

WARNING DEVICES USE GUARDING WORK AREAS

	CONTENTS	PAGE
1.	GENERAL	1
2.	PRECAUTIONS	1
3.	WARNING DEVICES—DESCRIPTION AND USE	4
4.	POSITIONING WARNING DEVICES	8
5.	JOB PRESURVEY	9
6.	WORKING ON HIGHWAYS	10
7.	WORKING IN CITY STREETS AND ALLEYS	17
8.	WORKING AT THE ROAD SHOULDER	24
9.	ADDITIONAL PROTECTION DURING HOURS OF DARKNESS	29

1. GENERAL

1.01 This section describes the use of warning devices for guarding work areas. Warning devices are used for the purpose of providing maximum protection to craftspersons, equipment, and to the public in general, while causing minimum interference to vehicular and pedestrian traffic.

1.02 This section is being reissued to reflect changes specified in the "Manual on Uniform Traffic Control Devices" published by the U.S. Department of Transportation. Since this reissue is a general revision, no revision arrows have been used to denote significant changes.

1.03 The devices required to protect a work area must be considered in advance to meet the individual requirements of the job site. Craftspersons

familiar with the area where the job is to be performed shall equip themselves with an adequate supply of warning devices prior to starting a job. Supervisors conducting field surveys of work to be performed at a later date should make a notation on the field job plan report (Force Management System) of the protective devices required to adequately protect the work area.

1.04 State and local laws and ordinances pertaining to traffic control, warning signals, color of lenses in lighting devices, guards, and similar devices must be complied with. It is a good practice to notify local law enforcement officials when a minor traffic dislocation is involved. Where a major traffic dislocation will occur, such as blocking a lane on a highway or a main traffic artery within a town, the police force having jurisdiction should be consulted before work is begun.

1.05 It is recognized that urban traffic conditions differ from rural, and in many instances signs must be applied and located differently. On secondary highways and city streets, smaller signs may be used if authorized by local authorities. However, additional protection may be required when special complexities and hazards prevail.

1.06 When work is performed in a roadway, the warning devices are to be placed before positioning the truck or starting work. Place warning signs in the traffic lane in which work is to be performed, and sufficiently far enough away to permit the approaching motorist to adjust his speed and course to avoid an accident.

2. PRECAUTIONS

2.01 To ensure maximum safety, continued alertness is required to supplement the best warning devices available. For example, the noise caused by a car out of control striking a distant warning de-

**Reprinted to comply with modified final judgment.

vice may give an alert craftsperson sufficient time to get in the clear. Table A specifies the warning sign selection.

2.02 Carefully observe all moving traffic and exercise extreme caution when placing warning devices. Positioning of warning devices are specified in Table B.

2.03 Place warning devices before positioning the truck or starting work. Warning devices are employed to direct a motorist around the work area. Place warning devices in the traffic lane in which work is to be done, and sufficiently far enough away to permit the approaching motorist to adjust his speed and course to avoid an accident. Remove the devices as soon as the work has been completed. The first device the motorist will encounter should be a warning sign.

2.04 The amount of work to be performed shall have no bearing as to whether or not work area protection is required. Warning and guarding devices are to be placed whenever work of any duration is performed in a roadway.

2.05 When manhole work is involved, place tools and equipment at the work area in a position to prevent them from being pushed into the manhole.

2.06 In entering or leaving manholes, employees are to face the direction of the oncoming traffic.

2.07 Keep all warning devices clean and in good condition. Place the devices on the truck so that they will not be damaged by contact with tools or materials. Carefully store warning flags when not in use. Dirty, torn, faded, or damaged flags should be replaced.

2.08 Make every effort to minimize the exposure time of craftspersons and others to possible danger. All discussions and planning should take place off the street or highway, not in traffic lanes.

