.

## **700-8 Erection of Signs and Sign Supports.**

Do not erect overhead sign supports until the concrete strength in the support footing is at least 2,500 psi. Determine concrete strength from tests on a minimum of two test cylinders sampled and tested in accordance with ASTM C 31 and ASTM C 39 and verifying test results have been provided to the Engineer.

Erect the signs and sign structures in accordance with the details shown in the plans. The Contractor may fabricate the structural steel sign trusses in sections that will fit into available galvanizing vats. Prior to galvanizing, weld the joints as specified in 460-6 and in accordance with the details shown in the plans. Re-galvanize damaged parts as specified in Section 562.

Weld aluminum structures in accordance with 965-3.

## **700-9 Removal or Relocation of Signs.**

Relocation of signs shall consist of removing the existing sign assembly and installing the sign on a new foundation.

When the plans call for existing ground-mounted signs to be relocated or removed, immediately remove supports and footings that project more than 6 inches above the ground surface after removing the sign panel from the assembly. Remove existing footings to a depth at least 12 inches below the ground surface. The costs will be included in the Contract unit price of the item to which it is incidental.

#### **700-10 Overlay Existing Sign Panels.**

Use 0.040-inch thick aluminum sheeting for overlays larger than 3 square feet placed on a sign panel. Replace hex head bolts on the sign surface using stainless steel flat head machine screws with nuts and lock washers to give a flat surface for the overlay panel. Install the overlay panels starting at the edge away from traffic. Place each panel against the sign using a clamp at the top to hold the panel in place. Drill 1/8-inch holes 1-inch inside the panel edge every 6-inches to 8-inches and install 1/4-inch to 3/8-inch length pop rivets. Install additional rivets along the outer edge 6-inches to 8-inches. Place the remaining panels using the same procedure with the overlap in the direction away from the traffic and with rivets along the overlap on 12-inch centers.

#### **700- 11 Method of Measurement.**

The quantities to be paid for will be:

- (1) The number of ground traffic signs of each designated class of assembly, complete.
- (2) The number of lighted overhead traffic signs of each designated class of assembly, complete.
- (3) The number of existing signs removed, relocated, modified of each designated class of assembly, complete.
- (4) The number of overhead signs span wire mounted, bridge mounted, and lighted sequential, of each designated class of assembly, complete.

For the purpose of payment, a sign assembly consists of all the signs mounted on a single structure (one, two or three posts, or overhead structure) or all the signs on a bridge mounted sign structure and the sign structure.

#### **700-12 Basis of Payment.**

Price and payment will be full compensation for furnishing and installation of all materials necessary to complete the signs in accordance with the details shown in the plans; including sign panels complete with sheeting, painting, and message; sign posts and supports, ~~footings~~ *foundations*, excavation, etc.; for the lighted signs, all costs of the electrical installation for lighting, up to the point of connection by others; and all other work specified in this Section, including all incidentals necessary for the complete item.

**HIGHWAY SIGNING.****(REV 6-29-09)**

SECTION 700 (of the Supplemental Specifications) is deleted and the following substituted:

**700-1 Description.**

Furnish and erect aluminum roadway signs, with supporting posts or columns, at the locations shown in the plans, in accordance with the details shown in the plans. All overhead cantilever and truss mounted signs are to be lighted unless otherwise noted in the plans. Signs shall be retroreflective unless otherwise specified.

The Department designates Ground Traffic Signs as all signs erected on the shoulders, slopes, or medians, but not extending over the traveled roadway.

The Department designates signs erected partially or completely over the traveled roadway or mounted on bridges as Overhead Traffic Signs, and may further classify some of these signs as Overhead Cantilever Traffic Signs.

**700-2 Sign Assembly Design Requirements.**

**700-2.1 General:** Sign assemblies as specified in the plans fall into two general categories: ground sign assemblies, and overhead sign assemblies.

**700-2.2 Sign Panels:** All sign panels shall be aluminum. Fabricate standard sign panel messages in accordance with details included in the Standard Highway Signs Manual published by the U.S. Department of Transportation. The Engineer will not require the submittal of shop drawings for these signs or for non-standard sign panels and messages fabricated in accordance with details shown in the plans. Submit seven copies of shop drawings indicating detailed layout of the sign legend, spacing, and border for all other signs to the Engineer prior to fabrication.

If the size of a sign is not specified in the plans, provide the size sign for conventional roadways as shown in the MUTCD.

