

ALABAMA DEPARTMENT OF TRANSPORTATION

DATE: March 5, 2021

Special Provision No. 18-0222(2)

EFFECTIVE DATE: September 1, 2021.

SUBJECT: Roadway Signs.

Alabama Standard Specifications, 2018 Edition, SECTION 710 and SECTION 880 shall be replaced with the following:

SECTION 710 ROADWAY SIGNS

710.01 Description.

(a) General

This Section shall cover the work of furnishing and erecting roadway signs of the various types, sizes, wording, marking, etc., detailed by the plans in accordance with the latest edition of the MUTCD except as modified herein or by the plan details. The type and number of signs, sign supports, backing frames when required, foundations and reflectorization to be furnished and installed shall be as detailed on the plans. Concrete foundations, when required, shall be constructed as shown on the plans or as directed by the Engineer.

(b) Types and Classes of Signs

The items of work for Roadway Signs will indicate whether the sign is of a reflectorized or non-reflectorized type, and the kind of backing material.

Sheeting used in the fabrication of sign faces shall be one of the following types unless required otherwise on the plans or in the proposal:

TYPES AND DESCRIPTIONS OF SIGN SHEETING	
Type I	Medium-intensity retroreflective sheeting, "engineering grade"
Type I-N	Non-reflective sheeting
Type II	Medium-high-intensity retroreflective sheeting, "super engineering grade"
Type III	High-intensity retroreflective sheeting
Type IV	High-intensity retroreflective sheeting, "microprismatic"
Type V	Super-high-intensity retroreflective sheeting, "microprismatic"
Type VI	Elastomeric high-intensity retroreflective sheeting without adhesive, "microprismatic"
Type VII	Sheeting previously classified as Type VII has been reclassified as Type VIII. The designation of Type VII has been discontinued. (ASTM D 4956-09)
Type VIII	Super-high-intensity retroreflective sheeting (ASTM D 4956 Table 2) , "microprismatic"
Type IX	Very-high-intensity retroreflective sheeting, "microprismatic"
Type X	Sheeting previously classified as Type X has been reclassified as Type VIII. The designation of Type X has been discontinued. (ASTM D 4956-09)
Type XI	Super-high-intensity unmetallized cube corner microprismatic retroreflective sheeting. (ASTM D 4956-09, Table 10)

CLASSES AND DESCRIPTIONS OF SIGNS	
Class 1	Obsolete
Class 1A	Obsolete
Class 2	Type IV Reflectorized Sheeting Background with the same Type Reflectorized Sheeting Cut-Out Copy
Class 2A	Type IV Reflectorized Sheeting Background with Non-Reflectorized Cut-Out Copy For Multiple Extruded Panels, Type XI Reflectorized Sheeting Background with Digital Printing is also allowable.
Class 3	Obsolete
Class 4	Type IV Reflectorized Background with Screen Copy
Class 5	Type IV Reflectorized Sheeting Background with Screen Copy
Class 6	Type IV Reflectorized Sheeting Background with Type XI Reflectorized Sheeting Cut-out Copy For Multiple Extruded Panels, Type XI Reflectorized Sheeting Background with Digital Printing is also allowable.
Class 7	Type IV or XI Reflectorized Sheeting Background with Screen Copy Type XI Reflectorized Sheeting with Digital Printing is also allowable.
Class 8	Obsolete
Class 9	Type XI Reflectorized Sheeting Background with the same Type Reflectorized Sheeting Cut-Out Copy or Digital Printing
Class 10	Type XI with Screen Copy or Digital Printing

When the Contractor has the choice of selecting the sheeting Type within a respective Class, the mixing of different sheeting types on signs on the same project will not be allowed unless shown otherwise on the plans or in the proposal.

(c) Methods of Fabrication.

In addition to the Classes noted above, signs will be designated by the method of fabrication as follows:

1. Flat Panel.

A sign face which can be fabricated from a single sheet of material normally not in excess of 4 feet {1200 mm} in width.

2. Multiple Flat Panel.

A sign face which because of size can not be fabricated from a single sheet of material. These panel sections shall be fabricated from sheets not less than 4 feet {1200 mm} in width, except that only one sheet for any one sign may be cut to less than 4 feet {1200 mm} in width to fabricate signs which are not multiples of 4 feet {1200 mm} in width. Multiple flat panel sign sections shall run from top edge to bottom edge of sign face without horizontal joints, except that signs greater than 11 feet {3.4 m} in height may have a horizontal joint but no sign shall have more than one horizontal joint.

The use of material sheets of greater width than the minimum 4 feet {1200 mm} noted to form sign panels will be acceptable; however, the backing, support, etc. must conform to the plan requirements for this classification of panel.

All panel joints shall be provided with backing strips firmly affixed to the sign to keep the panel sections in proper alignment as detailed on the plans.