2.09 Carefully select the height of the warning mast so that visibility will not be impaired or obstructed by trees, shrubbery, parked cars, or moving traffic. Where necessary, two or more warning masts equipped with flags and/or warning lights

TABLE A

WARNING SIGN SELECTION

POSTED SPEED (MPH)	LANE CLOSED	INITIAL SIGN	SIGN SIZE	ADDITIONAL SIGN (SEE PARAGRAPH 3.04)	SIGN SIZE
40 or Under	No	Men Working or Worker Symbol	30" 36"	—	—
45 or Over	No	Men Working	48"	Men Working	30"
	Yes	Lane Closed	48"	Men Working or Worker Symbol	30" 36"
Expressway or Freeway	No	Men Working	48"	Men Working	48"
	Yes	Lane Closed	48"	Lane Closed or Men Working	48" 48"
One-Lane Traffic	Yes	Lane Closed	48"	Lane Closed	30"
				or Men Working	48"

may be used at different levels for maximum visibility, except that minimum height from the ground shall be 8 feet.

TABLE B
SPACING FOR INITIAL
WARNING SIGNS AND CONES

POSTED TRAFFIC SPEED (MPH)	INITIAL SIGN DISTANCE (FEET)	CONE SPACING (FEET)
15 or under	105*	10
20	140*	20
25	175*	25
30	210*	30
35	245*	35
40	280*	40
45 or above	† See par. 3.04(b)	‡
Expressway or Freeway	3100 See par. 3.04(b)	‡
One lane traffic	See posted speed See par. 3.04(b)	‡

* Initial warning sign to be placed at a point 7 times posted speed

† Initial warning sign to be placed at a point 10 times posted speed

‡ Same as posted speed

2.10 Where a motorist cannot see the work area from the vicinity of the initial warning sign because of hills, curves, or other obstructions, place a mast with flags and a flashing light at this location, in addition to other normal protective devices.

2.11 Place floodlights, when used, so they will not cause a glare in the eyes of approaching motorists.

2.12 Inspect all displayed warning flags from time to time to be sure that they are not wrapped around their supports.

2.13 Inspect all displayed flashers from time to time to see that they are still operating at the proper flashing rate of 55 to 75 flashes per minute. A slower rate usually indicates that batteries require

changing. The flashing rate has been set by the manufacturer; do not attempt to make adjustments in the field.

2.14 Set up warning devices in a manner that does not create a hazard for pedestrians.

2.15 When working on private property, in pedestrian lanes, or in parkways, close all holes in the earth either temporarily or permanently, if feasible, before leaving the location. If this is impracticable, fence the area with a snow fence or equivalent, or place a guard on duty to prevent small children or animals from falling into the excavation. Such fencing or guarding may be in addition to, or part of, the normal warning devices used at the location.

2.16 Rope off all work areas with barricade tape or equivalent, if practical.

2.17 Place tape or equivalent to designate a safe pedestrian walkway around obstructions, such as ditches, holes, tool carts, or piles of dirt that may occur on busy sidewalks.

2.18 Steady burning amber lights can be used to channel the traffic around a work area. They should be placed in operation no later than 1/2 hour after sunset. Their operation should be observed several minutes before leaving.

2.19 Amber flashing lights may be used to alert oncoming traffic of special hazards ahead. They are to be placed well in advance of the work area, not for channelization.

2.20 A true test of the effectiveness of the positioned warning devices is to observe the manner in which the oncoming traffic is able to adjust and pass through the work area. Observe the traffic flow to be sure the vehicles are channeled around the work area in an orderly fashion. Since traffic patterns change, observations are to be made periodically.

2.21 If manhole guards or barricades are to be temporarily stored near the work location after a day of work, secure them to a post, pole, or trailer where they will be least likely to cause interference. Do not secure manhole guards or barricades to fire hydrants or to poles having fire, police, or emergency call boxes.

2.22 Spread sand or salt on the icy pavement in the traffic approach lane near the work area to provide increased traction for approaching motorists who may have to stop.