**700-2.3 Breakaway Support Mechanisms:**

**700-2.3.1 Frangible Supports:** Provide posts for all frangible sign assemblies consisting of aluminum tubes up to 3 1/2 inches outside diameter with 3/16 inch wall thickness. Alternatives to the round aluminum tubes shall meet the requirements of NCHRP 350, Structures Manual for wind load requirements and be listed on the Qualified Products List (QPL).

**700-2.3.2 Slip Bases:** For posts with slip base assemblies, use galvanized steel in accordance with the requirements in the Design Standards. Alternative slip plane, plastic hinge, fracture elements, or combination sign support systems meeting the requirements of NCHRP 350 and Structures Manual wind load requirements may be used, subject to approval by the Department and listing on QPL. The QPL shall classify these systems as directional or omni-directional systems.

**700-2.4 Overhead Sign Structures:**

**700-2.4.1 Department's Design:** When the overhead sign structure is detailed in the plans, submit shop drawings to the Department for approval as specified in Section 5. Prior to the submittal of the shop drawings, determine the actual length of

support columns for all sign structures on the basis of existing field conditions and include these lengths on the shop drawings.

**700-2.4.2 Contractor's Design:** When the overhead sign structure is not detailed in the plans, submit to the Department a foundation design and a sign structure design utilizing steel structural members. Meet the requirements of this Section and the FDOT Structures Manual.

Have designs and shop drawings prepared by a Specialty Engineer or the Contractor's Engineer of Record, and submit them to the Department for review and approval in accordance with Section 5.

Determine the actual length of support columns for all sign structures on the basis of existing field conditions, and include these lengths in the shop drawings and calculations.

**700-2.4.3 Installation:** Install nuts on anchor bolts in accordance with 649-5 and 649-6. Use ASTM A325 bolt, nut and washer assemblies for all installations other than anchor bolts as follows. Use bolt, nut and washer assemblies that are free of rust and corrosion and that are lubricated properly as demonstrated by being able to easily hand turn the nut on the bolt thread for its entire length. Tighten nuts to the full effort of an ironworker using an ordinary spud wrench to bring the faying surfaces of the assembly into full contact which is referred to as snug tight condition. After bringing the faying surfaces of the assembly into full contact and to a snug tight condition, tighten nuts to achieve the minimum torque as specified in Table 700-1 unless the connection is an alternate splice connection of a span sign structure, in which case, tighten nuts in accordance with the turn-of-nut method of Table 460-7 of Section 460. Maintain uniform contact pressure on the faying surfaces during snugging and the subsequent final tightening process, by using a bolt tightening pattern that balances the clamping force of each bolt, as closely as possible, with the equal clamping force of a companion bolt. Within 24 hours after final tightening, the Engineer will witness a check of the minimum torque using a calibrated torque wrench for 3 bolts or a minimum of 10% of the bolts, whichever is greater, for each connection; however, do not perform this check on alternate splice connections of span sign structures.

Table 700-1	
Bolt Diameter (in.)	Minimum Torque (ft.-lbs.)
3/8	15
1/2	37
5/8	74
3/4	120
7/8	190
1	275
1 1/8	375
1 1/4	525

**700-2.5 Sign Retroreflective Sheeting:** Meet the requirements of Section 994. Use Type III, IV, V or VII sheeting for background sheeting, white legends, borders and shields on all signs, excluding STOP, DO NOT ENTER, and WRONG WAY. Use

Type VII sheeting for STOP, DO NOT ENTER and WRONG WAY signs. Use Type III, IV, V or VII yellow-green fluorescent sheeting for S1-1 school advance signs and supplemental panels used with S1-1, S3-1 and S4-5 school signs. Do not mix signs having fluorescent yellow-green sheeting with signs having yellow retroreflective sheeting.

Use fluorescent orange Type VI or VII for all orange work zone signs.

Mesh signs shall meet the color, daytime luminance and nonreflective property requirements of Section 994, Type VI.

### **700-3 Materials.**

**700-3.1 General:** Meet the materials requirements shown below and any additional requirements which the plans might show.

