



Florida Department of Transportation

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Tallahassee, FL 32399-0450

KEVIN J. THIBAUT, P.E.
SECRETARY

December 15, 2020

Khoa Nguyen
Director, Office of Technical Services
Federal Highway Administration
3500 Financial Plaza, Suite 400
Tallahassee, Florida 32312

Re: State Specifications Office
Section: **993**
Proposed Specification: **9930100 OBJECT MARKERS AND DELINEATORS.**

Dear Mr. Nguyen:

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

The changes are proposed by Gevin McDaniel to remove High Performance Delineators and High Visibility Median Separator Delineators from the Specification and add new language to the Standard Specification. Please note there are two other revisions, the 9910000 and 7040000 that complement this proposal. They will be in separate emails for documentation purposes. See [Roadway Design Memorandum 20-03](#) for a detailed description of these changes.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to daniel.strickland@dot.state.fl.us.

If you have any questions relating to this specification change, please call me at 414-4130.

Sincerely,

Signature on file

Daniel Strickland, P.E.
State Specifications Engineer

DS/dh

Attachment

cc: Florida Transportation Builders' Assoc.
State Construction Engineer

OBJECT MARKERS AND DELINEATORS(REV ~~10-812-8-20~~)

ARTICLE 993-1 is deleted and the following substituted:

**SECTION 993
OBJECT MARKERS AND DELINEATORS****993-1 Object Markers.**

993-1.1 General: Object markers shall meet the general requirements outlined in the Manual of Uniform Traffic Control Devices (MUTCD). For uniformity, all Type 1 markers shall be ~~either OM1-1 or OM1-3 style markers, all Type 2 markers shall be either OM2-1V or OM2-2V style markers, and all Type 4 (end of road) markers shall be OM4-3 style markers, and all end of road markers shall be either OM4-1 or OM4-3 style markers.~~

~~**993-1.2 Retroreflectors:** The reflectors shall be of acrylic plastic and shall be a minimum of 3 inches in diameter. They shall be mounted in a heavy duty housing with a back plate.~~

~~The reflector shall consist of a clear and transparent plastic lens, which shall be red or amber as specified, and a plastic back of the same material, fused to the lens under heat and pressure around the entire perimeter, in such manner as to form a homogeneous unit, permanently sealed against dust, water, and water vapor.~~

~~The lens shall consist of a smooth front surface, free from projections or indentations (other than for identification or orientation) and a rear surface bearing a prismatic configuration such that it will effect total internal reflection of light.~~

~~The acrylic plastic shall be of a type meeting the requirements of Federal Specification L-P-380, Type I, Class 3, and, in order that the Department can readily check the suitability of the raw material used, the manufacturer shall stipulate the raw material and the particular molding compound to be furnished.~~

~~**993-1.2.1 Durability Tests for Retroreflectors:** Seal Test: The following test will be used to determine if a reflector is adequately sealed against dust and water.~~

~~Submerge 20 samples in water bath at room temperature. Subject the submerged samples to a vacuum of 10 inches gauge for five minutes. Restore atmospheric pressure and leave samples submerged for five minutes, then remove and examine the samples for water intake. Failure of more than two of the 20 samples tested shall be cause for tentative rejection of the LOT.~~

~~**993-1.2.2 Optical Requirements:** The initial specific intensity of object markers shall be at least equal to the minimum values shown below. Failure to meet the required specific intensity shall constitute failure of the reflector being tested.~~

Observation Angle	Entrance Angle	Specific Intensity candelas/foot-candle		
		Crystal	Yellow	Red
0.1 degree	0 degree	40	24	10
0.1 degree	20 degree	16	10	4

The reflector to be tested shall be spun so as to have an average orientation effect, and shall be placed at a distance of 100 feet from a single light source having an effective diameter of 2 inches. The light source shall be operated at approximately normal efficiency. The return light from the reflector shall be measured by means of a photo electric photometer having a minimum sensitivity of 1 by 10^7 foot candles per mm scale division. The photometer shall have a receiving aperture of 1/2 inch diameter, shielded to prevent the entry of stray light. The distance from light source center to aperture center shall be 2.1 inches for the 0.1 degree observation angle.