2.23 Use additional warning devices in locations such as crowded streets, dangerous intersections, and heavily-traveled roadways. If placing of additional devices will not afford adequate protection, or if the use of sufficient warning devices is not practicable, station a flagger at a location that will permit traffic to be given sufficient warning. A flagger must be constantly alert and equipped with an approved warning device. A flagger should not be used at night unless absolutely necessary, or unless required by state or local regulations. A flagger, if used, should be illuminated with a floodlight and should wear highly visible clothing including a reflective vest.

3. WARNING DEVICES—DESCRIPTION AND USE

3.01 The type and number of devices used to protect the work area will be dependent upon job conditions. These warning devices and their use are described in paragraphs 3.02 through 3.19. Table B specifies the positioning of warning signs and cones used to protect work locations. The need for any one or more of the following protective devices should be considered:

- Warning signs
- Barricades
- Traffic cones
- Lighting devices
- High level warning devices
- Flagger
- Company truck.

3.02 Warning Signs: Warning Signs are to be diamond shaped with a black legend on an orange background. When mounted on a support, the bottom of the sign shall not be less than 1 foot above the pavement. Standard orange flags or yellow flashing lights, used in conjunction with a sign, are permitted providing they do not interfere with a clear view of the sign face. During hours of darkness, the sign must be reflectorized or illuminated.

3.03 Warning Sign Size:

(a) **30-Inch "Men Working" Sign:** The 30-inch "Men Working" warning sign is to be used when work is performed in or near a roadway when the posted speed is 40 mph or under.

(b) **36-Inch Worker Symbol Sign:** The 36-inch worker symbol sign may be used as an alternate to the 30-inch "Men Working" sign. In some cases, such as in rural areas, or where there is a low volume of traffic on roadways, a 30-inch worker symbol sign may be adequate.

(c) **48-Inch "Men Working" Sign:** The 48-inch "Men Working" warning sign is to be used when work is performed in or near the roadway in the following instances:

- On expressways and freeways
- On roads with posted speed of 45 mph or over.

(d) **48-Inch Warning Sign—Lane Closed:** The 48-inch "Lane Closed" warning sign is to be used when work in progress obstructs a complete lane of the traveled roadway on:

- Expressways or freeways
- Roads with speeds of 45 mph and over
- One-lane traffic (any two-lane roadway where traffic, in both directions, must travel on a common lane in the roadway because of work in progress).

3.04 Multiple Signs: Additional warning signs should be placed and appropriately spaced when work is performed on expressways, freeways, one-lane traffic flow, and at job sites where the posted speed is 45 mph or over.

Placement

(a) **Expressways and freeways:**

Initial sign:

- 3100 feet from work area.

Intermediate signs:

- 1500 feet from work area
- 500 feet from work area.

(b) **One-Lane Traffic and Roads With Posted Speed of 45 MPH and Over:** On any two-lane roadway where traffic in both directions must travel in a common lane and for roadways with posted speeds of 45 mph and over, an additional sign should be placed at a point halfway between the initial warning sign and the work area.

3.05 Barricades: Barricades can be used in addition to other warning devices to protect the work area. They are normally used on road construction projects to block off a road section closed to traffic. The barricade rails shall have either orange and white stripes or black and white stripes. All new purchases of barricades shall be orange and white. However, different colored barricades are not to be used at the same job site. The striping on the rail should be 6 inches in width, sloping at an angle of 45 degrees. The minimum barricade height shall be 3 feet, with the rail length between 3 and 4 feet and a width of 8 to 12 inches.

3.06 Traffic Cones: Traffic cones are to be a minimum of 18 inches in height with a broadened base and made of materials to withstand impact without damage to themselves or to vehicles. Orange is to be the predominant color. They are to be reflectorized or provided with a slip on delineator or illuminated for nighttime use. They should be kept clean and bright for maximum visibility. Traffic cones are intended to guide the traffic around a work area, rather than act as a warning device, and therefore most always will be used together with a warning sign.

3.07 Lighting Devices: It may be desirable and necessary to supplement reflectorized signs, cones, or barricades with any one of the following lighting devices:

- Floodlights
- Steady burning lights
- Flashing lights.

