

## SECTION 984 TRAFFIC CONTROL DEVICES

### 984.1 GENERAL

Signs, barricades, delineators, vertical panels, and other traffic control devices, except signs or cones used only during daylight hours, shall be reflectorized with high intensity (Type III) sheeting applied to a satisfactory backing. Signs, barricade, delineators, and vertical panels shall be readable to the traveling public. The sheeting shall meet the requirements of AASHTO M 268. Engineering grade medium intensity (Type I) sheeting will be allowed for daytime use only.

### 984.2 FABRICATION

- A. **Background Color:** The background color shall be as specified in Part VI of the MUTCD.
- B. **Legend:** Message and borders shall be nonremovable copy of the color specified in Part VI of the MUTCD. The nonremovable copy may be screened processed or direct applied. Mounting holes will not be drilled or punched in any part of the nonremovable copy.
  - 1. **Screened Process:** Message borders shall be processed on reflective sheeting using mechanical equipment, materials, and operational methods and procedures as prescribed by the manufacturer. Processing shall be accomplished by the direct or reverse screen method using opaque or transparent processing material. Screening may be accomplished either before or after application of the sheeting to the base panels. Free hand painting will not be permitted on any part of the finished sign face.
  - 2. **Direct Applied:** Cut out message and borders shall be reflective sheeting or opaque lettering film applied directly to clean, dust free, reflective sheeting background. Message and borders shall be in accordance with the operational methods and procedures prescribed by the sheeting manufacturer. The finished letter, numerals, symbols, and borders shall be cut with smooth, regular outline, and free from ragged or torn edges.

### 984.3 TRAFFIC CONTROL DEVICE STANDARDS

The various types of traffic control devices shall be maintained in satisfactory condition.

- A. **Barricades:** Barricades shall conform to the requirements shown in Table I.

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**TABLE I**  
**(English Units)**  
**BARRICADE CHARACTERISTICS**

	TYPE I (SINGLE RAIL)	TYPE II (DOUBLE RAIL)	TYPE III (TRIPLE RAIL)
Width of Rail	8 to 12 inches	8 to 12 inches	8 to 12 inches
Length of Rail	2 foot min.	2 foot min.	4 foot min.
Width of Stripes*	6 inch	6 inch	6 inch
Height	3 foot min.	3 foot min.	5 foot min.
Number of ReflectORIZED Rail Faces	2 (one each direction)	4 (two each direction)	3 if facing traffic in one direction, 6 if facing traffic in two directions.

\*For rails less than three feet long, four inch wide stripes shall be used.

For wooden barricades, nominal lumber dimensions will be satisfactory.

Barricades may be fabricated from lumber, metal, or other suitable material and shall be easily broken when struck by a vehicle at 35 mph. Markings for barricade rails shall be alternate reflectORIZED white and orange. Stripes shall slope downward at an angle of 45E from the vertical in the direction traffic is to pass.

**TABLE I**  
**(In Metric)**  
**BARRICADE CHARACTERISTICS**

	TYPE I (SINGLE RAIL)	TYPE II (DOUBLE RAIL)	TYPE III (TRIPLE RAIL)
Width of Rail	200 to 300 mm	200 to 300 mm	200 to 300 mm
Length of Rail	600 mm min.	600 mm min.	1200 mm min.
Width of Stripes*	150 mm	150 mm	150 mm
Height	900 mm min.	900 mm min.	1500 mm min.
Number of ReflectORIZED Rail Faces	2 (one each direction)	4 (two each direction)	3 if facing traffic in one direction, 6 if facing traffic in two directions.

\*For rails less than one meter long, 100 mm wide stripes shall be used.

For wooden barricades, nominal lumber dimensions will be satisfactory.

Barricades may be fabricated from lumber, metal, or other suitable material and shall be easily broken when struck by a vehicle at 55 kph. Markings for barricade rails shall

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be alternate reflectorized white and orange. Stripes shall slope downward at an angle of 45° from the vertical in the direction traffic is to pass.

**B. Flashing Beacons (Flashing Electric Lights):** Flashing beacons (flashing electric lights) shall be power operated (not battery operated) and shall follow the design specifications for standard traffic signals, which include the following:

1. Each signal unit lens shall have a visible diameter of not less than 8 inches (200 mm).
2. The illuminating element, lens, reflector, and visor shall render the beacon clearly visible to drivers it faces for a distance of at least ¼ mile (0.4 kilometer) under normal atmospheric conditions unless obstructed.
3. The color of the lens shall be red for a stop condition or yellow for a warning condition. The lens colors shall be in accordance with the requirements of the Institute of Transportation Engineers Standard for Adjustable Face Vehicle Traffic Control Signal Heads.

The flashing beacon shall be controlled by a device located in a separate housing unit. The flasher mechanism shall provide the continuous intermittent illumination of the lens or lenses of the beacon. Flashing contacts shall be equipped with filters for suppression of radio interference.

Beacons shall flash not less than 50, nor more than 60 times per minute. The illuminated period of each flash shall not be less than ½ and nor more than 2/3 of the total cycle.

**C. Barricade Warning Lights:** Barricade warning lights shall be portable with lens directed enclosed lights. The lens of the unit shall not be less than seven inches (175 mm) in diameter and shall be amber in color. They may be used in either the steady burn or flashing mode.

Barricade warning lights shall be in accordance with the requirements of Equipment and Materials Standards of the Institute of Transportation Engineers (ITE) Publication No. ST 017, Purchase Specification for Flashing and Steady-Burn warning Lights. The lights shall be certified by the manufacturer.