If a test distance other than the stipulated 100 feet is used, the source and the aperture dimensions, and the distance between source and aperture shall be modified directly as the test distance.

993-1.2.3 Reflector Housing: The reflector shall be mounted in a housing fabricated of aluminum alloy No. 3003-H 14 (or other alloy approved as equal for the purpose), and having a thickness of 0.064 inches.

993-1.3 Retroreflective Sheeting:

993-1.3.1 Retroreflective Sheeting: The retroreflective sheeting for object markers shall meet the requirements of Section 994, sheeting Types IV, V or XI. The retroreflective area shall be in accordance with the MUTCD. The retroreflective sheeting shall be permanently adhered to 0.040 inch sheet aluminum for Type 2 markers and 0.080 inch sheet aluminum for Type 1, 3 and end of the road markers. Aluminum shall be of 6061 T6 (ASTM B209) prepared in accordance with recommendations of the sheeting manufacturer.

993-1.3.2 Assembly: Type 2 and 3 markers shall be mounted directly to the post by two holes on the face of the marker. The mounting holes shall be 1/4 inch square holes to receive 1/4 inch carriage bolts, or other 1/4 inch bolts and shall be spaced to fit holes on the post spaced at 1 inch centers.

993-1.4 Posts: The marker posts shall be of steel or aluminum as shown in the Standard Plans or the Plans. Steel posts shall be 3 lb/ft. flanged U Channel. The U channel posts shall meet the mechanical requirements of ASTM A499, Grade 60. Provide U channel posts that have been galvanized after fabrication in accordance with ASTM A123 and have a smooth uniform finish free from defects affecting strength, durability and appearance. For each U channel, punch or drill 3/8 inch diameter holes on 1 inch centers through the center of the post, starting approximately 1 inch from the top and extending the full length of the post. Punching or drilling operations shall be completed prior to galvanization. The weight per foot of a manufacturer's U channel size shall not vary more than plus or minus 3.5% of its specified weight per foot. Machine straighten the U channel to a tolerance of 0.4% of the length. U channel posts shall be listed on the APL. Round aluminum posts shall meet the requirements of Standard Plans, Index 700-010.

Use attachment hardware (nuts, bolts, clamps, brackets, braces, etc.) of aluminum or galvanized steel.

993-1.2.3 Retroreflective Sheeting:

993-1.2.3.1 Retroreflective Sheeting: The retroreflective sheeting for object markers shall meet the requirements of Section 994, sheeting Types IV, V or XI. The retroreflective area shall be in accordance with the MUTCD. The retroreflective sheeting shall be permanently adhered to ~~0.040 inch~~ 0.040-inch sheet aluminum for Type 2 markers and 0.080-inch sheet aluminum for Type 1, Type 3, and Type 4 end of the road markers. Aluminum

shall be of 6061-T6 (ASTM B209) prepared in accordance with recommendations of the sheeting manufacturer.

993-1.23.2 Assembly: Type 2 and 3 markers shall be mounted directly to the post by two holes on the face of the marker. The mounting holes shall be 1/4-inch square holes to receive 1/4-inch carriage bolts, or other 1/4-inch bolts and shall be spaced to fit holes on the post spaced at 1-inch centers.

993-1.34 Posts: The marker posts shall be of steel or aluminum as shown in the Standard Plans or the Plans. Steel posts shall be 3 lb/ft. flanged U-Channel. The U-channel posts shall meet the mechanical requirements of ASTM A499, Grade 60. Provide U-channel posts that have been galvanized after fabrication in accordance with ASTM A123 and have a smooth uniform finish free from defects affecting strength, durability, and appearance. For each U-channel, punch or drill 3/8-inch diameter holes on 1-inch centers through the center of the post, starting approximately 1 inch from the top and extending the full length of the post. Punching or drilling operations shall be completed prior to galvanization. The weight per foot of a manufacturer's U-channel size shall not vary more than plus or minus 3.5% of its specified weight per foot. Machine-straighten the U-channel to a tolerance of 0.4% of the length. U-channel posts shall be listed on the APL. Round aluminum posts shall meet the requirements of Standard Plans, Index 700-010.