3.08 Floodlights: For nighttime work, a floodlight can be used to illuminate the work area. The light is to be positioned so that it will not cause a glare to oncoming drivers on the highway.

3.09 Steady Burning Lights: Steady burning, yellow, low-wattage lights could be used to route the traffic around a work area. The lamps can be mounted on a series of barricades to effectively aid in channelizing traffic around the job site.

3.10 Flashing Electric Lights: Flashing lights can be used to alert oncoming vehicles of a special hazard ahead. When used, this device is normally placed at the initial warning sign. The emitted yellow light shall flash at a rate of 55 to 75 times per minute. Two types are approved for use.

- Low Intensity—minimum 8-inch diameter lens, commonly mounted on barricades
- High Intensity—rotating dome light.

The four-way emergency flashing lights and/or strobes and rotating beacons on company vehicles can also be operated for added protection in both stationary and moving operations. These types of flashing lights shall always be considered as supplementary to other forms of work area protection.

3.11 High Level Warning Device: High level warning devices are used to supplement other controls and devices used to alert motorists of construction and maintenance activities. The high level warning devices are designed to be seen over the top of preceding vehicles. These devices shall consist of a minimum of three 16-inch square warning flags; the lowest flag shall be at least 8 feet from the ground. A high intensity warning light may be used in place of the center flag.

3.12 Use of Flagger: Whenever traffic movement in both directions must use a single lane for a limited distance, it is necessary to provide for alternate one-way movements through the area. It is possible that the movement may be self-regulating and no additional control, other than signs, will be required.

3.13 Where the one-lane movement is not self-regulating, a method of coordinating movements at each end must be utilized so that vehicles are not simultaneously moving in opposite directions in a one-lane section and so that delays are not extensive at either end. In order to achieve this, a flagger must be placed at each end of the one-lane section so as to permit easy passing of opposing lines of vehicles.

3.14 A flagger could also be required to stop traffic intermittently as necessitated by work in progress or to maintain continuous traffic past a work site at reduced speeds.

3.15 When it is necessary to direct movement in both directions through a single lane, the flagger stations shall be located far enough ahead of the work site to ensure that vehicles will have sufficient distance to slow down before entering the work area.

3.16 A flagger should be positioned to provide oncoming traffic sufficient warning of the work area ahead. The flagger is to be equipped with an approved warning device, constantly alert, and shall be familiar with the flagger signals described in paragraph 3.19.

3.17 The flagger is to wear an orange vest so that he or she may be readily seen by oncoming motorists. For nighttime conditions, the vest is to be reflectorized and the flagger must be illuminated (paragraph 2.23).

3.18 An employee, acting as a flagger, shall use either a red flag (24 inches by 24 inches with a 3-foot staff) or a STOP/SLOW paddle in directing the traffic through the work area. The sign paddle should be at least 18 inches wide with 6-inch lettering and reflectorized for nighttime use. The background of the STOP face shall be red with white lettering and border. The background of the SLOW sign on the opposite side shall be orange with black lettering and border.

3.19 **Flagging Procedures:** The flagger should stand on the shoulder adjacent to the line of traffic being controlled or in the barricaded lane if one lane is completely closed. Under no circumstances should the flagger stand in the lane being used by moving traffic. The flagger should be clearly visible to the traffic being controlled for a distance of 200 to 300 feet when the traffic must be controlled

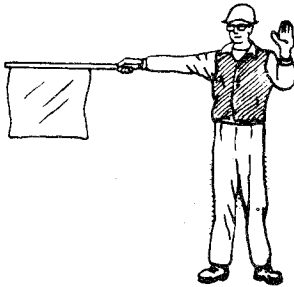
for any length of time. In urban areas, when speeds are low, the distance necessarily may be reduced. A flagger using a hand signaling device can direct the oncoming vehicles as illustrated in Fig. 1 and described in the following paragraphs.