3. Multiple Extruded Panels

Multiple panel signs may be made of extruded sections. All extruded sections shall be 12 inches {300 mm} wide mounted horizontally and shall have no vertical joints. All panels shall be flat and straight. Multiple extruded panel signs shall be limited to Class 6 and Class 2A signs. Exceptions will be made to allow 6 inch {150 mm} wide extruded sections in cases where the

height of a sign or exit panel dictates. There shall not be more than one 6 inch {150 mm} wide panel allowed per individual sign or exit panel.

710.02 Materials.

All materials furnished for use shall comply with the appropriate requirements of Division 800, Materials, and the requirements noted herein in this Section. Special reference is made to Section 880 for Sign Materials, Section 501 for Concrete, Section 502 for Steel Reinforcement, and Section 508 for Structural Steel.

Sampling and inspection of sign materials will be done in accordance with the requirements given in ALDOT-245, "Procedures for Sampling and Inspection of Roadway Signs and Overhead Sign Structures."

Design drawings covering details for legend and message layouts for sign panels will be shown on the plans.

Any deviation from details shown in the plans or furnished the successful bidder must be approved by the Engineer.

Letter series shall meet the requirements of the MUTCD, unless otherwise provided by plan details.

Unless otherwise noted by plan details, signs shall meet Standard Highway Sign sign blank standards or shall have rounded corners. For guide signs square corners are allowed, but the border shall be rounded to the radius shown in the plans.

In the event the plans do not contain a detailed layout for a specific sign, such as a route marker, the layout shall be as approved by the Engineer.

710.03 Construction Requirements.

(a) General.

1. All signs shall be erected and supported in accordance with these specifications and as shown on the plans. Horizontal edges of sign shall be level and faces of signs shall be vertical.

2. After being authorized by the Department to proceed with the work, the Sign Contractor shall be required to begin with the erection of signs, on that portion of the project that, as determined by the Engineer, will best serve the traveling public.

In most instances sign work will of necessity be performed while the roadway is open to traffic. It is not intended that any section of road be left unmarked or in a hazardous condition; therefore, the Contractor shall plan his operation in such a manner as to accomplish the following, all of which shall be considered an integral part of the work required under this section.

- a. Work shall be performed in such a manner as not to be hazardous to the traveling public.
- b. Existing signs shall not be removed until the new replacement signs are installed and completed.
- c. No sign posts, particularly adjacent to the shoulders, shall be left standing without a sign face after daylight hours unless warning markers, etc. are provided to warn the traveling public. In the same manner no holes or other hazardous condition shall be left without proper warning markers or delineation.
- d. Once the work of installation of a sign structure is begun, the work shall be diligently prosecuted until its completion.

3. When a section of a project is completed to the state of use, the Contractor may be required to begin erection of signs within ten days after receipt of notice from the Engineer, even though the work on the roadway may not be completed and accepted by the State.

4. The contractor shall be responsible for any damage done to signs or posts which may occur from any cause, save an unavoidable natural cause, until the work is complete and accepted by the State. Signs and posts are to be stored under cover and protected from the weather and other damage until they are erected.

5. The plans indicate the extent and general arrangement of signs. The plans are to be used for the general guidance of the Contractor and any commission or omission shown or implied shall not be the cause for deviating from the intent of the plans and specifications. If any departures from the plans and specifications are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Engineer for approval. The decision of the Engineer shall be final and mandatory.

(b) Staking Out Signs.

The Contractor shall not order posts until the length has been established in the field. If Geometric Controls are not set up, the Engineer shall stake out the location of each sign along the work. The Contractor, however, will be required to check all dimensions and clearances measured from such stakes and shall thereafter become responsible for orientation, elevation, offset and level of all signs erected. If Geometric Controls are set up, the contractor shall stake out the location of each sign along the work. The Contractor shall not order posts until the Engineer has reviewed the sign locations as staked. The Contractor will be required to provide all dimensions and clearances measured from such stakes and shall thereafter become responsible for orientation, elevation, offset and level of all signs erected.

Where beam posts are required the contractor shall set foundations and verify post lengths before ordering posts. No foundations shall be mounded to compensate for beam posts which are too short.

(c) Positioning of Sign Faces.

Positioning of sign faces shall be such as to eliminate or minimize specular (mirror like) reflection and provide maximum readability.

Ground mounted signs shall be erected so that the face is truly vertical and at an angle to the roadway centerline as detailed by the plans unless otherwise directed by the Engineer. On curves, sign faces shall be oriented so as to be most effective, both day and night, to avoid specular reflection.

Overhead signs shall be erected so that the sign face is at the vertical angle with the roadway indicated by the plans or directed and is in the proper position over designated traffic lanes.

All sign panels shall be so mounted that the tops of panels or the messages on shaped panels are truly horizontal. Vertical and horizontal positioning of sign faces shall be as detailed by the plans or directed to provide the clearance and height required by MUTCD or noted on the plans.

