



Barricades and warning devices for highway construction work

Highway construction work has increased steadily each year, along with concern for the safety and well-being of workers and pedestrians, and the consideration of possible vehicle collisions.

1. This data sheet will address the warning devices currently being used in the highway construction industry.
2. In the past, each state or community usually drew up its own standards for barricades and warning devices. This resulted in a wide variety of styles that confused motorists far from home.
3. To avoid any further confusion, it was recommended that Part VI of American National Standard, Manual on Uniform Traffic Control Devices, D6.1-1978, be adopted by all highway authorities. This standard also has been adopted into the Federal Occupational Safety and Health Act Rules and Regulations for Construction. Title 29-Labor, Code of Federal Regulations, Subpart G, Section 1926.202, "Barricades" (specifications in the present revision of

this data sheet are in accordance with this standard).

4. Regulatory signs involve legal requirements and restrictions; therefore, it is essential that their use be officially authorized.

Hazards

5. The function of barricades and channeling devices is to alert drivers to hazards created by construction or maintenance operations on or near a roadway. They also are meant to guide and direct a driver safely past a hazard(s).
6. Some of the major sources of injuries surrounding the inadequate use of barricades and warning devices are:
 - Collision with construction equipment
 - Collision with other vehicles
 - Pedestrians falling into open excavation work
 - Driving into work areas
 - Driving into contractor personnel
 - Loss of car control because of minor road repairs, soft shoulders and windrows

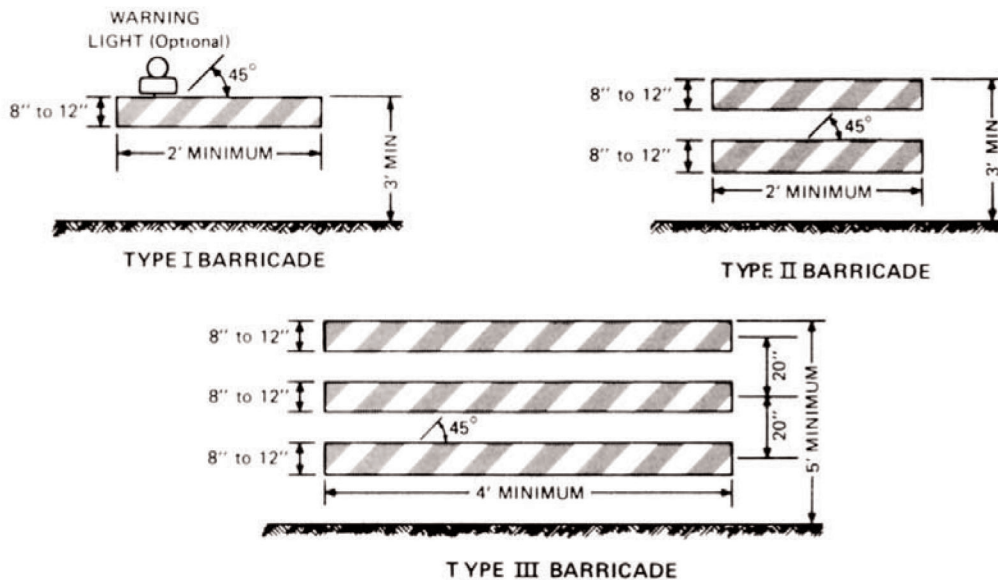


Figure 1. The three most common types of traffic barricades and their dimensions.

Characteristics of barricades			
Types	I	II	III
Width of rail	8 inches minimum - 12 inches maximum	8 inches minimum - 12 inches maximum	8 inches minimum - 12 inches maximum
Length of rail	2 foot minimum	2 foot minimum	2 foot minimum
Width of stripes	6 inches	6 inches	6 inches
	(For less than 3 ft long, stripes shall be 4 in. minimum)		
Height	3 foot minimum	3 foot minimum	3 foot minimum
Number of reflectionized rail face	2 (one in each direction)	4 (one in each direction)	6 (one in each direction)

Barricades

- There are generally three types of barricades (I, II, and III) and they should be frangible (see Figure 1). The Type III barricades are recommended for use as a roadblock and around heavy equipment; the other types are used for all other purposes. Standard design recommendations are given in the accompanying table.
- Barricades should have orange and white alternate stripes. It is recommended that stripes be 6 inches wide and inclined to an angle of 45 degrees with the horizontal starting downward in the direction toward the side on which traffic is to pass.

