Florida Department of Transportation

RICK SCOTT
GOVERNOR

605 Suwannee Street
Tallahassee, FL 32399-0450

ANANTH PRASAD, P.E.
SECRETARY

July 29, 2013

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

Re: State Specifications and Estimates Office
Section **993**
Proposed Specification: **9930000 Object Markers and Delineators.**

Dear Ms. Gourdine:

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

These changes were proposed by Stefanie Maxwell of the State Construction Office to correct the name to “barrier delineators”, and correct sheeting Types based on new changes in Section 994.

Please review and transmit your comments, if any, within two weeks. Comments should be sent via email to SP965DS or daniel.scheer@dot.state.fl.us.

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

Sincerely,

Daniel Scheer, P.E.
State Specifications Engineer

DS/cah
Attachment
cc: Florida Transportation Builders' Assoc.
State Construction Engineer

OBJECT MARKERS AND DELINEATORS.
(REV *7*~~6~~-*29*~~187~~-13)

SECTION 993 (Pages 1142 – 1145) 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 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 ~~III,~~ IV~~,~~ *V* or ~~VI~~*X*I. 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 Design Standards or Plans. Steel posts shall be 2.5 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~~es~~ 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 QPL. Round aluminum posts shall meet the requirements of Design Standards, Index No. 11860.

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

993-2 Delineators.

993-2.1 General: Delineators shall be classified into f*ive*~~our~~ types: ~~recycled~~ flexible post delineators, nonflexible post delineators, high visibility median separator delineators, ~~and~~ high performance delineators*, and ~~guardrail 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 D1925 or ASTM E313. The daylight 45 degree, 0 degree luminous directional reflectance shall be a minimum of 70 when tested in accordance with ASTM E1347.

993- 2.2.3 Retroreflective Sheeting: The reflective sheeting shall be Types ~~III,~~ IV~~, V~~, *V* or ~~VI~~*X*I 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: 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. 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 ~~III,~~ IV~~, V~~, *V* or ~~VI~~*X*I 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 D1925 or 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 ~~III,~~ IV~~, V~~, *V* or ~~VI~~*X*I 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 48 inches above the pavement surface and have a minimum dimension of 2 inches.

993-2.5.2 Post Base: The base shall be manufactured to accommodate the replacement of the post. The base shall be mechanically anchored to the pavement and be capable of withstanding fifty 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 D1925 or 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: The post, installed according to manufacturer's recommendations, shall be capable of returning to a vertical position plus or minus 5 degrees with no delaminating after receiving fifty vehicle impacts 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 shall be at 65°F or greater. NTPEP data or independent test lab data shall be submitted for product approval. For acceptance purposes there should be no post failures and no more than two posts may list between 5° and 10°after receiving fifty vehicle impacts.

993-2.6 ~~Guardrail and~~ Barrier Delineators:

~~993-3 Retroreflector Units for Guardrail and Concrete Barrier Wall.~~

993-*2.6*~~3~~.1 General: ~~*Guardrail and b*~~*Barrier*~~Retroreflector units~~ *delineators for use on guardrail, concrete barrier and* ~~*bridge*~~*traffic railing* ~~for use on guardrail and concrete barrier wall installations~~ 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*~~Guardrail~~ *delineators*~~reflectors~~ *for guardrail* shall be designed for mounting to the web of steel posts or designed for mounting to wood posts. Barrier ~~wall reflectors~~*delineators for concrete barrier wall and* ~~*bridge*~~*traffic railings* shall be designed for mounting to the top of the barrier wall.

993-*2.6*~~3~~.2 Retroreflective Sheeting: The sheeting for ~~these reflector units *guardrail and*~~ *barrier delineators* shall be Type IV~~, V,~~ or ~~VI~~*X*I 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 *retro*reflective sheeting shall be 3 inches wide by 4 inches high. The sheeting shall be installed by the *delineator*~~reflector~~ manufacturer.

~~**993-3.3 Installation:** The reflector units shall be capable of being installed on the top of guardrail posts or the top of the barrier wall.~~

993-*3*~~4~~ Product Acceptance on the Project.

Acceptance will be made in accordance with the requirements of Section 705. Manufacturers seeking evaluation of their product must submit an application in accordance with Section 6.

OBJECT MARKERS AND DELINEATORS.
(REV 7-29-13)

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993-1 Object Markers.

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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.

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

993-2 Delineators.

993-2.1 General: Delineators shall be classified into five 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 D1925 or ASTM E313. The daylight 45 degree, 0 degree luminous directional reflectance shall be a minimum of 70 when tested in accordance with ASTM E1347.

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: 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. 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.

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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.

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993-2.5.5 Impact Performance: The post, installed according to manufacturer's recommendations, shall be capable of returning to a vertical position plus or minus 5 degrees with no delaminating after receiving fifty vehicle impacts 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 shall be at 65°F or greater. NTPEP data or independent test lab data shall be submitted for product approval. For acceptance purposes there should be no post failures and no more than two posts may list between 5° and 10°after receiving fifty vehicle impacts.

993-2.6 Barrier Delineators:

993-2.6.1 General: Barrier delineators for use on guardrail, concrete barrier and traffic railing 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 wood posts. Barrier delineators for concrete barrier wall and traffic railings shall be designed for mounting to the top of the barrier wall.

993-2.6.2 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 3 inches wide by 4 inches high. The sheeting shall be installed by the delineator manufacturer.

993-3 Product Acceptance on the Project.

Acceptance will be made in accordance with the requirements of Section 705. Manufacturers seeking evaluation of their product must submit an application in accordance with Section 6.