Florida Department of Transportation

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GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

JOSÉ ABREU
SECRETARY

November 2, 2004

Mr. Donald Davis
Program Operations Engineer
Federal Highway Administration
545 John Knox Road
Tallahassee, Florida 32303

Re: Office of Design, Specifications
Section 700
Proposed Specification: 7000000.D01

Dear Mr. Davis:

We are submitting, for your approval, two copies of a proposed Supplemental Specification for Highway Signing.

This change was proposed Chester Henson of the State Design Office to remove porcelain enamel or fiberglass reinforced panels.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via Email to SP965DB or duane.brautigam@dot.state.fl.us.

If you have any questions relating to this specification change, please call Duane F. Brautigam, State Specifications Engineer at 414-4110.

Sincerely,

Signature on file

Duane F. Brautigam, P.E.
State Specifications Engineer

DFB/jf
Attachment
cc: General Counsel
Florida Transportation Builders' Assoc.
State Construction Engineer

HIGHWAY SIGNING.
(REV 9-20-04)

SECTION 700 (Pages 727-737) is deleted and the following substituted:

SECTION 700
HIGHWAY SIGNING

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. Reflectorize all signs, and, when so specified in the plans, provide overhead signs with lighting.

The Department designates Roadside 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 three general categories: frangible support ground sign assemblies, breakaway support 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: Use either aluminum or galvanized steel for any sign panel shown in the plans, regardless of its mounting type.

If using galvanized steel for the sign panels, provide the same dimensions, including the thickness, as those shown in the plans 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 of Record 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.

~~When the plans allow the use of porcelain enamel for lighted overhead signs, use only one type (reflectorized or porcelain enamel) throughout the Contract.~~

~~For panels 16 ft^2 [1.5 m^2] or less and sign panel overlays, the Contractor may use fiberglass reinforced plastic.~~

~~Provide fiberglass reinforced plastic panels in accordance with ASTM D 3841 and the following requirements and properties:~~

~~Use fiberglass reinforced plastic sign panels and overlay panels of a fiberglass reinforced thermoset polyester laminate. Use acrylic modified panels stabilized to withstand ultraviolet attack for outdoor weatherability.~~

~~Stabilize the panels so as not to release migrating constituents such as solvents, monomers, etc. Keep the surface of the laminate free from any residue release agents that will interfere with any subsequent bonding operations.~~

~~Do not use any panels containing visual cracks, pinholes, foreign inclusions, or surface wrinkles that would affect implied performance, alter the specific dimensions of the panels, or otherwise affect their serviceability.~~

~~Measure the mechanical properties in both the line direction of the panels and at 90 degrees to the line as noted in the appropriate test referenced below:~~

~~Mechanical Property~~	~~Minimum Requirement PSI [MPa]~~	~~Test~~
~~Tensile Strength~~	~~10,000 [70]~~	~~ASTM D 638 [ASTM D 638M]~~
~~Tensile Modulus~~	~~1,200,000 [8,300]~~	~~ASTM D 638 [ASTM D 638M]~~
~~Flexural Strength~~	~~20,000 [140]~~	~~ASTM D 790 [ASTM D 790M]~~
~~Flexural Modulus~~	~~1,200,000 [8,300]~~	~~ASTM D 790 [ASTM D 790M]~~
~~Compression Strength~~	~~32,000 [220]~~	~~ASTM D 695 [ASTM D 695M]~~
~~Compression Modulus~~	~~1,400,000 [9,700]~~	~~ASTM D 695 [ASTM D 695M]~~
~~Punch Shear~~	~~13,000 [90]~~	~~ASTM D 732 [ASTM D 732]~~

~~Provide panels with the following physical properties:~~

~~1. Panel Thickness:~~

~~a. Sign Panel: 0.135 inch [3.43 mm] (tolerance ±0.005 inch [±0.13 mm])~~

~~b. Overlay Panel: 0.075 inch [1.91 mm] (tolerance ±0.005 inch [±0.13 mm])~~

~~2. Panel Width and Length:~~

~~a. Sign Panel: Tolerance to ±0.09% of length when measured in accordance with ASTM D 3841.~~

