



*Florida Department of Transportation*

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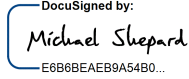
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**ROADWAY DESIGN MEMORANDUM 20-03**

DATE: October 30, 2020

TO: District Directors of Transportation Operations, District Directors of Transportation Development, District Design Engineers, District Construction Engineers, District Structures Design Engineers, District Maintenance Engineers, District Consultant Project Management Engineers, District Roadway Design Engineers, District Traffic Operations Engineers, Program Management Engineers, District Materials Engineers, District Specifications Engineers, District Estimates Engineers

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SUBJECT: Tubular Markers

This Memorandum highlights the implementation of design criteria in the 2021 *FDOT Design Manual (FDM)* regarding Tubular Markers and provides drafts of upcoming changes to the associated July 2021 *Standard Specifications* and a template for a *Modified Special Provision (MSP)* when a lower height tubular marker is required.

See the 2021 *FDM* for more information on the implementation of tubular marker criteria.

See the attached draft *Standard Specifications 704 (Tubular Markers)*, *991 (Channelizing Device Materials)*, and *993 (Object Markers and Delineators)*. These proposed changes are currently in the production process for the July 2021 *Standard Specifications*.

See the attached *Modified Special Provision (MSP)* template for *Section 991 (Channelizing Device Materials)* that may be used on projects for tubular markers with height of 24 inches. These lower heights are used to mitigate stopping sight distance when used for precluding lane changes in managed lane applications.

Roadway Design Memorandum 20-03

Tubular Markers

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## **BACKGROUND**

The Department is discontinuing the terminology previously used to describe managed lane channelizing devices (i.e., “Express Lane Markers” or “Managed Lane Markers”) and is now using the terminology “Tubular Markers” to classify the same device. Based on the superior in-service performance of these devices the Department is expanding their usage for channelization on arterials and collectors.

The *2021 FDM* now includes criteria for the use of Tubular Markers where previously, “High-Performance Delineators” or “High-Visibility Median Separator Delineators” have been specified. On July 1, 2021, the *Developmental Specification Dev993 (Object Markers and Delineators - Managed Lane Markers)* will be removed and replaced by the new *Standard Specifications 991 (Channelizing Device Materials)*.

The *Manual on Uniform Traffic Control Devices (MUTCD)* clearly defines the differences in applications between delineators and channelizing devices. Tubular markers are defined as one type of channelizing device. In addition, the *MUTCD* does not recognize delineators as traffic control devices for adding emphasis to traffic separators or islands. Instead, the *MUTCD* recommends tubular markers in these applications. See the *MUTCD, Chapter 3H* for more information.

With the increase in use of tubular markers within the traveled way, it is critical that the Department use the most durable and cost-competitive products available to reduce maintenance cost, exposure of maintenance workers, and traffic mobility impacts due to maintenance operations.

From cost history and experience from the Maintenance office, the High-Visibility Median Separator Delineators are no longer used. The cost of High-Visibility Median Separator Delineators is similar to the cost of the Managed Lane Markers. The durability of the Managed Lane Markers far exceeds the durability of High-Visibility Median Separator Delineators as supported by the current testing requirements and confirmed by all the District Maintenance Engineers.

The attached draft specifications show two categories of tubular markers, Durable Tubular Markers and Standard Tubular Markers. The specifications for the Standard Tubular Markers are similar to the old High-Performance Delineators and will only be available for project specific applications if requested by the District and approved by the Central Office specification monitor. The Standard Tubular marker section will be removed from the January 2022 *Standard Specifications*. The inclusion of the Standard Tubular Marker in the specification is solely to give the manufacturers for current High-Performance Delineators a reasonable amount of time to meet the requirements for Durable Tubular Markers. For this reason, the *FDM* does not distinguish between “Durable” and “Standard” tubular markers. After the implementation of the January 2022 *Standard Specifications*, “Durable Tubular Markers” will be renamed to “Tubular Markers” and the Standard Tubular Markers section will be deleted.

## **CONTACT**

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MAS/gm

**TUBULAR MARKERS**  
**(REV 9-28-20)**

The following new Section is added after Section 701.

**SECTION 704**  
**TUBULAR MARKERS**

**704-1 Description.**

Furnish and install tubular markers at the locations called for in the Standard Plans or in the Plans.