(a) **To Stop Traffic:** The flagger shall face traffic and extend the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible, hanging below the staff. For greater emphasis, the free arm should be raised with the palm toward approaching traffic. When a paddle is used, the STOP side of the sign is directed toward the oncoming traffic.

(b) **When It Is Safe to Proceed:** The flagger shall stand parallel to the traffic movement, with the flag arm lowered from view of the driver and motioning traffic ahead with the free arm. When using a paddle, the SLOW side of the sign is to be held in a stationary position, and traffic is directed with the free arm.

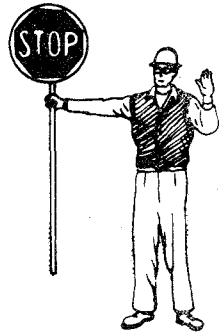
(c) **To Alert or Slow Traffic:** When it is desired to alert or slow traffic, the flagger shall face the oncoming vehicles and wave the flag in a sweeping motion. The arm holding the flag is not to be raised above a horizontal position. If a sign paddle is used, the SLOW message sign shall be directed toward the oncoming traffic and held in a stationary position.

FLAG

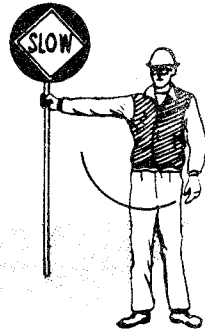


TO STOP
TRAFFIC

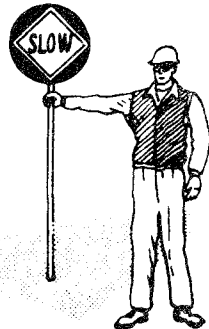
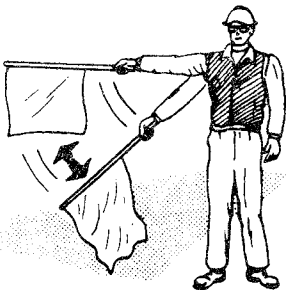
PADDLE



TRAFFIC
PROCEED



TO ALERT
AND SLOW
TRAFFIC



USE OF HAND SIGNALING DEVICES BY FLAGMAN

Fig. 1—Use of Hand Signaling Devices by Flagger

4. POSITIONING WARNING DEVICES

4.01 Initial warning devices for traffic control should be placed sufficiently ahead of the work area to give the motorist sufficient time to stop if necessary before reaching the work site. The selection and placing of warning signs and cone spacing for various speeds and roadways are shown in Fig. 2 and Tables A and B.

4.02 The spacing of traffic warning cones is dependent on normal traffic speeds. Where normal traffic speeds are less than 15 mph, the maximum distance between cones should be about 10 feet. Where normal traffic speeds are in excess of 15 mph,

it is suggested that the maximum spacing in feet be approximately that of the allowable speed limit in mph. As an example, if the speed limit is 50 mph, the cones should be spaced at intervals of about 50 feet. More cones should be used particularly at the work location to "round off" the traffic channel and to clearly define the work area.

4.03 Whenever road conditions permit, sufficient warning cones should be placed to obtain a taper length, in feet, of 10 times the posted traffic speed. (At a posted speed of 50 mph, the taper formed by the spaced warning cones should extend 500 feet from the work area.)