~~b. Overlay Panel: Tolerance to ±0.1% of length or 0.3% of width when measured in accordance with ASTM D 3841.~~

~~3. Panel Squareness: Sign Panel and Overlay Panel - tolerance to ± 0.09% of length when measured in accordance with ASTM D 3841.~~

~~4. Panel Smoothness: Ensure that smoothness does not adversely affect the adhesion of the reflective sheeting or the legibility of a sign when fabricated from the panel.~~

~~5. Color: Apply a visually uniform Department green pigment to the panels.~~

~~6. Coefficient of Thermal Expansion: A maximum of 0.000018 in/in/ºF [0.000032 mm/mm/ºC)] when tested in accordance with ASTM D 696.~~

~~7. Weatherability: Classify the panel as to a minimum Grade II (weather resistant) panel as specified in ASTM D 3841 following a 3,000 ± 100 hour weatherometer test.~~

~~8. Fire Resistance: Ensure that the extent of burning does not exceed 1 inch [25 mm] when tested in accordance with ASTM D 635.~~

~~9. Panel Flatness: Provide five 30 by 30 inch [760 by 760 mm] fiber reinforced plastic panels for this test. Measure initial warpage in four directions: 0 degree, 45 degrees, 90 degrees and 135 degrees. To measure warpage, freely suspend the panel at one corner, and place a straight edge along the panel so that the edges of the panel touch the straight edge. Exercise care to avoid disturbing the dimensional characteristics of the panel. Use a rule graduated in inches [millimeters] to measure the distance from the center of the panel face to the straight edge. Measure that distance to the nearest 1/32 inch [1 mm] in all four directions. Ensure that the maximum deflection does not exceed 15/32 inch [12 mm].~~

~~Then, freely suspend the panels diagonally in an oven for 48 hours at 180ºF [82ºC]. After 48 hours in the oven, remove the panels and allow them to cool to room temperature freely suspended. Again, record the warpage measurements and corresponding direction as described above. Ensure that the maximum deflection does not exceed 15/32 inch [12 mm].~~

~~10. Thermal Stability: Do not allow temperatures ranging from -65 to 212ºF [-54 to 100ºC] to appreciably affect the strength and impact resistance qualities of the panels. Determine the coefficient of linear thermal expansion in accordance with ASTM D 696.~~

~~11. Impact Resistance:~~

~~a. Sign Panel: Use a 1.18 pound [0.535 kg] falling ball test in accordance with ASTM D 3841 to ensure that the panel resists an impact of the ball dropped at 60 feet [18 m].~~

~~b. Overlay Panel: Use a 5.0 pound [2.27 kg] falling ball test in accordance with ASTM D 3841, to ensure that the panel resists an impact of the ball dropped at 4 feet [1.2 m].~~

~~12. Certification Requirements: Furnish to the Engineer six certified copies of a statement from the producer certifying that the materials described above meet all the requirements herein and they have passed all the stipulated tests.~~

700-2.3 Roadside Sign Supports:

700-2.3.1 Frangible Supports: Provide posts for all frangible sign assemblies consisting of aluminum tubes up to 3 1/2 inches [90 mm] outside diameter with 3/16 inch [4.76 mm] wall thickness, or galvanized steel U-Channel up to 3 lb/ft [4.5 kg/m] as listed on the Qualified Products List, and in accordance with Design Standards, Index Nos. 11860 through 11865 for frangible sign supports.

700-2.3.2 Breakaway Supports: For posts for breakaway sign assemblies, the Contractor may use either aluminum or galvanized steel in accordance with the requirements for breakaway signs in the Design Standards.

The Engineer will accept breakaway sign assemblies utilizing load concentrating couplers as an alternate to the slip base. Supply erection drawings with the assemblies. Supply evidence that the proposed couplers meet the breakaway requirements of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, prior to use on a project.