Use attachment hardware (nuts, bolts, clamps, brackets, braces, etc.) of aluminum or galvanized steel.

ARTICLE 993-2 is deleted and the following substituted:

993-2 Delineators.

993-2.1 General: Delineators shall be classified into five the following types: flexible post delineators, nonflexible post delineators, high visibility median separator delineators, high performance delineators, and barrier delineators.

993-2.2 Flexible Post Delineators:

993-2.2.1 Dimensions: The post shall have a minimum width of 3 inches facing traffic and of such length to generally provide a height of 48 inches above the pavement surface.

993-2.2.2 Color: The post shall be opaque white. The yellowness index shall not exceed 12 when tested in accordance with ASTM E313. The day~~time~~light 45 degrees, 0 degrees lumin~~ance~~ous factor, Cap Y, directional reflectance shall be a minimum of -70,~~when~~ tested in accordance with ASTM E1347 or ASTM E1164.

993- 2.2.3 Retroreflective Sheeting: The reflective sheeting shall be Types IV, V, ~~or~~ XI and meet the requirements of Section 994. The reflective sheeting shall have a minimum width of 3 inches and have a minimum area of 30 square inches.

993-2.2.4 Impact Performance: Six of the eight posts shall be capable of returning to a vertical position plus or minus 10 degrees with no delaminating. No post shall split, crack, break, or separate from base. Posts shall be tested and evaluated according to the National Testing Product Evaluation Program (NTPEP)-Project Work Plan for Field Evaluation of Flexible Surface Mounted Delineator Posts Evaluation of Temporary Traffic Control Devices: Flexible Delineators, for the following categories:

993-2.2.4.1 Pavement/Surface mounted: Use the Metropolitan Delineator Applications category for Hot Weather with a minimum of 10 impacts (default testing procedure uses a maximum of 200 impacts).

993-2.2.4.2 Ground mounted: Use the Ground Mount Side of Roadway Applications category for Hot Weather (default testing procedure uses a maximum of 10 impacts). A temperature of 65°F or greater may be used in lieu of the NTPEP temperature requirements. Posts shall be capable of returning to a vertical position plus or minus 5 degrees with no delaminating, and one post may list no more than 10 degrees. No post shall split, crack, break, or separate from base.

993-2.3 Nonflexible Post Delineators:

993-2.3.1 Posts: The posts shall meet the requirements of 993-1.4, except the steel delineator post shall be 1.1 lb/ft.

993-2.3.2 Retroreflective Sheeting: The retroreflective sheeting shall be Types IV, V, or XI sheeting and meet the requirements of Section 994. The reflective sheeting shall have a minimum width of 4 inches and have a minimum area of 32 square inches. The retroreflective sheeting shall be permanently adhered to 0.040-inch sheet aluminum.

993-2.4 High Visibility Median Separator Delineators:

993-2.4.1 Dimensions: The delineator shall have a minimum height of 42 inches above the surface of the separator.

993-2.4.2 Post Base: The base shall be manufactured to accommodate the replacement of the post. The base shall be mechanically anchored to the separator and be capable of withstanding ten vehicle impacts without damage.

993-2.4.3 Color: The plastic post shall be opaque white. The yellowness index shall not exceed 12 when tested in accordance with ASTM E313. The daylight 45 degree, 0 degree luminous directional reflectance shall be a minimum of 70 when tested in accordance with ASTM E1347 or ASTM E1164.

993-2.4.4 Retroreflective Sheeting: The reflective sheeting shall be Types IV, V, or XI and meet the requirements of Section 994. The reflective sheeting shall have a minimum width of 8 inches and have a minimum area of 230 square inches facing the approach to the separator. The sheeting shall be yellow in color for both approaches.

993-2.4.5 Impact Performance: The post, installed according to manufacturer's recommendations, shall be capable of returning to a vertical position plus or minus 5 degrees when tested according to National Testing Product Evaluation Program (NTPEP). The NTPEP requirement of one half of the hits at 32 F is waived. All hits may be at 65 F or greater. NTPEP data or independent test lab data shall be submitted for product approval.