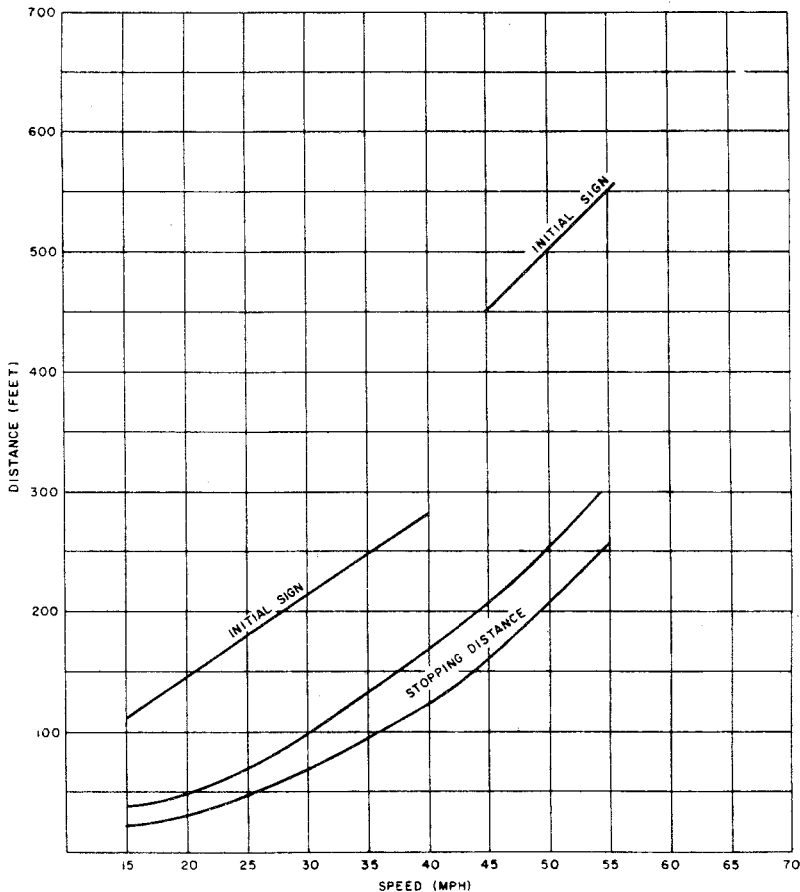


Fig. 2 — Placement of Initial Warning Sign (Not Expressway or Freeway)

4.04 When work is performed during hours of darkness, barricades with steady burning lights can be used in addition to or in place of warning cones for channeling the oncoming traffic around the work area.

4.05 If available, a motor vehicle equipped with flashers and/or rotating beacons may serve as a very effective barrier for vehicular traffic. These lights should be used day and night while the vehicle is used as a barrier. The vehicle should be placed between the work area and the oncoming traffic and should have the brakes set and the transmission engaged (manual transmission—reverse gear; automatic transmission—park position). During the hours of darkness, vehicles used as barricades shall be lighted by floodlights. Under extreme hazardous conditions, it may be desirable to use more than one vehicle to adequately guard a work area.

4.06 Where a vehicle is used for this purpose, there are a number of factors to be considered in determining which direction the truck should be faced, ie, toward oncoming traffic or in the same direction as the traffic flow. Headlights should be off when facing oncoming traffic. The principal concern is to afford maximum protection to the craftspersons. Some of the factors to be considered are:

- (a) Requirements of local laws and regulations.
- (b) Location of work areas to be protected with respect to traffic flow. For example, when oncoming drivers cannot observe the protected work area for a reasonable distance, facing the work vehicle in the same direction as the oncoming traffic may avoid possible confusion to a driver suddenly approaching a vehicle facing in the opposite direction from the normal flow.
- (c) Amount of equipment, tools, and materials which must be unloaded from the bin and side boxes of the truck.
- (d) Location of materials and work space on the particular type of truck.
- (e) Amount of work which must be done at the side or rear of the vehicle.
- (f) Safety considerations and difficulty in turning the truck around to face oncoming traffic.

4.07 When a vehicle is used in guarding a work area, it should be considered supplemental to

all other warning devices necessary to adequately safeguard the area and not as a substitute for any device. In this way, the work area is protected should it be necessary to remove the vehicle.

4.08 In addition to the warning devices, it may be desirable to use flashing lights at the warning sign locations both day and night.

5. JOB PRESURVEY

5.01 A suitable plan for guarding the work area should be developed before work in the area is begun. This may be accomplished during the job site visit provided for in the Construction Force Management System. At busy intersections on highways and city streets or at other heavy traffic locations, the supervisor should presurvey the work location and then discuss the protection plan with the craftspersons before work is started.