- Where both right and left turns are provided for, the chevron (zebra) striping may slope downward in both directions from the center of the barricade.
- The entire area of white and orange stripe should be a smooth reflective surface, visible under normal conditions from 1,000 feet away, when illuminated by an automobile's low beam at night. The predominant color for barricade components should be white.

Barricade construction

- The horizontal members of Type I barricades should be 8 - 12 inches wide. The supports for the rail can be built of lumber, metal or other suitable materials and shaped in the correct

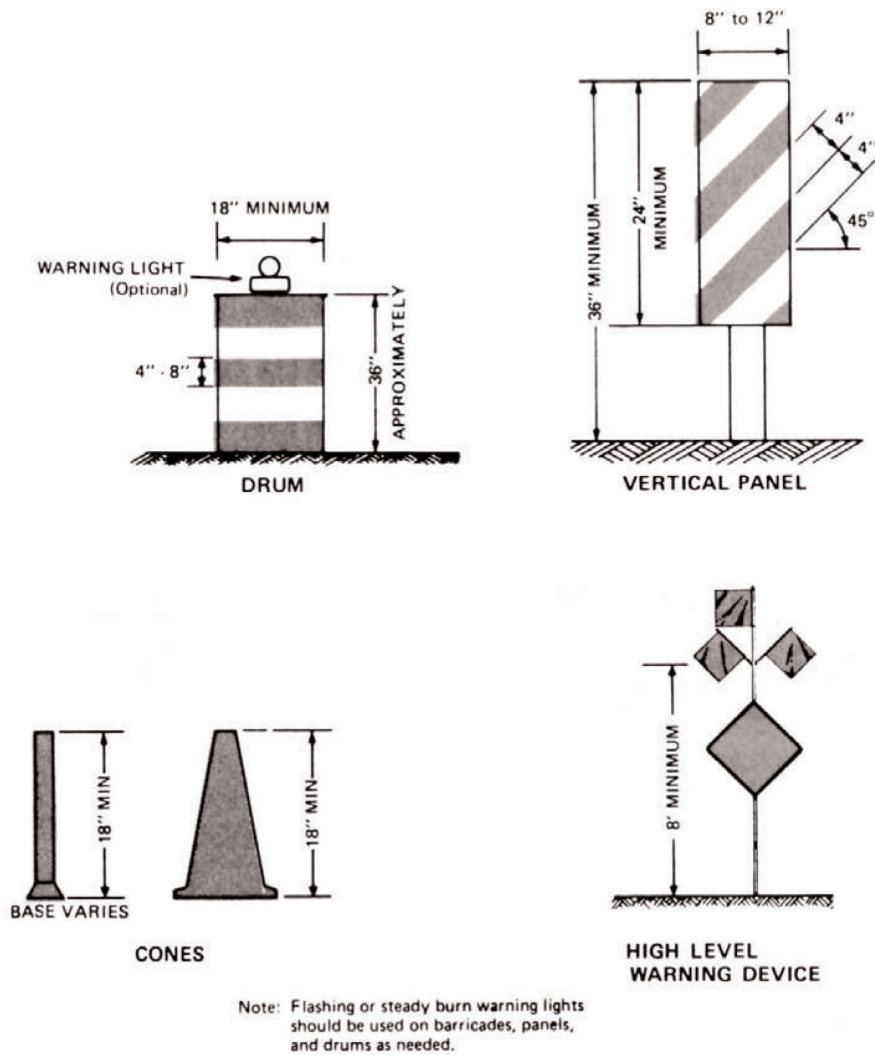


Figure 2. Some of the specifications for various channeling devices and high-level warning devices..

manner. In either case, the support should contain, at the right height, a notch or loop into which the horizontal members are inserted.