**704-2 Materials.**

Meet the following requirements:

Durable Tubular Markers.....Section 991

Standard Tubular Markers .....Section 991

**704-2.1 Product Acceptance on the Project:** Use tubular markers listed on the Department's Approved Product List (APL).

**704-3 Installation Requirements.**

Install tubular markers in accordance with the manufacturer's installation instructions posted on the APL. Use the same color as the pavement marking being emphasized.

**704-4 Method of Measurement.**

The quantity to be paid will be the number of tubular markers furnished, installed, and accepted.

**704-5 Basis of Payment.**

Prices and payments will be full compensation for work specified in this Section, including the cost of labor, materials, and incidental items required to complete the work.

Payment will be made under:

Item No. 704 - 1      Tubular Marker - each.

**CHANNELIZING DEVICE MATERIALS  
(REV 10-19-20)**

The following new Section is added after Section 990.

**SECTION 991  
CHANNELIZING DEVICE MATERIALS****991-1 Durable Tubular Markers****991-1.1 General.**

This subarticle describes the material requirements for tubular markers installed in accordance with Section 704. All Durable Tubular Marker products shall be listed on the Department's Approved Products List (APL).

**991-1.2 Dimensions.**

The post shall have a minimum diameter of 3 inches. The base of the tubular marker shall have a maximum dimension in any direction of 8 inches. The height of the tubular marker above the pavement surface shall be 36 inches.

**991-1.3 Color.**

Tubular Marker color must be uniform and integral throughout entire height of the post. The base may be black in color.

**991-1.3.1 White.**

The yellowness index shall not exceed 12, 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.

**991-1.3.2 Yellow.**

The daytime 45 degrees, 0 degrees luminance factor, Cap Y, shall be a minimum of 60, tested in accordance with ASTM E1347 or ASTM E1164.

**991-1.4 Retroreflective Sheeting.**

The color of the retroreflective sheeting shall match the color of the tubular marker. The retroreflective sheeting shall be abrasion resistant Type IV or Type V and meet the requirements of Section 994. The retroreflective sheeting shall meet supplementary requirements for reboundable sheeting as stated in section S.2 of ASTM D4956. The sheeting shall wrap around the entire circumference of the tube and have a minimum vertical dimension of 6 inches. The top of sheeting shall be 1-1/2 inches plus or minus 1/2 inch below the top of post.

**991-1.5 Product Testing.**

Manufacturers seeking evaluation of Durable Tubular Markers must include test reports from the National Transportation Product Evaluation Program (NTPEP) documenting the product meets the requirements of this Section. NTPEP impact testing must be performed in accordance with NTPEP Evaluation of Temporary Traffic Control Devices: Flexible Delineators for the category of High Speed Applications and for hot weather test temperature only.

Impact tests shall be performed only on tubular markers measuring 36 inches above the pavement surface.

Acceptable products are those listed on the IPL for Managed Lane Markers prior to July 2021 or those meeting the following requirements after receiving an average of 75 bumper impacts per sample and an average of 175 tire impacts per sample:

1. All posts shall self-restore to within 15 degrees list or lean from vertical.
2. All posts shall have a minimum of 50% of its cross-section, at any point along the post height, free of tears or cracks.

**991-1.6 Approved Product List Submission Requirements.**

Manufacturers seeking evaluation of Durable Tubular Marker products for inclusion on the APL shall submit an application in accordance with Section 6 and include the following documentation.

<b>Table 991-1</b>	
<b>Documentation</b>	<b>Requirement</b>
Product Photo	Displays the significant features of the product.
Technical Data Sheet, marker and adhesive	Uniquely identifies the product and includes product specifications, storage instructions, and recommended installation materials and equipment as applicable.
Safety Data Sheet, Adhesive	SDS meeting OSHA requirements for product and manufacturer recommended installation materials as applicable.
National Testing Product Evaluation Program (NTPEP) product testing report	See Section 991-1.5
Installation Instructions	Include mounting surface preparations, and touch-up and repair procedures. Separate installation instructions are required for different substrates.
Product Sample	Upon request from the Department, submit a sample of the tubular marker mounting material or hardware. If the product is a system comprised of multiple parts, a sample of each part must be submitted.