The Department lists alternate proprietary and non-proprietary breakaway assemblies on the Qualified Products List. For an acceptable non-proprietary breakaway lap

splice for U-Channel steel posts, refer to the U-Channel Lap Splice Detail. The Engineer may accept other alternate breakaway designs if satisfactorily tested in accordance with the current AASHTO requirements.

700-2.3.3 Steel Posts: When using steel posts as the structural member in a full length support or breakaway base installation for a small roadway sign, 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 [9.5 mm] diameter holes on 1 inch [25 mm] centers through the center of the post, starting approximately 1 inch [25 mm] from the top and extending the full length of the U-post. Ensure that the weight per foot [meter] of a particular manufacturer's U-channel size does not vary more than ±3 1/2% of its specified weight per foot [meter]. 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. Ensure that post configuration generally complies with the dimensions for Type F or Type M flanged U-channel, as shown on Design Standards, Index No. 11865.

Only provide steel components that have been galvanized after fabrication in accordance with ASTM A 123 [ASTM A 123M] 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. Only use attachment hardware (nuts, bolts, clamps, brackets, braces, etc.) of a non-corrosive metal, aluminum, or galvanized steel, meeting the requirements specified on the Design Standards, Index Nos. 11860 through 11865.

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 sign structure design utilizing steel structural members. Meet the requirements of this Section and the AASHTO Specification for the Design and Construction of Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Use a design wind speed as shown on the Contract drawings. When a sign structure is attached to a bridge or wall structure, ensure that the loads from the sign structure applied to the bridge or wall structure are equal to or less than those shown on the Contract drawings. When the sign support is not on a structure, the Contractor is responsible for the design of the foundation.

Have designs and shop drawings prepared by a Specialty Engineer, 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.

700-2.5 Sign Background: Meet the requirements of Section 994. Use Type III, IV, ~~or~~ 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 ~~only~~ for S1-1 school advance signs and *supplemental panels used with* S~~2~~*1*-1*, S3-1 and S4-5* school ~~crossing~~ signs. Do not mix ~~work zone~~ signs having fluorescent ~~orange~~ *yellow-green* sheeting with signs having ~~orange~~ *yellow* reflective sheeting.

Use fluorescent orange Type VI or VII for all orange work zone signs ~~on interstates. Do not mix work zone signs having fluorescent orange sheeting with signs having orange reflective sheeting.~~

Mesh signs shall meet the color, daytime luminance and non-reflective 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, use Class II 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, [ASTM B 209M], 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 [ASTM B 308M] 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 [5 µm] 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 [ASTM A 123M] or ASTM A 153 [ASTM A 153M] 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 962-7. For steel plate for use as sign panels, meet the requirements of ASTM A 283 [ASTM A 283M] 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 ~~therefor~~.

For all other metal parts, 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 Reflective Sheeting: Meet the reflective sheeting requirements of Section 994.

700-3.8 Process Colors: Use transparent and black opaque process colors meeting the requirements of 994-4 on reflective ~~sheeting~~ and non-reflective sheeting.

700-3.9 Demountable Sign Face Materials: For demountable sign face materials, meet the requirements of Section 995.

~~**700-3.10 Porcelain Enamel Background:** For porcelain enamel background material, meet the requirements of Section 996.~~

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 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 249ºF [57 and 120ºC], 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 180ºF [38 to 82ºC] 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 180ºF [71 and 82ºC] 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 100ºF [38ºC] 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 100ºF [38ºC], 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 Preparation of Surface for Steel Sign Blanks: Clean and prepare galvanized steel sign blanks for painting or for application of reflective sheeting in accordance with the recommendations of the manufacturer of the material to be applied to the sign blanks.

700-4.3 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 reflective sheeting. Do not allow the metal to come in contact with greases, oils or other contaminants prior to the application of reflective sheeting.

700-4.4 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 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 Reflectorized Sign Faces.