12. Rapid assembly and disassembly of this type is an essential ingredient. This barricade is usually found in 6 - 8 foot lengths.
13. Type II barricades can be made of wood, metal or other components and combinations. The supports are of the A-frame type, or hinged to permit easy folding. This is to allow stacking and convenient transport from location to location.
14. As this portability is of prime importance, the materials should be as lightweight as possible; yet they should provide the necessary strength and durability (This type of barricade has a high center of gravity and is easily blown over.)

15. The Type III barricades are usually for a permanent location and, therefore, should be built of substantial material. If they are built on bases instead of posts, consideration should be given to providing additional ballasts in the form of sandbags or the like.

Other devices

16. Traffic cones and tubular markers often are useful adjuncts to barricades for marking the outer limit of a traveled roadway, which is adjacent to a ditch or an unfinished shoulder (see Figure 2). Where lane obstructions occur and adequate advance warning has been provided, cones also can be used to funnel traffic into appropriate lanes.

17. The predominant color used with cones should be orange. Traffic cones and tubular markers should be a minimum of 18 inches high with a broad-ended base and be constructed of materials that will withstand any damage either to their design or to vehicles striking them.
18. Larger sized cones should be used where traffic speeds are tight or where more conspicuous guidance is needed. All cones should be kept clean and bright. When used during the night, they should be reflective or equipped with lighting devices for maximum visibility
19. When cones are used, precautions are necessary to ensure that they will not be blown over or displaced. This may be of particular importance when they are adjacent to lanes of moving traffic where there will be a wind created by passing vehicles. Some cones are built with a base that can be filled with ballast. With other types, it may be necessary to double the cones in order to increase the weight or to fabricate weights that can be added to the cone for extra stability.
20. Traffic cones have a greater target value than do the tubular shaped devices. The target value of either device can be increased by an orange flag in the top and, at night, by colored delineators or interval lights.
21. A delineator, as used here, means all types of reflector units capable of reflecting light from either the upper or lower beam of automobile headlights. They are used primarily for guidance rather than for warning.
22. Properly installed, delineators will indicate the horizontal and vertical alignment of the roadway and, thereby, outline the path vehicles must take. They should be spaced sufficiently close, to outline their intended path during night hours. They always should be used in combination with other traffic control devices.
23. Another traffic channeling device is the metal, 30 - 55 gallon drum (see Figure 2). They are set on end and used as an expedient channeling method.
24. The color and marking should be the same as for barricades—orange and white. The color should be orange with at least two horizontal, circumferential white stripes, 4 - 8 inches wide.
25. Drums should be reflective and never placed in a roadway without advance warning signs. In addition, a flashing warning light should be added when drums are used singly, and steady warning lights should be added when they are used in series.
26. One application of drums is to show an unusual vehicle path made necessary by construction activity. Another effective application occurs on road-widening projects, where a row of barrels is used at night to mark the edge of pavement and to direct traffic away from an open excavation at the edge. During working hours, the same barrels are moved further onto the pavement to provide working room for construction activities.
27. These barrels are heavy, bulky and not easily transported, but they do provide a good visual warning. They give the appearance of being formidable obstacles and they command drivers' respect. However, they do not inflict undue damage to a vehicle in the event that they are struck. Barrels may be weighted-down with sand or water to resist wind forces, but should not be so heavy as to present a hazard to motorists if struck.
28. Vertical panels used as channeling devices should consist of at least one panel, 8 - 12 inches wide and 24 inches high. They are striped and reflective in the same manner as barricades, and mounted with the top a minimum of 36 inches above the roadway on a single, lightweight post.
29. The shape, size and coloring of signs should conform to the specifications set forth in ANSI Z535.1-2006 (R2011) American National Standard Safety Colors.

