ORIGINATION FORM

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X Modify Specification **Section 993**.
Section/File number

☐ New Section _____.
Section number

Subject: Highway Delineators

Origination date: June 1, 2007

Originator: Chester Henson
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Problem statement: The current specification did not address the differences between object markers and delineators. Information in the current specification was inconsistent with the Manual on Uniform Traffic Control Devices.

Information source: The changes were coordinated with specifications, maintenance and industry.

Background data: The Design Standards and pay items have also been revised to clarify the differences between object markers and delineators.

Recommended Usage Note:

Expected fiscal impact, if implemented: There is no significant financial impact.

Implementation of these changes, if and when approved, will begin with the July 2008 letting.

Florida Department of Transportation

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GOVERNOR

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STEPHANIE KOPELOUSOS
SECRETARY

M E M O R A N D U M

DATE: June 8, 2007

TO: Specification Review Distribution List

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

SUBJECT: Proposed Specifications Change: 9930000 Object Markers and Highway Delineators

In accordance with Specification Development Procedures, we are sending you a copy of a proposed new specification change for Object Markers and Highway Delineators.

This change was proposed by Chester Henson of the State Design Office to address differenced between object markers and delineators and to eliminate inconsistencies with the current specs and the Manual on Uniform Traffic Control Devices.

Please share this proposal with others within your responsibility. Review comments are due within four weeks and should be sent to Mail Station 75 or to my attention via e-mail at SP965DB or duane.brautigam@dot.state.fl.us. Comments received after July 6, 2007 may not be considered. Your input is encouraged.

DFB/ft

Attachment

COMMENTS:

Submitted by: Phone #:

HIGHWAY DELINEATORS.

(REV ~~5-14-07~~*6-7-07*)

SECTION 993 (Pages 909 - 912) is deleted and the following substituted:

SECTION 993
OBJECT MARKERS AND **~~HIGHWAY~~ DELINEATORS**
~~(INCLUDING POSTS AND ATTACHMENTS)~~

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 Type A Delineators*Retroreflectors***~~ .

993-1.*2*~~1~~ ~~Reflectors~~*Retroreflectors*: The reflectors ~~for these alternate delineators~~ 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*~~colorless~~ 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.

The reflector element shall meet the test requirements specified below.

993-1.2.*1* Durability Tests For ~~Type A~~ *Retror*~~R~~eflectors:

(a) Seal Test: The following test will be used to determine if a reflector is adequately sealed against dust and water.

Submerge 50 samples in water bath at room temperature. Subject the submerged samples to a vacuum of 5 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 50 samples tested shall be cause for tentative rejection of the LOT.

In the event of such tentative failure of more than two of the 50 samples tested, a re-sample of the 100 reflector shall be checked-tested. If not more than four of these 100 samples fail then the LOT will be considered as acceptable.

(b) Corrosion Test: The reflector assembly shall withstand the combined corrosion test set forth in ASTM B 117.

993-1.*2.2*~~3~~ Optical Requirements:

~~**993-1.3.1 Definitions:** The term, "Entrance Angle", designates the angle at the reflector between the direction of light incident on it and the direction of the reflector axis.~~

~~The term, "Observation Angle", designates the angle at the reflector between the observer's line of sight and the direction of light incident on the reflector.~~

~~The term, "Specific Intensity", designates the candle-power returned by a reflector at the specific observation angle, for each foot-candle of illuminance at the reflector.~~

~~**993-1.3.2 Specific Intensity:**~~ The specific intensity of every ~~reflex~~ reflector intended for use in the delineators 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. Failure of more than two reflectors out of 50 subjected to test shall constitute failure of the entire LOT.

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

~~**993-1.3.3 Optical Testing Procedure:**~~ The ~~reflex~~ 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*~~4 Delineator~~ *Reflector* ~~*Retroreflective*~~ *Housing*~~Element~~: The ~~delineator *retroreflective* element shall consist of a~~ reflector *shall be*~~element~~ mounted in a housing fabricated of aluminum alloy No. 3003-H 14 (or other alloy approved as equal for the purpose), ~~or of heavy thickness, cold-rolled, hot-dip, galvanized steel,~~ and having a thickness of 0.064 inch.