700-5.1 Application of Sheeting: Apply 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 [1.5 mm] beyond the radius of top edge.

Match sign faces comprising two or more pieces of reflective sheeting for color and 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 nonuniform shading and an undesirable contrast between adjacent widths of applied sheeting.

700-5.2 Finish: Seal 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 reflective sheeting in accordance with the recommendations of the paint 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 Painting Panels for Nonreflectorized Background.**~~

~~When specified in the Contract Documents, provide all Type A and Type B signs, all GORE EXIT signs, and all REST AREA signs with a nonreflectorized background, composed of one spray coat of primer and two finish coats of baked enamel, as specified below. Make the REST AREA signs blue and all others green.~~

~~After the cleaning and etching, give these sign faces one spray coat of primer of the type the manufacturer of the finish coats recommends. Allow this prime coat to dry for at least 12 hours and until dry, after which, give the sign faces two coats of finish paint meeting the following requirements.~~

~~Provide finish coats of baked alkyd resin enamels meeting Federal Specifications TT-E-529A, Class B, of a composition which effects on the finished background surface, when thoroughly dry, colors matching those described in the current Highway Blue Color Tolerance Chart, PR Color No. 3, or in Highway Green Color Tolerance Chart, PR Color No. 4, published by the U.S. Department of Commerce, Bureau of Public Roads (now designated as the U.S. Department of Transportation, FHWA, Washington, D.C. 20590), as specified for the particular application. The Department will judge the color match visually per the Chart directions but the Department may use instrumental methods in the case of questionable visual matches.~~

~~Revise the package viscosity requirement on the opaque paints, as specified in Federal Specifications TT-E-529A, as follows: change the maximum requirement for Viscosity (Package), No. 4 Ford Cup, for Class B, from 110 seconds as shown to 150 seconds.~~

~~Ensure that the manufacturer of the enamel paints furnishes the Engineer with six copies of a certified test report indicating that the paint furnished meets the above requirements. Identify the pigmentation by the appropriate color number in Table I, and show the manufacturer's test results for compliance with the requirements of 3.3.1, 3.3.2.2, 3.4.1, and 3.4.2 of Federal Specifications TT-E-529A.~~

~~Notwithstanding the certification required, the Department reserves the right to test this paint. Submit samples to the Engineer in accordance with 6-5.~~

700-~~7~~*6* Acceptance of Signs.

700-~~7~~*6*.1 Manufacturer's Certification and Recommendations: Ensure that the sign manufacturer provides producer's certifications of materials incorporated into the signs. Ensure that the sign manufacturer certifies that the delivered signs conform to this Section and provides recommendations for storing and repairing signs.

700-~~7~~*6*.2 Packaging and Shipping: Have the manufacturer package and ship the signs in a manner which will minimize possible damage.

700-~~7~~*6*.3 Storage of Signs: If signs are stored prior to installation, store them in accordance with the manufacturer's recommendations.

700-~~7~~*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-~~7~~*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-~~8~~*7* Footings for Signs, Posts and Supports.

700-~~8~~*7*.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 [100 mm] 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-~~8~~*7*.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^3 [0.4 m^3]. Use cast-in-place or precast concrete for the footings.

700-~~8~~*7*.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 [100 mm] of loose earth, free from clods or gravel, over the top of the footing to effect curing.

700-~~8~~*7*.4 Finishing Concrete: Trowel the top of the concrete to a smooth finish.

700-~~8~~*7*.5 Removal of Footing: When the plans call for existing ground-mounted signs to be modified or removed, immediately remove supports and footings that project more than 6 inches [150 mm] above the ground surface after removing the sign panel from the assembly. Remove existing footings to a depth at least 12 inches [300 mm] below the ground surface. The costs will be included in the Contract unit price of the item to which it is incidental.

700-~~9~~*8* Erection of Signs and Sign Supports.

Do not erect overhead sign supports until the concrete in the support footing has cured for at least seven days. The Engineer may allow sign support erections prior to seven days provided the footing concrete strength is at least 2,500 psi [17 MPa]. Determine concrete strength from tests on a minimum of two test cylinders, tested in accordance with Section 346.