(d) Installation of Ground Mounted Sign Supports.**1. General.**

The size, number and type of supports shall be shown on the plans. The support shall not extend above the sign panel, but in no case shall the support be less than 3 inches {75 mm} above the uppermost stringer mounting bolt. Cutting steel supports to length after they have been galvanized will be permitted provided the cutting is limited to sawing and the damaged area is regalvanized as shown on the plans or directed.

2. Erection of Posts.**a. General.**

Posts shall be installed as indicated by plans. The length of the posts or supports shall be determined as noted in this Section.

Installation shall be accomplished in such a manner that the entire post is installed as one unit, unless shown otherwise by the plans, to insure proper alignment, etc. of the post. All posts shall be checked with a spirit level for vertical alignment. Posts with breakaway features may be adjusted slightly by the use of special shims as indicated by plan details; major adjustments shall require removal and resetting.

When breakaway features are incorporated into post assemblies, the requirements noted in this Item shall be complied with to insure their functioning properly under field conditions.

Tubular posts after installation shall be provided with a proper cap. Caps may not be required for perforated tubular posts.

b. Foundations.

When foundations require the use of concrete encasements, the posts shall be installed in pre-dug holes and backfilled with Class A concrete. Reinforcement, if required, shall be as detailed on the plans.

When plans and soil conditions permit the installation of posts by driving, a method of driving will be required that will not damage the posts. Any damage in driving shall be cause for rejecting the post and requiring it to be replaced. In lieu of driving, the

Contractor may elect to install the posts by pre-dug holes and backfilling with sand. The sand backfill shall be thoroughly flooded with water to insure good compaction. If solid rock is encountered, the posts shall be placed in drilled holes and backfilled with concrete to the top of the rock as shown on the plans or directed and the remainder backfilled as noted above.

c. Breakaway Features.

(1) General.

Unless otherwise noted in the detailed plans, all bolts, nuts and washers used in the breakaway features shall be High Strength galvanized complying with the requirements of Article 836.33.

The functioning of the breakaway design is dependent upon the proper installation of these bolts so that the residual tension specified by the plans is obtained. To accomplish this, the following requirements shall apply:

All bolts, nuts and washers of each diameter bolt required in the work shall be from the same manufacturer. Bolts used in each type connection (hinge, fuse or base) shall be so sized that all bolts for a particular type connection in a support structure are of the same length. Said length shall be the minimum plan specified length plus any additional length necessary to provide at least two exposed threads on the bolt after the connection has been properly tightened.

The torque necessary to obtain the residual bolt tension required by the plans shall be determined by a "bolt-tension calibrator." The Department will provide the "bolt-tension calibrator" for calibration of the Contractor's torque wrench for the various sizes of bolts.

The Contractor shall supply five sets of bolts, nuts and washers of each diameter to be used in the work for determination of the bolt torque necessary to obtain the residual bolt tension specified by the plans.

(2) Setting of Bolt Tension.

All posts and sign panels shall be in place prior to setting of the bolt tension for the base connections and the post fuse and hinge plates.

After completion of the sign panel installation, all bolts, nuts and washers used in the hinge plates, fuse plates and base connections during the shipping and installation of the support assembly shall be removed and replaced with approved High Strength bolts, nuts and washers.

Prior to use of the H.S. bolts, etc. they shall be checked to insure they are free turning and are lubricated with a bee's wax based lubricant approved by the Engineer (some commercial wax products have proven satisfactory). Installation of the bolts, etc., may then proceed using the appropriate calibrated torque wrenches for the size bolt being installed. All lubricating and torquing of the H.S. bolts and nuts shall be performed in the presence of an inspector. Any bolt not installed in the presence of an inspector shall be removed and examined to insure the nut is free turning for the full thread length (any binding shall be cause for rejection), lubricated and re-installed as noted.

Setting of bolt tension may be achieved without the use of a torque wrench if special hardware is provided by the manufacturer of the approved breakaway device. The bolt hardware must be designed with an integral means for tightening the bolts to the required tension.

(e) Erection of Framework and Sign Panels.

Framework for erecting sign panels shall be assembled and attached to the ground supports as provided on the approved drawings. All horizontal members of supporting frames shall be truly horizontal and at correct height so that the bottom of the sign shall be at the height above pavement specified and proper horizontal position.

Erection of sign panels shall be done in a neat and workmanlike manner. Sign panels shall be attached to the supporting frames in accordance with the recommendations of the sign panel manufacturer. All nuts, bolts, screws and set screws shall be tightened securely.

Signs shall be inspected at night by the Engineer, and if specular (mirror like) reflection is apparent on any signs, its positioning shall be adjusted by the Contractor.

When sign panels are noted to be re-installed on another support assembly, removal of the old panel from its supports shall be done in such a manner as to prevent damage to the panels; remounting shall be accomplished in the same manner noted for new panels. The use of dismantled hardware in remounting of the old panels is allowed; however, if the old hardware is unusable, the Contractor shall provide the appropriate new hardware necessary to install the panel.

(f) Removal of Existing Signs.