After all fabrication has been completed, the aluminum housing shall be treated with Alodine 1200, Iridite 14-2, Bonderite 721, or equal product, in accordance with the recommendations of the manufacturer of the particular treatment used.

~~**993-1.5 Assembly:** The attachment of the delineator *retroreflector* to the housing and of the housing to the post shall be by such method that no mounting hole is required in the *object marker or* delineator; also, that the *object marker or* delineator can be easily removed from the post with proper tools but that such removal is not possible without the use of such tools.~~

~~The mounting holes shall be sized to receive 1/4 inch carriage bolts, or other 1/4 inch bolts, and shall be spaced to fit holes on the posts spaced at 1 inch centers.~~

993-*1.3*~~2~~ ~~Type C Delineators~~*Retroreflective Sheeting*.

993-*1.3*~~2~~.1 *Retror*~~R~~eflective Sheeting: The reflective sheeting for *object markers*~~these alternate delineators~~ shall meet the requirements of Section 994, sheeting Types III, IV, V *or*~~and~~ VII. The *retro*~~delineators~~ *reflective area* shall be *in accordance with the MUTCD*~~4 by 4 inch or 4 by 8 inch~~. *The retro*~~ with the~~ reflective 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 4 markers. Aluminum shall be* of 6061-T6 (ASTM B 209) prepared in accordance with recommendations of the sheeting manufacturer.

993-*1.3*~~2~~.2 Assembly: The attachment of the ~~delineator~~ *Type 2 and 3 markers shall be*~~*reflective sheeting and sheet aluminum*~~ *mounted* directly to the post~~ shall be~~ by two holes on the face of the *marker*~~delineator~~.

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.

~~*For flexible, plastic posts, the reflective sheeting is installed onto the flat surface of the top end of the post.*~~

993-*1.4*~~3 Delineator~~ Posts~~ and Accessories~~.

The *marker*~~delineator~~ posts shall be of steel ~~,~~*or* ~~or~~ aluminum~~, *plastic or recycled plastic*~~ as shown in the *Design Standards or* plans~~ and of the alloys called for~~. ~~They shall have the necessary holes for attachment of the delineator housing.~~

~~The assembly shall be furnished with the necessary bolts, nuts and washers for attaching to the posts.~~

993-2 Delineators.

993-2.1 General: *Delineators shall be classified into three types: recycled flexible post delineators, nonflexible post delineators, high visibility median separator delineators, and high performance delineators.*

993-2.2 Recycled Flexible Post Delineators: *Meet the requirements of Section 972.*

993-2.3 Nonflexible Post Delineators:

993-2.3.1 Posts: *The post shall be 2.5 #/Ft. steel flanged channel posts and have a minimum height of 48 inches above the pavement surface.*

993-2.3.2 Retroreflective Sheeting: *The reflective sheeting shall be Type I III, IV, V or VII 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 inch^2. 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 post shall have a minimum height of 42 inches above the surface of the separator.*

993-2.4.2 Post Base: *The base shall have a replacement feature which allows for the replacement of the post. The base shall be permanently anchored to the separator and be capable of withstanding one hundred vehicle impacts without damage.*

993-2.4.3 Color: *The post shall be opaque white. The yellowness index shall not exceed 12 when tested in accordance with ASTM D 1925 or ASTM E 313. The daylight 45 degree, 0 degree luminous directional reflectance shall be a minimum of 70 when tested in accordance with ASTM E 1347.*

993-2.4.4 Retroreflective Sheeting: *The reflective sheeting shall be Types III, IV, V or VII 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 inch^2.*

993-2.4.5 Impact Performance: *The post, installed according to manufacturer's recommendations, shall be capable of returning to a vertical position ±5 degrees and remain serviceable after receiving twenty five vehicle impacts at 55 mph at a 20 degree angle. The ambient temperature must be no less than 40ºF.*

993-2.5 High Performance Delineators:

993-2.5.1 Dimensions: *The post shall have a minimum height of 48 inches above the pavement surface. The post shall have a minimum diameter or width of 3 inches.*

993-2.5.2 Post Base: *The base shall have a replacement feature which allows for the replacement of the post. The base shall be permanently anchored to the roadway and be capable of withstanding one hundred vehicle impacts without damage.*