The use of the warning lights shall be in accordance with Part VI of the MUTCD.

Hazard warning lights, when mounted shall be as follows:

1. **Barricades and Portable Standards:** A minimum height of **30 inches (750 mm)** from the bottom of the lens to the roadway.
2. **Signs:** The light shall not be less than 12 inches (300 mm) nor more than 24 inches (600 mm) above the sign. The light or housing shall not obstruct the face

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of the sign.

- 3. Vertical Channelizing Devices and Independent Supports:** The light shall be a minimum height of **30 inches (750 mm)** above the pavement.

**D. Cones and Vertical Panels:** Cones and vertical panels shall be in accordance with the following requirements:

- 1.** Traffic cones and tubular markers of various configurations shall be a minimum of 18 inches (450 mm) in height with a broadened base and shall withstand impact without damage to the marker or vehicles. Orange shall be the predominate color of these devices.

Traffic cones and tubular markers shall be a minimum of 28 inches (700 mm) in height when used on interstate and other high speed highways or when used at night.

For nighttime use, cones shall be reflectorized or equipped with lighting devices for maximum visibility. Reflectorized material shall have a smooth, sealed outer surface which will display the same color day and night.

Reflectorization of tubular markers shall be a minimum of two 3" (two 75 mm) white bands placed a maximum of two inches (50 mm) from the top with a maximum of six inches (150 mm) between the bands. Retroreflection of cones shall be provided by a minimum six inch (150 mm) white band placed a minimum of three inches (75 mm) but no more than four inches (100 mm) from the top. When the 28 inch (700 mm) or larger size cones are used, the standard 6 inch (150 mm) band shall be supplemented with an additional four inch (100 mm) white band spaced a minimum of two inches (50 mm) below the six inch (150 mm) band.

- 2.** Vertical panels shall be 8 to 12 inches (200 mm to 300 mm) in width and a minimum of 24 inches (600 mm) in height. The stripes shall be alternating reflectorized white and orange slanting downward at 45° from the vertical toward the side on which traffic is to pass. For panels less than three feet (900 mm) in height, four inch (100 mm) stripes shall be used.

Mounting shall be on a single, breakaway support assembly. The mounting and base support shall be constructed to minimize hazards to motorists.

The panel shall be mounted with the top a minimum of 36 inches (900 mm) above the roadway.

- E. Mounting Posts:** Mounting posts for construction signs shall yield upon impact to minimize hazards to motorists and shall be of a height adequate to properly display the signs.

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Wood posts with a cross sectional area greater than 24 square inches (155 square centimeters) shall be drilled to provide breakaway capability.

Portable frames for mounting traffic control signs may be used where sign mobility is required. The portable frames shall provide a minimum sign mounting height of one foot (300 mm) above the roadway and shall be easily broken when struck by a vehicle at 35 mph (55 kph).

- F. Pilot Car:** Pilot cars shall be four wheel motor vehicles with appropriate signing.
- G. Temporary Pavement Marking Tape:** Temporary pavement marking tape, type 2 shall not contain metallic foil and shall consist of a mixture of high quality polymeric materials and pigments, with glass beads. The glass beads shall be throughout the pigmented portion of the film, and a reflective layer of beads bonded to the top surface. The film shall be precoated with a pressure sensitive adhesive. A nonmetallic medium shall be incorporated to facilitate removal.

The film, without adhesive, shall have a minimum thickness of 39 mils (1.0 mm).

The marking film shall be completely removable from asphalt and Portland cement concrete, intact or in large pieces, either manually or with a roll up device at temperatures above 40EF (4EC) without use of heat, solvents, grinding, or sandblasting.

- H. Temporary Road Markers:** Temporary road markers shall consist of a yellow or white plastic body providing a horizontal width and length of approximately  $\pm 3\frac{1}{2}$  inches ( $\pm 90$  mm) in both dimensions and approximately  $\pm 2$  inches ( $\pm 50$  mm) high. If flexible vertical markers are used they shall be approximately  $\pm 4$  inches ( $\pm 100$  mm) wide and approximately  $\pm \frac{3}{4}$  inches ( $\pm 20$  mm) high.

A strip of reflective tape  $\frac{1}{4}$  inch (6 mm) minimum width shall be bonded horizontally along the top of the vertical area.

The adhesive shall be resistant to the effects of weather and capable of retaining the marker in position during the time it is required to function.

The markers shall consist of a methyl methacrylate, polycarbonate, polystyrene, or suitably compounded acrylonitrile butadiene (ABS) shell fitted with retroreflective lenses. The exterior surface shall be smooth.

The marker reflector shall have a minimum coefficient of (retroreflected) luminous intensity conforming to Table II.

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TABLE II

**Minimum Coefficient of (Retroreflected) Luminous Intensity in  
Millicandelas per lux or (Candelas per footcandle)**

Observation Angle in Radians (Degrees)	Entrance Angle in Radians (Degrees)	Luminous Intensity for Each Color in Millicandelas per lux (Candelas per footcandle)		
		<u>White</u>	<u>Yellow</u>	<u>Red</u>
0.0035 (0.2E)	0.0 (0E)	279 (3.0)	167 (1.8)	70 (0.75)
0.0035 (0.2E)	0.349 (20E)	112 (1.2)	67 (0.72)	28 (0.3)

The reflective tape shall be acrylic baked metalized polycarbonate microprism retroreflective material, methyl methacrylate, or equal.