30. Signs and other painted displays intended for night use should be reflective and illuminated.

Flagmen

31. “Flagger ahead” or similar signs should be removed, or covered or turned to face away from traffic when the flagger is not at his or her station, and if the roadway is free from hazards at that time. All signs should be removed as soon as the work is finished and no hazards remain.

32. On extended one-way traffic blocks, there should be a flagger in front of the work area. On extended two-way traffic blocks, there should be a flagger at each end of the working area; ideally they should communicate by two-way radio.

33. These employees should be instructed in the proper method of giving non-conflicting signals (see Figure 3). During the day, flaggers should be equipped with a red flag (for emergencies) or sign paddle (as well as a high-visibility vest and hard hat).

34. The flag should be a minimum of 24 inches, square with bound edges and should be made of a good grade, bright red material that is securely fastened to a staff approximately 36 inches long. The free edge should be weighted so the flag will hang vertically, even in heavy winds.

35. Sign paddles should be at least 18 inches wide with 6-inch series C letters, made of sheet metal or other semi-rigid material, and mounted on a rigid handle. On one side of the paddle the word “stop” should be painted in white lettering on a red background with a white border and, on the opposite side, the word “slow” in black lettering and border on an orange background.

36. Flaggers are responsible for human safety and have the greatest number of public contacts of all highway construction personnel; it is important that only qualified personnel be selected.

37. A flagger should possess the following characteristics:

- Average intelligence
- Good physical condition, including sight and hearing
- Mental alertness
- Courteous but authoritative
- Neat appearance
- Sense of responsibility for safety of both public and crew

38. Flaggers are provided at work sites to protect both the construction personnel and the public. To perform these functions, flaggers must be visible to approaching traffic sufficiently in advance of the work site to permit the proper response to be made. In positioning flaggers, consideration must be given to maintaining color contrast between the flagger’s protective garments and his or her background.

39. A flagger should wear a bright orange hard hat and an orange or fluorescent green vest for greater visibility. He or she should stand on the shoulder or in the barricaded lanes, adjacent to the lane being controlled and should face traffic. The flagger should never stand in the traffic lane.

40. When using a flag, the flagger should give the slow signal, by waving the flag in a sweeping motion in front of his body, and the stop signal, by holding the flag stationary in a horizontal position across the line of traffic, using the left hand to signal to stop (See Figure 3).

41. When using hand signals, flaggers should stand in the same position as mentioned in paragraph 40 and hold the signal across the line of traffic with the proper message facing traffic. When the flagger wishes traffic to proceed, he or she should conceal the flag or signal and wave traffic on with the free hand.

42. During night operations, flaggers should be equipped with red lanterns or flashlights.

They should wear orange, yellow or other light-colored clothing with reflective surfaces and vests with reflective strips. Supplementary illumination, such as flares, should surround them.

- 43. With a lantern or flashlight, only one signal is used, and that may mean either “stop” or “slow.” The signal is given by waving the red lantern or flashlight across the line of traffic. “Proceed” signals are to be given only by hand, never with the lantern or flashlight.
- 44. Flaggers and operators of construction machinery should understand that every reasonable effort should be made to allow the driving public the right-of-way and prevent excessive delays.

Illumination

- 45. Warning illumination usually is provided by incandescent or fluorescent lamps or spotlights. These may be used to illuminate barriers and primary warning signs.

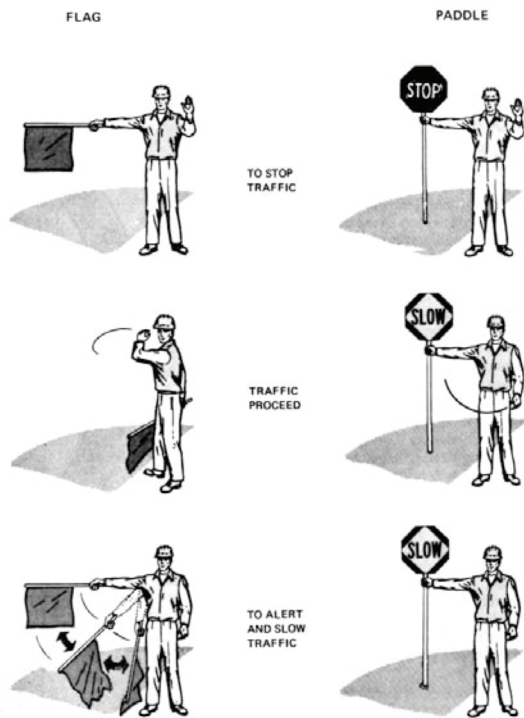


Figure 3. The use of hand signals and signaling devices.