**700-3.2 Concrete:** Use concrete meeting the requirements of Section 346.

**700-3.3 Reinforcing Steel:** For reinforcing steel in footings, meet the requirements of Section 415.

#### **700-3.4 Aluminum Materials:**

**700-3.4.1 General:** For aluminum materials, meet the general provisions of 965-1.

**700-3.4.2 Sheets and Plates:** For aluminum sheets and plates for sign panels, meet the requirements of ASTM B 209, Aluminum Association Alloy 6061-T6, 5154-H38 or 5052-H38 and those shown in the plans.

**700-3.4.3 Extruded Tubing:** For extruded aluminum tubing, meet the requirements shown in the plans.

**700-3.4.4 Castings:** Provide aluminum castings of the alloys shown in the plans. For aluminum alternates the Engineer will allow a cast base, provided the Contractor submits test reports giving evidence that the base to be used for each pole size is as strong as the pole with which it is to be used. Perform physical tests and submit certified reports for one base to be used with each pole size. Use Alloy A 356-T6 for the castings. Use aluminum bolts for connecting parts of the cast base.

**700-3.4.5 Channels:** For aluminum channels, meet the requirements of ASTM B 308 for the alloys shown in the plans.

**700-3.4.6 Bolts, Nuts, and Lockwashers:** For aluminum bolts, nuts, and lockwashers, meet the requirements shown in the plans. Ensure that finished bolts and washers are given an anodic coating of at least 0.0002 inch in thickness and are chromate-sealed.

#### **700-3.5 Steel:**

**700-3.5.1 General:** Only use structural steel, including bolts, nuts, and washers, that have been hot dip galvanized or metalized after fabrication. Perform hot dip galvanizing in accordance with ASTM A 123 or ASTM A 153 and metalizing in accordance with Section 562. For galvanized steel members meet the general requirements of Section 962 and the specific requirements of 962-9.

**700-3.5.2 Specific Uses of Aluminum and Galvanized Steel:** Use aluminum bolts, nuts, and hardware to connect parts of the cast base.

Use galvanized steel anchor bolts for anchoring base plates to concrete bases and for the nuts and washers.

For all other metal parts of the cast base, the Engineer will allow galvanized steel as an alternate to aluminum.

**700-3.6 Bearing Pads:** For bearing pads, meet the requirements of 932-2.

**700-3.7 Retroreflective Sheeting:** All retroreflective sheeting must be listed on the QPL and meet the retroreflective sheeting requirements of Section 994.

**700-3.8 Process Colors:** Use transparent and black opaque process colors listed on the QPL meeting the requirements of 994-4 on retroreflective and nonreflective sheeting.

#### **700-4 Preparation of Sign Blanks.**

##### **700-4.1 De-greasing and Etching for Aluminum Sign Blanks:**

**700-4.1.1 General:** Prior to the application of retroreflective sheeting, use any of the methods shown below to de-grease and etch the aluminum sign blanks.

**700-4.1.2 Hand Method:** Under this method, de-grease and etch the blanks in one operation, using steel wool (medium grade) with any of the following combinations of materials:

(1) An abrasive cleanser of a commercial grade kitchen scouring powder.

(2) Acid and a suitable detergent solution.

(3) An alkaline solution.

Thoroughly rinse the blanks with clean water following all hand de-greasing operations.

**700-4.1.3 Power-Washer Method:** Under this method, de-grease the blanks with an inhibited alkaline cleanser, by spraying for 90 seconds with the solution between 135 and 249°F, the exact temperature to be as recommended by the manufacturer of the cleanser. After the spraying, rinse the blanks with clean water. Then etch the blanks by immersing them in a 6 to 8% solution of phosphoric acid at a temperature of 100 to 180°F for 60 seconds. After immersion, rinse the blanks in clean water.

**700-4.1.4 Immersion Method:** Under this method, de-grease the blanks by immersing them in a solution of inhibited alkaline cleanser at a temperature between 160 and 180°F for three to five minutes, and then rinsing with clean water. Then etch blanks by immersing them in a 6 to 8% solution of phosphoric acid at a temperature of 100°F for three minutes. After immersion, rinse the blanks in clean water.

**700-4.1.5 Vapor De-greasing Method:** Under this method, de-grease the blanks by totally immersing them in a saturated vapor of trichloroethylene. Remove trademark printing with lacquer thinner or a controlled alkaline cleaning system.

**700-4.1.6 Alkaline De-greasing Method:** De-grease the blanks by totally immersing them in a tank containing an alkaline solution, controlled and titrated in accordance with the solution manufacturer's directions. Adapt immersion time to the amount of soil present and the thickness of the metal. After immersion, thoroughly rinse the blanks with running water.