The Contractor shall dismantle and remove all existing signs designated to be removed; however, when they are to be replaced with another sign, the new sign shall be in place before the old sign is removed unless otherwise ordered by the Engineer.

Unless noted otherwise on the plans, the Contractor will be allowed to keep all sign panels that are designated for removal.

All materials to be retained by the State (panels, supports and hardware) shall be removed in such a manner as to prevent undue damage and the materials stacked and stored at a site on the project designated by the Engineer, for later pickup by others. Care shall be taken during removal, handling and storage to protect the treated surfaces; especially sign faces; hardware shall be bagged or boxed; posts, especially those with breakaway features, shall be removed so that the bases are kept intact insofar as practical. Any damage to or loss of removed materials due to negligence on the part of the Contractor's removal methods shall be cause for ordering replacement in kind for the damaged or lost items.

Any posts or mounting supports to be removed shall either be pulled or removed or, at the discretion of the Contractor, cut off and removed to a depth of not less than 1 foot {0.5 m} below the actual ground surface and the area backfilled with suitable material. The area shall be cleaned and dressed out in a manner consistent with the surrounding area.

(g) Cleanup of Area.

The Contractor shall be required to remove all rejected and unused materials and debris from the right of way. The contractor shall restore shoulders and slope, including grass, to the original condition. Excess excavation will be disposed of off the right of way at the Contractor's expense, unless otherwise authorized by the Engineer, and other cleaning up as may be necessary to insure the effectiveness and neat appearance of the work.

(h) Inspections.

Attention is directed to the fact that sign panels as well as supports must be approved before installation will be permitted.

In addition to normal inspections particular attention will be directed to inspection of the unit after installation to ensure that any damage caused by the installation operation or any defect which will affect the serviceability is promptly corrected.

Attention is directed to the special inspection requirements noted in Subitem 710.03(d)2c when setting base plate, hinge plate and fuse plate bolt tensions.

710.04 Method of Measurement.

Completed and accepted Sign Face Panels will be measured in square feet {square meters} between the outside edges of the signs (includes frame and border).

Installed and accepted posts will be measured in feet {meters} which will be the entire length of the installed post from tip to tip and includes any breakaway feature.

Unless a pay item is provided in the plans or proposal for the removal of Existing Roadway Signs, the removal, etc. of such signs will be considered incidental to the work and no measurement for pay purposes will be made. However, when the removal of existing signs is designated for pay purposes, measurement will be made on a lump sum basis for all signs designated to be removed.

710.05 Basis of Payment.

(a) Unit Price Coverage.

Sign Panels measured as noted above will be paid for at the contract unit price bid per square foot {square meter} which shall be full compensation for the sign face complete in place on its

support assembly and includes all costs necessary for obtaining the material, processing, all copy, symbols, legend and the like, and for all hardware necessary to furnish and install the sign on its supports in accordance with plan details and for all equipment, tools, labor and incidentals necessary to complete the work.

Posts measured as noted above will be paid for at the contract unit price per linear foot {meter} which shall be full compensation for the particular size post involved completely installed in its proper position. Said unit price bid shall include all costs necessary to obtain materials, fabrication, processing, excavation, erecting, backfilling, backfill material, concrete, steel, clearing, all hardware, and miscellaneous parts necessary to furnish and install the post in accordance with plan details and for all equipment, tools, labor and incidentals necessary to complete the work.

Removal of existing signs under Item 710-C, measured as noted above, will be paid for at the contract lump sum price bid which shall be full compensation for the dismantling, removal of the designated sign assemblies or portion of the sign assembly, the salvaging of materials or reuse when designated, the stacking or storage of the salvaged materials in a designated location on the project, and for any materials, equipment, tools, labor and incidentals necessary to complete this item of work.

(b) Payment will be made under Item No.:

710-A Class *, ** Sign Panels *** - per square foot {square meter}

710-B Roadway Sign Post (Description & Size) - per linear foot {meter}

710-C Removal of Existing Roadway Signs - per lump sum

* Appropriate Class

** Aluminum Flat

Aluminum Multiple Flat

Aluminum Multiple Extruded

*** Approximate thickness of panel material desired.

SECTION 880 SIGN MATERIALS

880.01 Sign Panels.

(a) Aluminum Sign Materials.

1. General.

Aluminum sign materials shall conform to the details and thickness's shown on the plans and the following:

The materials used, unless otherwise noted by plan details, shall meet the requirements noted below and, in addition, the material used shall be free from corrosion, white rust, water stains, dirt, and grease with the panels processed as noted in Item 2 below.