- 46. Steady-burning or flashing lights in sufficient number should be used to supplement signs and barriers and to warn of obstacles.
- 47. Flashing lights (flashers) may be used as alerting devices for advance warning. They also may be used for marking severe, unexpected hazards in or near the roadway. Amber is the only permissible color of light to be emitted by flashers.

Placement

- 48. Primary warning signs, such as “Road Construction Ahead,” or “Barricade Ahead,” should be placed 1,500 feet from the end point of operations. Secondary warning signs, such as “Road closed-1,000 feet” and “Men Working,” should be placed 1,000 and 500 feet respectively, from the end point of operations. Final warning signs and barricades should be placed 25 feet from the end point of operations. “End Road Work” or “End Construction” signs usually are placed about 500 feet beyond the repair zone.
- 49. Red flags, 24 inches square, may be used in conjunction with signs as long as they do not interfere with a clear view of the signs and barricades.
- 50. Terrain and climatic conditions affect the exact placement of these signs, but, in all cases, they should be placed so they will be visible to oncoming traffic for a distance of at least 500 feet.
- 51. Small pavement repairs should be surrounded by Type I barricades. At night, these barricades should be supplemented by flashing lights, which are placed at maximum intervals of 25 feet.
- 52. Short stretches of excavation within 5 feet of the pavement should be lined by Type I barricades on the traffic side. At night, flashing lights should be added at maximum intervals of 25 feet. Long stretches of excavation should be marked by