993-2.5.3 Color: *The post shall be opaque white. The yellowness index shall not exceed 12 when tested in accordance with ASTM D 1925 or ASTM E 313. The daylight 45 degree, 0 degree luminous directional reflectance shall be a minimum of 70 when tested in accordance with ASTM E 1347.*

993-2.5.4 Retroreflective Sheeting: *The reflective sheeting shall be Type IV abrasion resistant sheeting 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 inch^2.*

993-2.5.5 Marking: *The top of the post on the side away from traffic shall be date stamped showing the month and year of fabrication. The numerals shall be at least 1/2 inch in height and shall be either die stamped or legibly stamped with permanent ink.*

993-2.5.6 Impact Performance: *The post, installed according to manufacturer's recommendations, shall be capable of returning to a vertical position ±5 degrees and remain serviceable after receiving one hundred vehicle impacts at 55 mph at a 20 degree angle. The ambient temperature must be no less than 40ºF.*

~~**993-4 Insulating Materials.**~~

~~Neoprene, for the separating of aluminum parts and steel parts, shall contain at least 60%, by volume, of pure neoprene. Other approved material may be used, subject to the requirement that the material shall meet the approval of the Engineer as to pliability and ability to withstand wear caused by stretching or distortion.~~

~~If other material or method is proposed for use as insulation, it shall be indicated along with any details necessary.~~

~~Additional materials specifications are shown in the plans.~~

993-*3*~~5~~ *Retror*~~R~~eflector Units for Guardrail and Concrete Barrier Wall.

993-~~5~~*3*.1 General: *Retror*~~R~~eflector units for use on guardrail and concrete barrier wall installations shall consist of ~~a hermetically sealed acrylic plastic prismatic reflex reflector or~~ retroreflective sheeting permanently adhered to 0.*090*~~040~~ inch *minimum* thick ~~sheet aluminum of 6061-T6 (ASTM B 209)~~ *body. The body shall have a flexible hinge which allows the reflector to fold down and spring back to an upright position after impact*~~prepared in accordance with recommendations of the sheeting manufacturer~~.

993-~~5~~*3*.2 *Retroreflective Sheeting*~~Reflector Element~~: *The sheeting for these reflector units shall be Type IV, V, or VII 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 reflective sheeting shall be 3 wide by 4 inches high. The sheeting shall be installed by the reflector manufacturer.*

~~**993-5.2.1 Acrylic Plastic:** These reflectors shall be of acrylic plastic meeting the requirements of Federal Specification L-P-380, Type I, Class 3. The manufacturer shall stipulate the raw material used in the compound in order that the Department may readily check the suitability of the raw material.~~

~~The reflector shall consist of a clear transparent, or translucent amber plastic face, herein referred to as the lens, with a heat sealable plastic coated metallic foil back fused to the lens under heat and pressure around the entire perimeters of the lens to form a unit permanently sealed against dust, water and water vapor.~~

~~The reflector lens shall consist of a smooth front surface, free from projections or indentations and the necessary identification markings, and a rear surface having a prismatic configuration such that it will affect total internal reflection of light.~~

~~When the reflectors are tested as specified in 993-1.3 for Type A Delineators, the specific intensity of the colorless reflectors shall not be less than 119 at 0 degree entrance angle and not less than 47 at 20 degree entrance angle, and the specific intensity of the amber reflectors shall be not less than 71 at 0 degree entrance angle and not less than 28 at 20 degree entrance angle.~~

~~**993-5.2.2 Retroreflective Sheeting**: Retroreflective sheeting for these reflector units shall be Type III, IV, V, or VII meeting the requirements of Section 994. The sheeting shall be yellow or white, depending on the locations of use for each. The minimum reflective surface area of the marker shall be 9 inch^2. The adhesive backing for these markers shall be Class I.~~

993-~~5~~*3*.3 Installation: ~~Markers shall be installed at locations identified in the plans and in accordance with the Design Standards, Index Nos. 400 and 410.~~*The reflector units shall be capable of being installed on the top of guardrail posts or the top of the barrier wall.*

993-*4*~~6~~ 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.