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. Metalize damaged parts as specified in Section 562.

Weld aluminum structures in accordance with 965-3.

700-~~10~~ *9* Method of Measurement.

The quantities to be paid for will be:

(1) The number of roadside traffic signs of each designated class of assembly, complete.

(2) The number of overhead traffic signs of each designated class of assembly, complete.

(3) The number of lighted overhead traffic signs of each designated class of assembly, complete.

(4) The number of existing signs removed, relocated, modified, lighted, placed on breakaway or nonbreakaway supports, of each designated class of assembly, complete.

(5) The number of each existing sign refurbished, existing sign panel removed, pole installed, exit numbering panel, and mile post, complete.

(6) The number of overhead signs span wire mounted, bridge mounted, and lighted sequential, of each designated class of assembly, complete.

(7) The number of lighted roadside signs 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-~~11~~*10* 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, 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 9-20-04)

SECTION 700 (Pages 727-737) is deleted and the following substituted:

SECTION 700
HIGHWAY SIGNING

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. Reflectorize all signs, and, when so specified in the plans, provide overhead signs with lighting.

The Department designates Roadside 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 three general categories: frangible support ground sign assemblies, breakaway support 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: Use either aluminum or galvanized steel for any sign panel shown in the plans, regardless of its mounting type.

If using galvanized steel for the sign panels, provide the same dimensions, including the thickness, as those shown in the plans 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 of Record 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 Roadside Sign Supports:

700-2.3.1 Frangible Supports: Provide posts for all frangible sign assemblies consisting of aluminum tubes up to 3 1/2 inches [90 mm] outside diameter with 3/16 inch [4.76 mm] wall thickness, or galvanized steel U-Channel up to 3 lb/ft [4.5 kg/m] as listed on the Qualified Products List, and in accordance with Design Standards, Index Nos. 11860 through 11865 for frangible sign supports.

700-2.3.2 Breakaway Supports: For posts for breakaway sign assemblies, the Contractor may use either aluminum or galvanized steel in accordance with the requirements for breakaway signs in the Design Standards.

The Engineer will accept breakaway sign assemblies utilizing load concentrating couplers as an alternate to the slip base. Supply erection drawings with the assemblies. Supply evidence that the proposed couplers meet the breakaway requirements of the AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, prior to use on a project.

The Department lists alternate proprietary and non-proprietary breakaway assemblies on the Qualified Products List. For an acceptable non-proprietary breakaway lap splice for U-Channel steel posts, refer to the U-Channel Lap Splice Detail. The Engineer may accept other alternate breakaway designs if satisfactorily tested in accordance with the current AASHTO requirements.

700-2.3.3 Steel Posts: When using steel posts as the structural member in a full length support or breakaway base installation for a small roadway sign, 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 [9.5 mm] diameter holes on 1 inch [25 mm] centers through the center of the post, starting approximately 1 inch [25 mm] from the top and extending the full length of the U-post. Ensure that the weight per foot [meter] of a particular manufacturer's U-channel size does not vary more than ±3 1/2% of its specified weight per foot [meter]. 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. Ensure that post configuration generally complies with the dimensions for Type F or Type M flanged U-channel, as shown on Design Standards, Index No. 11865.

Only provide steel components that have been galvanized after fabrication in accordance with ASTM A 123 [ASTM A 123M] 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. Only use attachment hardware (nuts, bolts, clamps, brackets, braces, etc.) of a non-corrosive metal, aluminum, or galvanized steel, meeting the requirements specified on the Design Standards, Index Nos. 11860 through 11865.

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 sign structure design utilizing steel structural members. Meet the requirements of this Section and the AASHTO Specification for the Design and Construction of Structural Supports for Highway Signs, Luminaires and Traffic Signals.