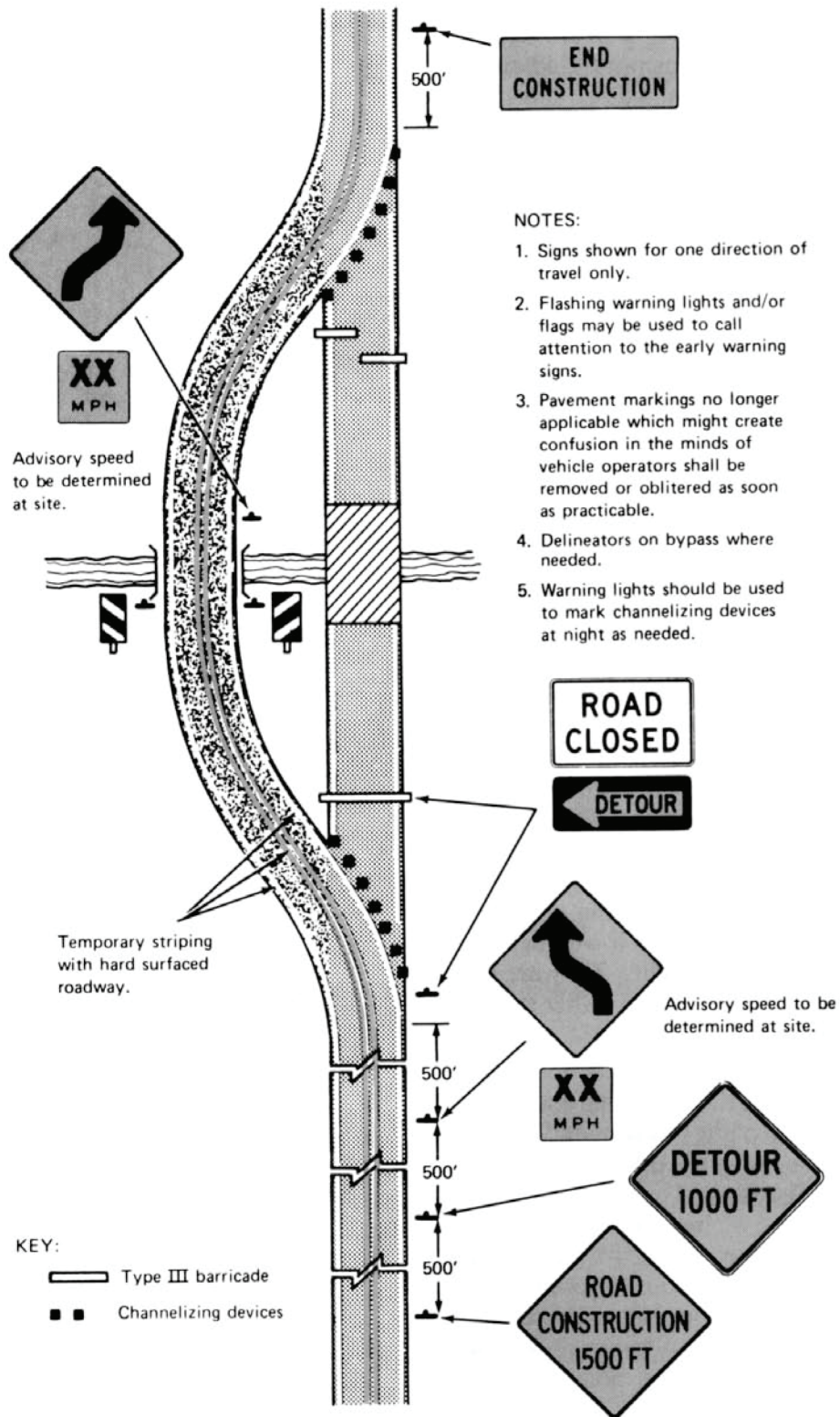


Figure 4. The recommended placement of various barricades and warning devices on a two-lane highway where the entire roadway is closed and a detour is provided.