**991-2 Standard Tubular Markers:**

**991-2.1 General.**

This subarticle describes the material requirements for tubular markers installed in accordance with Section 704. All Standard Tubular Marker products shall be listed on the Department's Approved Products List (APL). Standard Tubular Markers must be approved for project-specific use with an issued project-specific pay item.

**991-2.2 Dimensions.**

The post shall have a minimum diameter of 2 inches. The minimum height of the tubular marker above the pavement surface shall be 36 inches.

**991-2.3 Color.**

Tubular Marker color must be uniform and integral throughout entire height of the post. The base may be black in color.

**991-2.3.1 White.**

The yellowness index shall not exceed 12, 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.

**991-2.3.2 Yellow.**

The daytime 45 degrees, 0 degrees luminance factor, Cap Y, shall be a minimum of 60, tested in accordance with ASTM E1347 or ASTM E1164.

**991-2.4 Retroreflective Sheeting.**

The color of the retroreflective sheeting shall match the color of the tubular marker. The retroreflective sheeting shall be abrasion resistant Type IV or Type V and meet the requirements of Section 994. The retroreflective sheeting shall meet supplementary requirements for reboundable sheeting as stated in section S.2 of ASTM D4956. The sheeting shall wrap around the entire circumference of the tube and have a minimum vertical dimension of 6 inches. The top of sheeting shall be 1-1/2 inches plus or minus 1/2 inch below the top of post.

**991-2.5 Product Testing.**

Manufacturers seeking evaluation of Standard Tubular Markers must include test reports from the National Transportation Product Evaluation Program (NTPEP) documenting the product meets the requirements of this Section. NTPEP impact testing must be performed in accordance with NTPEP Evaluation of Temporary Traffic Control Devices: Flexible Delineators for the category of High Speed Applications and for hot weather test temperature only.

Impact tests shall be performed only on tubular markers measuring 36 inches above the pavement surface.

Acceptable products are those meeting the following requirements after receiving an average of 50 bumper impacts per sample and an average of 50 tire impacts per sample:

1. Six out of eight posts shall self-restore to within 15 degrees list or lean from vertical.
2. All posts shall have a minimum of 50% of its cross-section, at any point along the post height, free of tears or cracks.

**991-2.6 Approved Product List Submission Requirements.**

Manufacturers seeking evaluation of Standard Tubular Marker products for inclusion on the APL shall submit an application in accordance with Section 6 and include the following documentation.

<b>Table 991-2</b>	
<b>Documentation</b>	<b>Requirement</b>
Product Photo	Displays the significant features of the product.
Technical Data Sheet, marker and adhesive	Uniquely identifies the product and includes product specifications, storage instructions, and recommended installation materials and equipment as applicable.
Safety Data Sheet, Adhesive	SDS meeting OSHA requirements for product and manufacturer recommended installation materials as applicable.
National Testing Product Evaluation Program (NTPEP) product testing report	See Section 991-2.5
Installation Instructions	Include mounting surface preparations, and touch-up and repair procedures. Separate installation instructions are required for different substrates.
Product Sample	Upon request from the Department, submit a sample of the tubular marker mounting material or hardware. If the product is a system comprised of multiple parts, a sample of each part must be submitted.

**OBJECT MARKERS AND DELINEATORS**  
**(REV 10-~~138~~-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.~~

~~**993-1.23 Retroreflective Sheeting:**~~

~~**993-1.23.1 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, 3 and end of the road markers. Aluminum shall be of~~

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

**993-1.23.2 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 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](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 3 inches wide by 4 inches high. The sheeting shall be installed by the delineator manufacturer.

## MSP Template for Section 991 (24 inch tall tubular markers for use on managed lanes)

### CHANNELIZING DEVICE MATERIALS

(REV XX-XX-XX)

SUBARTICLE 991-1.2 is expanded by the following:

#### **991-1.2 Dimensions.**

The post shall have a minimum diameter of 3 inches. The base of the tubular marker shall have a maximum dimension in any direction of 8 inches. The height of the tubular marker above the pavement surface shall be 36 inches. **At specific locations shown in the Plans, the height of the tubular marker above the pavement surface may be 24 inches.**

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