993-2.5 High Performance Delineators:

993-2.5.1 Dimensions: The delineator shall have a minimum height of 36 inches above the pavement surface and have a minimum diameter of 2 inches.

993-2.5.2 Post Base: The base shall be mechanically anchored to the pavement and be capable of withstanding 50 vehicle impacts without damage.

993-2.5.3 Color: The plastic post shall be opaque white. The yellowness index shall not exceed 12 when tested in accordance with ASTM E313. The daylight 45 degree, 0 degree luminous directional reflectance shall be a minimum of 70 when tested in accordance with ASTM E1347 or ASTM E1164.

993-2.5.4 Retroreflective Sheeting: The reflective sheeting shall be Type V abrasion resistant sheeting and meet the requirements of Section 994. The reflective sheeting shall have a minimum omni-directional area of 30 square inches.

993-2.5.5 Impact Performance: To resist an impact of a test vehicle, the post must restore to within 10 degrees of vertical in any direction, and not have a crack or tear

~~through more than 50% of its cross section. List/Lean must be measured from the point the post protrudes from the base to the top edge of the post. For acceptance purposes, there should be no post failures and no more than two posts may list between 5 degrees and 10 degrees after receiving fifty vehicle impacts.~~

~~Impact testing must be performed in accordance with NTPEP Evaluation of Temporary Traffic Control Devices: Flexible Delineators, for the category of High Speed Applications. Testing must be performed by a facility that is listed on the Laboratories Accredited to Crash Test Roadside Safety Hardware which can be found at the following URL: http://tf13.org/Subcommittee_7_Test_Facilities.php.~~

993-2.64 Barrier Delineators:

993-2.64.1 General: Barrier delineators shall consist of retroreflective sheeting permanently adhered to 0.090-inch minimum thick body. The body shall have a flexible hinge which allows the reflector to fold down and spring back to an upright position after impact. Barrier delineators for guardrail shall be designed for mounting to the web of steel posts or designed for mounting to the top of wood posts. Barrier delineators for concrete barrier, traffic railings, and vehicular longitudinal channelizing devices (LCDs) shall be designed for mounting to the top of each device.

993-2.64.2 Retroreflective Sheeting: The sheeting for barrier delineators shall be Type IV or XI meeting the requirements of Section 994. The sheeting shall be yellow or white, depending on the locations of use for each. The dimensions of the retroreflective sheeting shall be a minimum of 3 inches wide by 4 inches high. The sheeting shall be installed by the delineator manufacturer.

OBJECT MARKERS AND DELINEATORS**(REV 12-8-20)**

ARTICLE 993-1 is deleted and the following substituted:

**SECTION 993
OBJECT MARKERS AND DELINEATORS****993-1 Object Markers.**

993-1.1 General: Object markers shall meet the general requirements outlined in the Manual of Uniform Traffic Control Devices (MUTCD). For uniformity, all Type 1 markers shall be OM1-3 style markers, all Type 2 markers shall be OM2-2V style markers, and all Type 4 (end of road) markers shall be OM4-3 style markers.

993-1.2 Retroreflective Sheeting:

993-1.2.1 Retroreflective Sheeting: The retroreflective sheeting for object markers shall meet the requirements of Section 994, sheeting Types IV, V or XI. The retroreflective area shall be in accordance with the MUTCD. The retroreflective sheeting shall be permanently adhered to 0.040-inch sheet aluminum for Type 2 markers and 0.080-inch sheet aluminum for Type 1, Type 3, and Type 4 markers. Aluminum shall be of 6061-T6 (ASTM B209) prepared in accordance with recommendations of the sheeting manufacturer.

993-1.2.2 Assembly: Type 2 and 3 markers shall be mounted directly to the post by two holes on the face of the marker. The mounting holes shall be 1/4-inch square holes to receive 1/4-inch carriage bolts, or other 1/4-inch bolts and shall be spaced to fit holes on the post spaced at 1-inch centers.