ALUMINUM SIGN MATERIALS	
USE	ALLOY & TEMPER DESIGNATION
Sign Panels	ASTM B 209 Alloy 5052-H38 or 6061-T6
Extruded Shapes (sign panels), Bars or Rods	ASTM B 221 Alloy 6063 - T6
Angles, Structural Shapes (including Stiffeners)	ASTM B 308 Alloy 6061-T6
*Bolts	ASTM B 211 Alloy 2024-T4
Tamper Proof Nuts $\leq \frac{1}{4}$ "	ASTM B 211 Alloy 2024 - T4
*Spring Lock Washers	ASTM B 211 Alloy 7075-T6
Washers	ASTM B 209 Alloy Alclad 2024 - T4
Rivets	ASTM B 316 Alloy 6053 - T6
Shims	ASTM B 209 Alloy 1100-0
Flange Splicing Material	ASTM B 209 Alloy 6061 - T6
Weld Filler Wire	ASTM B 285 Alloy ER 5356 or ER 5556
*Hex. Nuts (Plain)	ASTM B 211 Alloy 6262-T9
*Hex. Lock Nuts	ASTM B 211 Alloy 2017-T4
* Unless otherwise specified	

Aluminum bolts, nuts, and washers shall have an anodic coating of at least 0.0002 inch {0.0051 mm} in thickness and shall be chromate sealed.

Galvanized bolts, nuts, and washers as specified under Galvanized Signs, or stainless steel hardware meeting the requirements of ASTM F 593, will be acceptable in lieu of the above.

2. Special Treatment of Aluminum Sign Material.

Each panel shall receive a chemical conversion treatment that will produce an acceptable etched surface suitable for either porcelainizing or attachment of reflectorized or non-reflectorized sheeting.

3. Tests and Samples.

The Contractor shall furnish certified test reports confirming compliance with the requirements noted and, in addition, shall furnish samples of all materials used in the signs in accordance with current Departmental policy for evaluation and verification tests.

4. Recycled Aluminum Sign Panels.

Recycled aluminum sign panels will be allowed for installation in accordance with the following requirements.

Recycled sign panels shall be the same alloy and temper required for new sign panels. They shall be free of corrosion and white rust and shall meet the required tolerances for flatness and thickness for new sign panels. The process for removing the old reflectorized or non-reflectorized sheeting shall not damage the chromate coating. Smelting, sanding, and chemical stripping processes for recycling will not be allowed.

Recycled signs will be inspected, sampled, and tested in accordance with current Departmental policy, except certified test reports will not be required. The Contractor shall furnish a materials guaranty that the materials conform to the requirements for recycling the sign panels.

(b) Metal and Galvanization Requirements.

1. Metal and Galvanization Requirements.

Galvanized steel sign sheets shall conform to the details and thickness designated on the plans and the following:

The materials used for Galvanized Steel Signs, unless otherwise noted by plan details, shall meet the following specifications:

USE	ASTM For METAL	ASTM For GALVANIZING
Sign Panels	A 653/A 653M, SS: Grade 33 and A 924/ A 924M	A 123
Angles (including Stiffeners)	A 36	A 123
Bolts, Nuts and Washers, unless otherwise specified.	A 307 *	A 153
* Aluminum bolts, nuts, and washers as specified under Aluminum Signs, or stainless steel hardware meeting the requirements of ASTM F 593, will be acceptable in lieu of.		

Galvanized steel sheets and parts other than bolts, nuts and washers shall be mill galvanized with a 2 ounce per square foot {57 g per 0.1 m²} coating in accordance with ASTM A 653/A 653M G235. The galvanizing shall be a continuous coat, extra smooth, minimum spangle process. After galvanizing, the sheets are to be given a light, tight, crystalline phosphate coating.

No galvanizing of any steel part may be done until all welding, cutting, milling, punching, and drilling of the part has been completed. This includes all holes necessary for attaching demountable copy.

2. Tests and Samples.

The Contractor shall furnish certified test reports confirming compliance with the requirements noted and in addition shall furnish samples of all materials used in the signs in accordance with current Departmental policy for evaluation and verification tests.

880.02 Reflective and Non-Reflective Sheeting.

(a) General.

Retroreflective sheeting used in the fabrication of sign faces shall meet the requirements for ASTM D 4956. All retroreflective sheeting shall be the ASTM Type classification shown on the ALDOT Standard Highway Drawings for Standard Highway Signs, unless otherwise required by plan details or the proposal.

Non-retroreflective sheeting, Type I-N, shall be a smooth, flat durable gloss plastic film meeting the requirements of ASTM D 4956, Type I, with the Specific Intensity requirements waived.

Sheeting will be classified by type in accordance with the following:

TYPES AND DESCRIPTIONS OF SIGN SHEETING MATERIALS	
Type I	A medium-intensity retroreflective sheeting referred to as "engineering grade" and typically enclosed lens glass-bead sheeting. Typical applications for this material are permanent highway signing, temporary traffic control devices, and delineators.
Type I-N	Non-reflective sheeting
Type II	A medium-high-intensity retroreflective sheeting sometimes referred to as "super engineering grade" and typically enclosed lens glass-bead sheeting. Typical applications for this material are permanent highway signing, temporary traffic control devices, and delineators.
Type III	A high-intensity retroreflective sheeting, that is typically encapsulated glass-bead retroreflective material. Typical applications for this material are permanent highway signing, temporary traffic control devices, and delineators.
Type IV	A high-intensity retroreflective sheeting. This sheeting is typically an unmetallized microprismatic retroreflective element material. Typical applications for this material are permanent highway signing, temporary traffic control devices, and delineators.
Type V	A super-high-intensity retroreflective sheeting. This sheeting is typically a metallized microprismatic retroreflective element material. This sheeting is typically used for delineators.
Type VI	An elastomeric high-intensity retroreflective sheeting without adhesive. This sheeting is typically a vinyl microprismatic retroreflective material. This sheeting is typically used for orange temporary roll-up warning signs, traffic cone collars, and post bands.
Type VII	Sheeting previously classified as Type VII has been reclassified as Type VIII. The designation of Type VII has been discontinued. (ASTM D 4956-09)
Type VIII	A super-high-intensity retroreflective sheeting (ASTM D 4956 Table 2). This sheeting is typically unmetallized, microprismatic with the highest values of retroreflection attained at long and medium roadway distances. Typical applications are temporary traffic control devices, delineators, and permanent highway signing.
Type IX	A very-high-intensity retroreflective sheeting which is typically unmetallized, microprismatic with the highest values attained at short roadway distances where viewing angles may be critical. Typical applications are permanent highway signing, temporary traffic control devices and delineators.
Type X	Sheeting previously classified as Type X has been reclassified as Type VIII. The designation of Type X has been discontinued. (ASTM D 4956-09)
Type XI	A super-high-intensity unmetallized cube corner microprismatic sheeting (ASTM D 4956, Table 10). Typical applications are temporary traffic control devices, delineators, and permanent highway signing.

(b) Tests and Samples.

The Department's Product Evaluation Board has established a list of sheetings (V-1, "Materials, Sources, and Devices with Special Acceptance Requirements", manual). Only the materials on this list shall be furnished for use. Refer to Subarticle 106.01(f) and ALDOT-355 "General Information Concerning Materials, Sources, and Devices with Special Acceptance Requirements" for further information.

In addition these materials will be inspected, sampled, and tested in accordance with the Department's Testing Manual and Laboratory Manual.

(c) Application of Sheeting.

Application of sheeting shall be in accordance with the manufacturer's recommendations; splicing of sheeting will be allowed on sign faces provided such splices have a minimum overlap of 1/2 inch {13 mm} and are held to a minimum. More than one splice per 48 square feet {4.5 m²} of panel is considered excessive.

On signs which consist of one panel only, the sheeting shall extend to the edge of the sign panel, except where indicated in the plans. On all signs which are sufficient size to require two or more panels, sheeting shall be applied separately to each panel. No attempt shall be made to extend

the sheeting from one panel to adjacent panels. Sheeting shall be applied in strict conformity with the recommendations of the manufacturer.

(d) Color and Luminance Requirements.

The chromaticity and luminance of fluorescent retroreflective materials shall be determined in accordance with the requirements given in ASTM E 991, using instrumentation which complies with the requirements given in E 991 and which has circumferential viewing (illumination). The instrumentation shall illuminate the specimen with light having the spectral irradiance criteria for CIE Standard Illuminant D-65 as set forth in Section 5.1 of E 991 for the testing of fluorescent specimens. The reflectance data for the CIE 1931 2° Observer shall be computed in accordance with ASTM E 308.

Fluorescent retroreflective materials shall meet the requirements for chromaticity coordinates given in the following table.

CHROMATICITY COORDINATES								
Color	1		2		3		4	
	x	y	x	y	x	y	x	y
Fluorescent Orange	0.583	0.416	0.535	0.400	0.595	0.351	0.645	0.355
Fluorescent Yellow	0.479	0.520	0.446	0.483	0.512	0.421	0.557	0.442
Fluorescent Yellow-Green	0.387	0.610	0.369	0.546	0.428	0.496	0.460	0.540

Fluorescent retroreflective materials shall meet the luminance requirements given in the following table.

LUMINANCE REQUIREMENTS			
Color	Luminance Factor Limits (Y) (%)		
	Minimum	Maximum	Y _F *
Fluorescent Orange	25	None	15
Fluorescent Yellow	45	None	20
Fluorescent Yellow-Green	60	None	20

*Fluorescent luminance factors (Y_F) are typical values, and are provided for quality assurance purposes only. Y_F shall not be used as a measure of performance during service.

880.03 Sign Copy.

(a) Applied Copy.

1. General.

Applied copy is classified as copy applied directly to the sign background.

Unless noted otherwise, all standard Class 5, 7 and 10 signs shall have the sign copy applied by either the direct or reverse screening (silk screen) method as noted in Items 2 and 3 below. Route shields and markers with blue background and yellow symbols (typically a Class 4 or a portion of a Class 2 or 6 sign) shall use the Cut-out copy process as noted in Item 5 below. Special Class 5, 7 and 10 signs may utilize cut-out copy or acrylic electronic cuttable film as noted in Item 5 below, if so noted by the plans or on the approved shop drawings.