Use a design wind speed as shown on the Contract drawings. When a sign structure is attached to a bridge or wall structure, ensure that the loads from the sign structure applied to the bridge or wall structure are equal to or less than those shown on the Contract drawings. When the sign support is not on a structure, the Contractor is responsible for the design of the foundation.

Have designs and shop drawings prepared by a Specialty Engineer, 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.

700-2.5 Sign Background: 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 reflective sheeting.

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

Mesh signs shall meet the color, daytime luminance and non-reflective 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, use Class II 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, [ASTM B 209M], 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 [ASTM B 308M] 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 [5 μm] 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 [ASTM A 123M] or ASTM A 153 [ASTM A 153M] 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 962-7. For steel plate for use as sign panels, meet the requirements of ASTM A 283 [ASTM A 283M] 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, 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 Reflective Sheeting: Meet the reflective sheeting requirements of Section 994.

700-3.8 Process Colors: Use transparent and black opaque process colors meeting the requirements of 994-4 on reflective and non-reflective sheeting.

700-3.9 Demountable Sign Face Materials: For demountable sign face materials, meet the requirements of Section 995.

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 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 249ºF [57 and 120ºC], 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 180ºF [38 to 82ºC] 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 180ºF [71 and 82ºC] 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 100ºF [38ºC] 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 100ºF [38ºC], 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 Preparation of Surface for Steel Sign Blanks: Clean and prepare galvanized steel sign blanks for painting or for application of reflective sheeting in accordance with the recommendations of the manufacturer of the material to be applied to the sign blanks.

700-4.3 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 reflective sheeting. Do not allow the metal to come in contact with greases, oils or other contaminants prior to the application of reflective sheeting.

700-4.4 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 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 Reflectorized Sign Faces.

700-5.1 Application of Sheeting: Apply 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 [1.5 mm] beyond the radius of top edge.

Match sign faces comprising two or more pieces of reflective sheeting for color and 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 nonuniform shading and an undesirable contrast between adjacent widths of applied sheeting.

700-5.2 Finish: Seal 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 reflective sheeting in accordance with the recommendations of the paint 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 provides producer's certifications of materials incorporated into the signs. 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.

700-7.1 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 [100 mm] 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.

700-7.2 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^3 [0.4 m^3]. Use cast-in-place or precast concrete for the footings.

700-7.3 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 [100 mm] of loose earth, free from clods or gravel, over the top of the footing to effect curing.

700-7.4 Finishing Concrete: Trowel the top of the concrete to a smooth finish.

700-7.5 Removal of Footing: When the plans call for existing ground-mounted signs to be modified or removed, immediately remove supports and footings that project more than

6 inches [150 mm] above the ground surface after removing the sign panel from the assembly. Remove existing footings to a depth at least 12 inches [300 mm] below the ground surface. The costs will be included in the Contract unit price of the item to which it is incidental.

700-8 Erection of Signs and Sign Supports.

Do not erect overhead sign supports until the concrete in the support footing has cured for at least seven days. The Engineer may allow sign support erections prior to seven days provided the footing concrete strength is at least 2,500 psi [17 MPa]. Determine concrete strength from tests on a minimum of two test cylinders, tested in accordance with Section 346.

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. Metalize damaged parts as specified in Section 562.

Weld aluminum structures in accordance with 965-3.

700- 9 Method of Measurement.

The quantities to be paid for will be:

(1) The number of roadside traffic signs of each designated class of assembly, complete.

(2) The number of overhead traffic signs of each designated class of assembly, complete.

(3) The number of lighted overhead traffic signs of each designated class of assembly, complete.

(4) The number of existing signs removed, relocated, modified, lighted, placed on breakaway or nonbreakaway supports, of each designated class of assembly, complete.

(5) The number of each existing sign refurbished, existing sign panel removed, pole installed, exit numbering panel, and mile post, complete.

(6) The number of overhead signs span wire mounted, bridge mounted, and lighted sequential, of each designated class of assembly, complete.

(7) The number of lighted roadside signs 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.

700-10 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, 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.