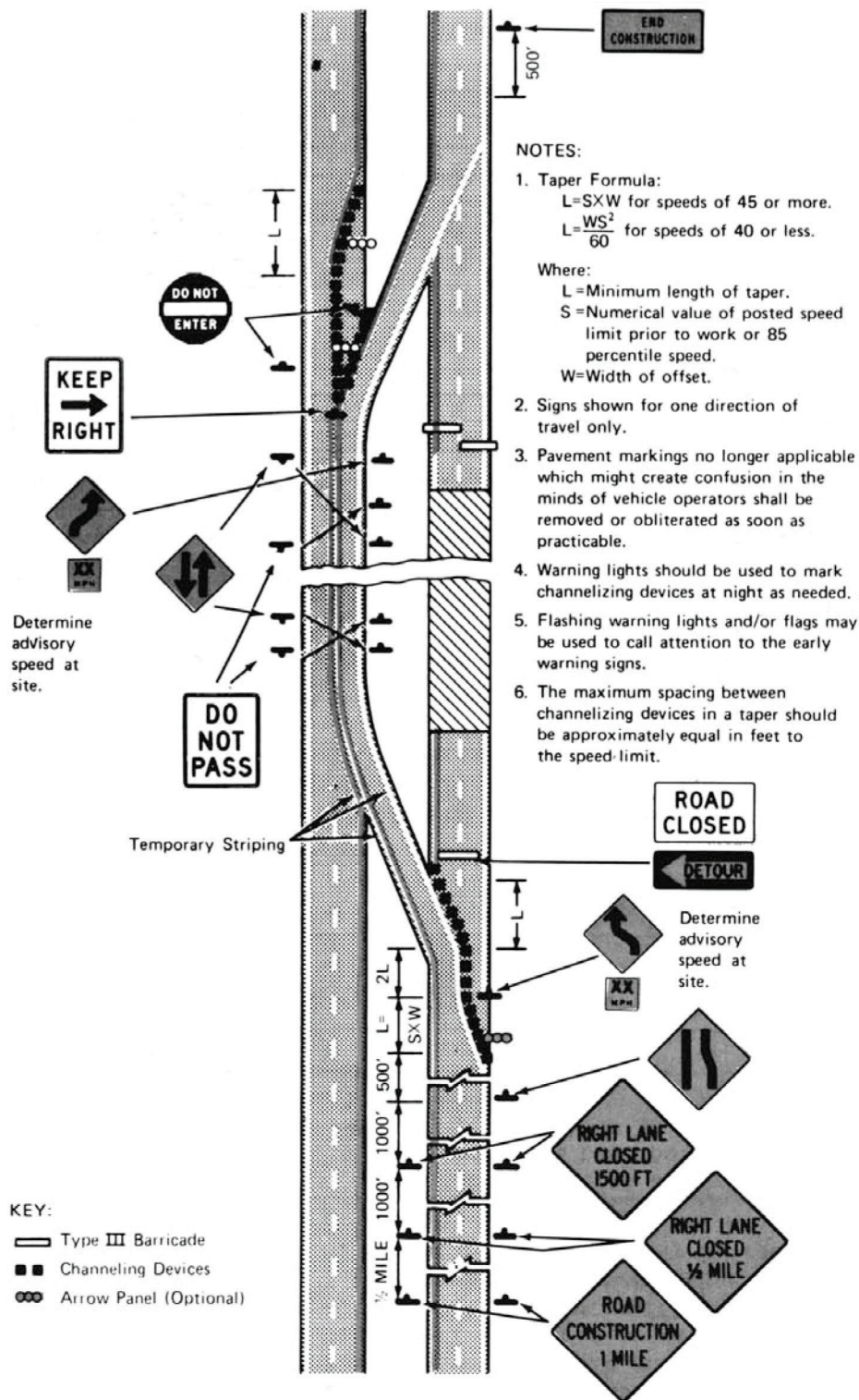


Figure 5. The recommended placement of various barricades and warning devices for construction or repair projects on four-lane divided roadway where one roadway is closed.