**700-4.1.7 Etching Method when De-greasing is Separate Operation:** If using either of the de-greasing methods described under 700-4.1.5 and 700-4.1.6, accomplish etching by one of the following alternate methods:

(1) Acid Etch: Etch well in a 6 to 8% phosphoric acid solution at 100°F, or in a proprietary acid etching solution. Rinse thoroughly with running cold water, which may be followed by a hot water rinse.

(2) Alkaline Etch: Etch aluminum surfaces in an alkaline etching material that is controlled by titration. Meet the time, temperature, and concentration requirements specified by the solution manufacturer. After completing etching is complete, rinse the panel thoroughly.

**700-4.2 Drying:** Dry the panels using a forced-air drier. Use a device or clean canvas gloves, to handle the material between all cleaning and etching operations and the application of retroreflective sheeting. Do not allow the metal to come in contact with greases, oils or other contaminants prior to the application of retroreflective sheeting.

**700-4.3 Fabrication of Sign Blanks:** Fabricate all metal parts to ensure a proper fit of all sign components. Complete all fabrication, with the exception of cutting and punching of holes, prior to metal de-greasing and applying the retroreflective sheeting. Cut metal panels to size and shape and keep free of buckles, warp, dents, burrs, and defects resulting from fabrication. Provide all sign panels with a flat surface.

### **700-5 Fabrication of Retroreflectorized Sign Faces.**

**700-5.1 Application of Sheeting:** Apply retroreflective sheeting to the base panels with mechanical equipment in a manner specified for the manufacture of traffic control signs by the sheeting manufacturer. Ensure that sheeting applied to extruded aluminum sections adheres over and around the side legs of all panels to a minimum distance of 1/16 inch beyond the radius of top edge.

Match sign faces comprising two or more pieces of retroreflective sheeting for color and retroreflectivity at the time of sign fabrication. Reverse and apply consecutively alternate successive width sections of either sheeting or panels to ensure that corresponding edges of sheeting lie adjacent on the finished sign. The Engineer will not accept nonconformance that may result in non-uniform shading and an undesirable contrast between adjacent widths of applied sheeting.

**700-5.2 Finish:** Seal retroreflective sheeting splices and sign edges with materials the sheeting manufacturer supplies in a manner the sheeting manufacturer specifies for traffic control signs.

**700-5.3 Screening-on Message:** Screen message and borders on retroreflective sheeting in accordance with the recommendations of the ink or overlay manufacturer. Process either before or after applying the sheeting to the base panels.

**700-5.4 Finished Sign Face:** Provide finished signs with clean cut and sharp messages and borders. Ensure that finished background panels are essentially a plane surface.

**700-5.5 Stenciling:** For permanent roadway signs, mark the back of all finished panels at the bottom edge with "FDOT", the date of fabrication, the date of installation, and the fabricator's initials. Make the markings unobtrusive, but legible enough to be easily read by an observer on the ground when the sign is in its final position. Apply the markings in a manner that is at least as durable as the sign face.

### **700-6 Acceptance of Signs.**

**700-6.1 Manufacturer's Certification and Recommendations:** Ensure that the sign manufacturer certifies that the delivered signs conform to this Section and provides recommendations for storing and repairing signs.

**700-6.2 Packaging and Shipping:** Have the manufacturer package and ship the signs in a manner which will minimize possible damage.

**700-6.3 Storage of Signs:** If signs are stored prior to installation, store them in accordance with the manufacturer's recommendations.

**700-6.4 Sign Inspection:** Do not install signs until the Engineer inspects them for conformance with this Section. Provide all manufacturer certifications and recommendations prior to the Engineer's inspection. The Engineer will inspect the signs upon delivery to the storage or project site and again at the final construction inspection. Repair and replace signs deemed unacceptable by the Engineer at no expense to the Department.

**700-6.5 Imperfections and Repairs:** Repair and replace signs containing imperfections or damage regardless of the kind, type, or cause of the imperfections or damage. Make repairs according to the manufacturer's recommendations and to the satisfaction of the Engineer. Ensure that completed repairs provide a level of quality necessary to maintain the service life warranty of the sign and are satisfactory in appearance to the Engineer.