2. Direct Screening Process.

This method is used for applying non-reflective copy to a sign background.

3. Reverse Screening Process.

This method is used for applying reflectorized copy to a reflectorized background by utilizing transparent inks applied to a white reflectorized background.

4. Screening Material and Application.

Material for application by the silk screen method shall be manufacturer recommended matched component inks manufactured especially for use on roadway signs and compatible with the type sign background material being used. Application of screened copy and curing

thereof shall be in strict compliance with the manufacturer's recommendations of the background material.

Colors shall be durable and consistent with the requirements of the FHWA Standards Colors Charts for Signs. The color shall be uniform in acceptable hue when viewed in daylight and under normal headlights at night.

5. Substitution of Cut-Out Copy or Electronic Cuttable Film for Screen Copy.

Certain signs for which standardization is impractical, such as destination signs, may be authorized to use cut-out copy or acrylic electronic cuttable film, unless noted otherwise on the plans.

Cut-out copy shall be fabricated from the appropriate class sheeting by individually cutting the borders, legends, numerals, and symbols, and applying them to the required background in strict compliance with the sheeting manufacturer's recommendation.

If electronic cuttable film is used, it shall be the sheeting manufacturer's recommended film and shall be applied to the required background in strict compliance with the sheeting manufacturer's recommendations. The film shall be transparent when used in lieu of reverse screening and non-reflective when used in lieu of direct screening.

When cut-out copy or electronic cuttable film is authorized, borders, legends, symbols, or numerals shall be either screened, cut-out copy, or created using electronic cuttable film; mixing of methods to form a border, a legend, a symbol, or numerals will not be permitted except when authorized on construction warning signs.

(b) Digital Printing.

An approved digital printing system must be used. Digital printing systems include a digital printer with appropriate software and drivers, flexible white or colored prismatic retroreflective sheeting, acrylic overlay films, and inkjet inks. A list of approved digital printing systems is included in List V-1 of the MSDSAR.

Sign messages shall be printed according to the manufacturer's recommendations. Digital printing shall produce the desired color and the same retroreflectivity values as required for the reflective sheeting of the same type and color when applied on a reflective sheeting background.

Traffic signs printed with digital ink systems will be fabricated with a full sign Protective Overlay Film designed to protect the entire sign from fading and UV degradation. The overlay will comply with the retroreflective sheeting manufacturer's recommendations to ensure proper adhesion and transparency.

880.04 Sign Supports.

(a) Ground Mounted Sign Supports.

1. General.

Ground mounted supports shall fall into two categories, a light weight {mass} or bendaway post and a standard or rigid post.

The light weight {mass} or bendaway posts are normally single "U" channels (aluminum or steel) and tubular shapes (round, square, etc.) of such size and design that when hit by a moving vehicle, will easily bendaway from the vehicle without seriously damaging it.

The standard or rigid posts shall be of various designs (shapes, tubular, etc.) which by size and design will not easily bendaway when hit by a moving vehicle. This type post, unless otherwise noted by plan details, will require a "breakaway" feature to be incorporated with the post. The material and design of the breakaway features for the various shapes of standard posts shall be shown by the plan details.

Breakaway features constructed of steel shall have all elements galvanized, unless otherwise provided by the plan details. Damage to galvanization or any bare spots developed during construction shall be treated with two coats of approved galvanizing paint (Section 855) or approved zinc spelter paint. Aluminum elements will require no special treatment, unless so specified by plan details.

All materials furnished for use shall be new, unless otherwise specified by plan details or provisions of the contract.

All tubular post shapes whose design will have a tendency to collect water shall be provided with an approved tight fitting post cap fabricated of material compatible with that of the post.

2. Steel Posts.

a. Tubular Type (Std.)

This type of post shall be fabricated from standard steel shapes of the size and weight {mass} shown by plan details. Round shapes shall conform to the requirements of ASTM A 53, Grade B, Schedule 40 or better (no pressure test required). Other shapes and materials shall be as noted by plan details.

b. Beam Type (Std.)

This type of post shall be fabricated from standard beam shapes of the size, shape, and weight {mass} shown on the plans. The material shall conform to the requirements of either ASTM A 588 or A 572, Grade 50, unless otherwise noted by plan details.

c. Light Weight {Mass} or Bendaway Type.

(1) This post shall be fabricated to acceptable shape and design to provide the Moment of Inertia and Section Modulus for the requirements of the designated post size shown by the plan details. The posts shall be made of rerolled rail steel meeting the requirements of ASTM A 499, Grade 60, or a comparable new billet steel meeting the requirements of ASTM A 572, Grade 60. The steel in the posts shall meet the chemical requirements of ASTM A 1 for rails having a nominal weight {mass} of 91 pounds per yard {37 kg/m} or greater. Shaped sections shall be provided with 3/8 inch {9.5 mm} diameter holes placed on 1 inch {25 mm} centers starting 1 inch {25 mm} from the top of the post and extending the full length of the post.

