993 OBJECT MARKERS AND DELINEATORS.
(REV 7-18-07) (FA 7-23-07) (1-08)

SECTION 993 (Pages 909-912) 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 candelasr/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 inch.

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, or VII. 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 B 209) 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#/Ft. flanged U-Channel meeting the requirements of 700-2.3. Round aluminum posts shall meet the requirements of Index 11860.

993-2 Delineators.

993-2.1 General: Delineators shall be classified into four 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 1.1 #/Ft. steel U-Channel posts meeting the requirements of 700-2.3.

993-2.3.2 Retroreflective Sheeting: The retroreflective 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 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: Thedelineator 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 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 square inches facing the approach to the separator.

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 when tested according to National Testing Product Evaluation Program (NTPEP). 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 diameter or width of 2.7 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 separator 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 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 omni directional area of 30 square inches.

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 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 85 F. NTPEP data or independent test lab data shall be submitted for product approval.

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

993-3.1 General: Retroreflector units 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. Guardrail reflectors shall be designed for mounting to the web of steel posts or designed for mounting to wood posts. Barrier wall reflectors shall be designed for mounting to the top of the barrier wall.

993-3.2 Retroreflective Sheeting: 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.

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

993-4 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.