## **700-7 Foundations.**

### **700-7.1 Footings**

**700-7.1.1 Excavation and Backfilling:** Perform excavation and backfilling for the footings in accordance with Section 125, with the exceptions that no specific density is required and that the backfill may be tamped in 4 inches maximum layers. Use material that is at near optimum moisture and neither dry or saturated, and tamp to the extent directed by the Engineer. The Department may require that the backfilling be done with poured concrete.

Install spread footings which support sign structures overhanging the roadway as required in 455-25 through 455-37.

**700-7.1.2 Mixing and Placing Concrete:** For batching and mixing of concrete for footings, meet the requirements of Section 346, except that the Engineer will allow hand mixing by approved methods where the quantity to be mixed does not exceed  $1/2 \text{ yd}^3$ . Use cast-in-place or precast concrete for the footings. Obtain precast concrete footings from a plant that is currently on the list of Producers with Accepted Quality Control Programs. Producers seeking inclusion on the list shall meet the requirements of 105-3.

**700-7.1.3 Forms:** The Engineer will not require forms when the ground is sufficiently firm, in which case, sufficiently moisten the adjacent earth to prevent it from absorbing the moisture from the concrete. Where forms are required and the soil is not moist, place sufficient water, as directed by the Engineer, in the hole, and pour the concrete as soon as the water has been absorbed. Place at least 4 inches of loose earth, free from clods or gravel, over the top of the footing to effect curing.

**700-7.1.4 Finishing Concrete:** Trowel the top of the concrete to a smooth finish.

**700-7.2 Drilled Shafts:** Meet the requirements of Section 455.

## **700-8 Erection of Signs and Sign Supports.**

Do not erect overhead sign supports until the concrete strength in the support footing is at least 2,500 psi. Determine concrete strength from tests on a minimum of two test cylinders sampled and tested in accordance with ASTM C 31 and ASTM C 39 and verifying test results have been provided to the Engineer.

Erect the signs and sign structures in accordance with the details shown in the plans. The Contractor may fabricate the structural steel sign trusses in sections that will fit into available galvanizing vats. Prior to galvanizing, weld the joints as specified in 460-6 and in accordance with the details shown in the plans. Re-galvanize damaged parts as specified in Section 562.

Weld aluminum structures in accordance with 965-3.

#### **700-9 Removal or Relocation of Signs.**

Relocation of signs shall consist of removing the existing sign assembly and installing the sign on a new foundation.

When the plans call for existing ground-mounted signs to be relocated or removed, immediately remove supports and footings that project more than 6 inches above the ground surface after removing the sign panel from the assembly. Remove existing footings to a depth at least 12 inches below the ground surface. The costs will be included in the Contract unit price of the item to which it is incidental.

#### **700-10 Overlay Existing Sign Panels.**

Use 0.040-inch thick aluminum sheeting for overlays larger than 3 square feet placed on a sign panel. Replace hex head bolts on the sign surface using stainless steel flat head machine screws with nuts and lock washers to give a flat surface for the overlay panel. Install the overlay panels starting at the edge away from traffic. Place each panel against the sign using a clamp at the top to hold the panel in place. Drill 1/8-inch holes 1-inch inside the panel edge every 6-inches to 8-inches and install 1/4-inch to 3/8-inch length pop rivets. Install additional rivets along the outer edge 6-inches to 8-inches. Place the remaining panels using the same procedure with the overlap in the direction away from the traffic and with rivets along the overlap on 12-inch centers.

#### **700- 11 Method of Measurement.**

The quantities to be paid for will be:

- (1) The number of ground traffic signs of each designated class of assembly, complete.
- (2) The number of lighted overhead traffic signs of each designated class of assembly, complete.
- (3) The number of existing signs removed, relocated, modified of each designated class of assembly, complete.
- (4) The number of overhead signs span wire mounted, bridge mounted, and lighted sequential, of each designated class of assembly, complete.

For the purpose of payment, a sign assembly consists of all the signs mounted on a single structure (one, two or three posts, or overhead structure) or all the signs on a bridge mounted sign structure and the sign structure.

#### **700-12 Basis of Payment.**

Price and payment will be full compensation for furnishing and installation of all materials necessary to complete the signs in accordance with the details shown in the plans; including sign panels complete with sheeting, painting, and message; sign posts and supports, foundations, excavation, etc.; for the lighted signs, all costs of the electrical

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installation for lighting, up to the point of connection by others; and all other work specified in this Section, including all incidentals necessary for the complete item.