993-1.3 Posts: The marker posts shall be of steel or aluminum as shown in the Standard Plans or the Plans. Steel posts shall be 3 lb/ft. flanged U-Channel. The U-channel posts shall meet the mechanical requirements of ASTM A499, Grade 60. Provide U-channel posts that have been galvanized after fabrication in accordance with ASTM A123 and have a smooth uniform finish free from defects affecting strength, durability, and appearance. For each U-channel, punch or drill 3/8-inch diameter holes on 1-inch centers through the center of the post, starting approximately 1 inch from the top and extending the full length of the post. Punching or drilling operations shall be completed prior to galvanization. The weight per foot of a manufacturer's U-channel size shall not vary more than plus or minus 3.5% of its specified weight per foot. Machine-straighten the U-channel to a tolerance of 0.4% of the length. U-channel posts shall be listed on the APL. Round aluminum posts shall meet the requirements of Standard Plans, Index 700-010.

Use attachment hardware (nuts, bolts, clamps, brackets, braces, etc.) of aluminum or galvanized steel.

ARTICLE 993-2 is deleted and the following substituted:

993-2 Delineators.

993-2.1 General: Delineators shall be classified into the following types: flexible post delineators, nonflexible post delineators, and barrier delineators.

993-2.2 Flexible Post Delineators:

993-2.2.1 Dimensions: The post shall have a minimum width of 3 inches facing traffic and of such length to generally provide a height of 48 inches above the pavement surface.

993-2.2.2 Color: The post shall be opaque white. The yellowness index shall not exceed 12 when tested in accordance with ASTM E313. The daytime 45 degrees, 0 degrees luminance factor, Cap Y, shall be a minimum of 70, tested in accordance with ASTM E1347 or ASTM E1164.

993- 2.2.3 Retroreflective Sheeting: The reflective sheeting shall be Types IV, V, or XI and meet the requirements of Section 994. The reflective sheeting shall have a minimum width of 3 inches and have a minimum area of 30 square inches.

993-2.2.4 Impact Performance: Six of the eight posts shall be capable of returning to a vertical position plus or minus 10 degrees with no delaminating. No post shall split, crack, break, or separate from base. Posts shall be tested and evaluated according to the National Testing Product Evaluation Program (NTPEP) Evaluation of Temporary Traffic Control Devices: Flexible Delineators, for the following categories:

993-2.2.4.1 Pavement/Surface mounted: Use the Metropolitan Delineator Applications category for Hot Weather with a minimum of 10 impacts (default testing procedure uses a maximum of 200 impacts).

993-2.2.4.2 Ground mounted: Use the Ground Mount Side of Roadway Applications category for Hot Weather (default testing procedure uses a maximum of 10 impacts).

993-2.3 Nonflexible Post Delineators:

993-2.3.1 Posts: The posts shall meet the requirements of 993-1.4, except the steel delineator post shall be 1.1 lb/ft.

993-2.3.2 Retroreflective Sheeting: The retroreflective sheeting shall be Types IV, V or XI sheeting and meet the requirements of Section 994. The reflective sheeting shall have a minimum width of 4 inches and have a minimum area of 32 square inches. The retroreflective sheeting shall be permanently adhered to 0.040-inch sheet aluminum.

993-2.4 Barrier Delineators:

993-2.4.1 General: Barrier delineators shall consist of retroreflective sheeting permanently adhered to 0.090-inch minimum thick body. The body shall have a flexible hinge which allows the reflector to fold down and spring back to an upright position after impact. Barrier delineators for guardrail shall be designed for mounting to the web of steel posts or designed for mounting to the top of wood posts. Barrier delineators for concrete barrier, traffic railings, and vehicular longitudinal channelizing devices (LCDs) shall be designed for mounting to the top of each device.

993-2.4.2 Retroreflective Sheeting: The sheeting for barrier delineators shall be Type IV or XI meeting the requirements of Section 994. The sheeting shall be yellow or white, depending on the locations of use for each. The dimensions of the retroreflective sheeting shall be a minimum of 3 inches wide by 4 inches high. The sheeting shall be installed by the delineator manufacturer.