(2) Tubular sections shall be fabricated from steel meeting the requirements of ASTM A 653 SS: GRADE 33 and ASTM A 924/ A 924M. Tubular sections shall be provided with 3/8 inch {9.5 mm} diameter holes placed on 1 inch {25 mm} centers starting 1 inch {25 mm} from the top of the post and extending the full length of the post (holes shall extend through the opposite walls).

In lieu of the above, tubular steel posts may conform to ASTM A 1011/A 1011M SS: Grade 33 or better. The posts shall be provided with 7/16 inch {11 mm} diameter die-cut knockouts on 1 inch {25 mm} centers on all four sides.

d. Post Finish.

Standard posts shall be hot dipped zinc galvanized after fabrication in accordance with ASTM A 123 for beam shape and ASTM A 53 for tubular shape.

Light weight {mass} or bendaway posts shall be zinc galvanized in accordance with the following:

"U" Channel Section - ASTM A 123 after fabrication.

Tubular Section - ASTM A 653, Grade G90 or better. An alternate coating may be an in-line hot dip galvanized zinc coating per ASTM B 6, followed by a chromate conversion coating and cross-linked polyurethane acrylic exterior coating, with the inside surface given a double in-line application of a full zinc-based organic coating.

3. Aluminum Posts.

a. Tubular Type (Std.)

This type of post shall be fabricated from extruded tubing to the size, shape, and wall thickness shown on the plans and shall conform to the Aluminum Association, Alloy 6061-T6 (ASTM B 221).

b. Beam Type (Std.)

This type of aluminum support shall be fabricated from extruded shapes of the size, shape, and weight {mass} shown on the plans and shall conform to the Aluminum Association, Alloy 6061-T6 (ASTM B 308).

c. Light Weight {Mass} or Bendaway Type.

This type of aluminum support shall be fabricated from acceptable extruded shapes meeting the design requirements (Moment of Inertia and Section Modulus) for the designated post size shown in the plan details. Materials shall conform to the requirements of Alloy 6061-T6 of ASTM B 221.

Holes 3/8 inch {9.5 mm} in diameter shall be placed on 1 inch {25 mm} centers starting 1 inch {25 mm} from the post top and extending the full length of the post or within 8 feet {2.4 m} or less of the bottom of the post (holes in tubular sections shall extend through the opposite walls),

d. Finish.

Aluminum supports shall be provided with a smooth non-glare finish.

4. Bolts, Nuts, Washers and Miscellaneous Hardware.

High strength bolts, nuts, and washers shall meet the requirements of Article 836.33. Bolts, nuts, and washers other than high-strength shall meet the requirements of ASTM A 307 for bolts and the appropriate requirements noted in Subarticle 836.33(a) for nuts and washers.

All bolts, nuts, and washers shall be galvanized utilizing zinc in accordance with the provisions of ASTM B695 Class 50. Other miscellaneous hardware shall be galvanized in accordance with ASTM A 153, Class B.

(b) Overhead Sign Supports.

The materials required for overhead sign supports shall be furnished in accordance with the requirements given in Section 891.

880.05 Protection Of Sign Material.

All sign panels shall be protected by packaging after fabrication and during shipment and storage. Packaging and packing shall be adequate to prevent damage to any part of the sign panel, legends, copy, or borders. Before packaging all paint shall be thoroughly dry and all signs free of moisture. Adhesive tapes shall not be used on any sign face. All packaged signs shall be kept entirely dry.

All assembled or partially assembled signs, other than flat sheet signs, shall have sufficient braces securely attached to prevent buckling or warping at all times from after assembly has begun until the signs have been attached to their permanent supports.

880.06 Sampling, Inspection and Testing of Sign Materials.

Sampling and inspection of sign materials will be done in accordance with the requirements given in ALDOT-245, "Procedures for Sampling and Inspection of Roadway Signs and Overhead Sign Structures."

All hardware such as nuts, bolts, washers, angles, channels, etc., sign panels along with the samples of the materials used in the panels and any certified test reports required and sign supports shall be shipped to the project site. Inasmuch as certain tests require actual inspection of all sign panels, the Contractor shall supply at the time of inspection the necessary personnel for uncrating and movement of the panels.

Until test reports are issued on the sign materials, the Contractor will not be permitted to install the sign materials, unless written approval for such has been obtained from the Central Office.

Should any material samples fail or any question arise concerning submitted samples being representative of those on the project, additional samples shall be selected from those on hand at the job site. Failure of resamples shall be cause for rejection of all items of the type involved.

Verification of color by comparison with Color Tolerance Charts published by the FHWA shall be made. Noticeable variation in color shall be cause of ordering inspection of all sign faces and the rejection of any sign face outside the tolerances provided by the Color Charts.

All signs shall be inspected for faulty application, blemishes, or other faults that might impair the serviceability of the sign or any noticeable color mismatching when viewed from a distance of 25 feet {8 m} under both daylight and nighttime conditions shall be cause for rejection of the sign face.