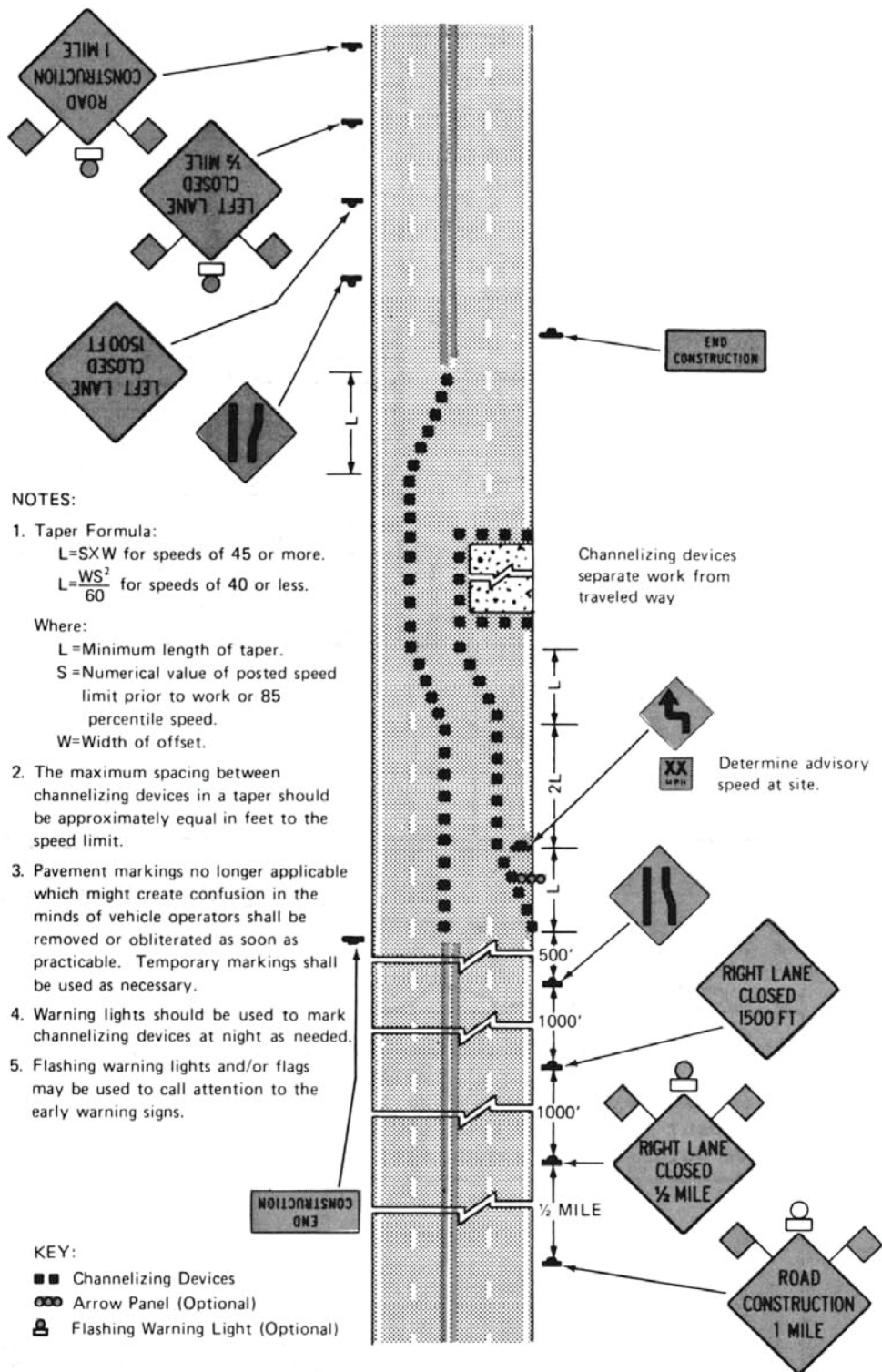


Figure 6. The recommended arrangement of warning devices and barricades when a repair project closes half of a four lane undivided roadway.

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Figure 7. A reproduction of both sides of a typical daily inspection record sheet (shown here in abbreviated form).

square red flags, 24 inches on each side, during the day and by steady-burning lights at night (see Figures 4, 5 and 6).

- 53.** Where the road is closed to traffic, frangible barricades should be erected across the entire width of the road. These should be effectively reflective or illuminated if used at night. If necessary, special arrangements may be made to permit passage of local traffic through the barrier.
- 54.** The traffic side of windrows should be mounted with red flags, 18 inches square, at 50-foot intervals (maximum) during the day, and with warning lights at similar intervals during the night.

When using lights, batteries should be checked and replaced where necessary.

Maintenance

- 55.** In order to serve their purpose, all traffic control devices must be kept in good condition and in proper position.
- 56.** Barriers should be neat. Damaged, defaced or soiled signs should be cleaned, repaired or replaced immediately.
- 57.** Barriers must be checked daily. A report should be made and checked regularly (see Figure 7).

Acknowledgment

Figures 1 through 6 are courtesy of the U.S. Department of Transportation. Federal Highway Administration, Washington, DC.

Sources of information

U.S. Department of Labor, OSHA, 200 Constitution Ave., Washington, DC 20210:

Occupational Safety and Health Standards, 29CFR Title XVII, Part 1926, Subpart 6 (Signs, Signals and Barricades), Section 1926. 202, Barricades.

Government publications are available from the Superintendent of Documents, U.S. Government Printing Office, 732 N. Capitol St., NW, Washington, DC 20401-0001.

American National Standards Institute, 1899 L Street, NW, 11th Floor, Washington, DC 20036.

Manual on Uniform Traffic Control Devices for Streets and Highways, D6. 1-1978. (Approved by the Federal Highway Administrator as the National Standard for all highways open to public travel.)

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