5.02 After completing the plan for the setup of warning devices for a particular location, analyze the plan from the point of view of the motorist and the pedestrian.

5.03 The following checklist will be helpful in planning for guarding the work area before starting work.

- Speed of traffic
- Size and type of signs required
- Light or heavy traffic
- Change in nature of traffic while work is being done
- Barricade requirement
- Floodlight requirement
- Flagger requirement when setting up and removing warning devices
- Flagger requirement during work operation
- Complying with state and local laws and regulations
- Permit requirement
- Police notification requirement

- On routes to or near special events such as ballgames, racetracks, etc, schedule job on days or hours with least traffic
- Storage of required tools, materials, and equipment during work operations
- Safe storage of tools and equipment at the job site after working hours
- Placement of pump, blower, and lighting equipment with respect to work location
- Interference caused by work operation to pedestrian or vehicular crossing, such as school crossing or bus stop
- Placement of warning devices in traffic lane(s) in which manhole is located.

6.02 If one lane of a two-lane highway is blocked, one or more flaggers shall be used.

6.03 When working in the center of a two-lane highway or in the center lane of a multiple lane highway, an advance warning sign may have to be placed at the shoulder of the curb lane.

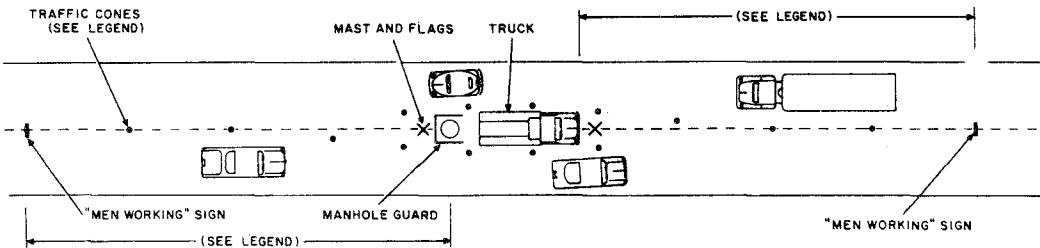


The taper length formed by warning cones or barricades shall effectively channel the traffic around the work area. The minimum taper length in feet, of 10 times the posted speed for highways of 45 mph or more and 7 times the posted speed for highways of less than 45 mph, shall be extended if the work area is not clearly visible, due to the contour of the road, or if the oncoming vehicles are having difficulty adjusting to the existing warning devices.

6. WORKING ON HIGHWAYS

6.01 If the posted traffic speed is 45 mph or over, additional warning signs are to be used to alert the oncoming traffic as described in paragraph 3.04.

6.04 Two-Lane Highway: Where the work area is located near the center of a two-lane highway, place warning devices as illustrated in Fig. 3. If



LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	MEN WORKING	48"	MEN WORKING *	30"

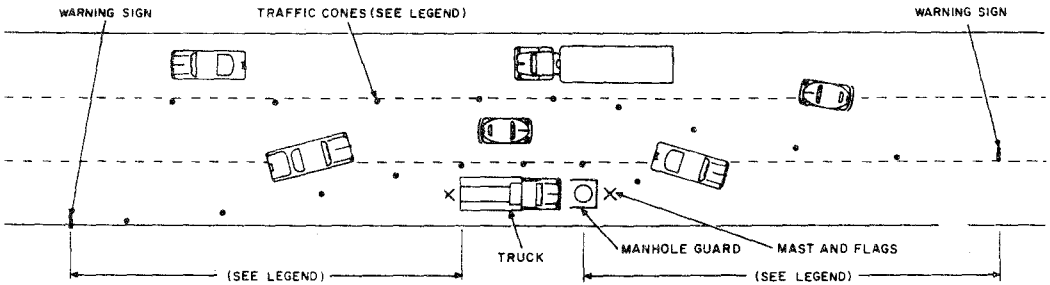
TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 TAPER LENGTH - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 56" WORKER SYMBOL SIGN MAY BE USED

Fig. 3—Placement of Warning Devices on Two-Lane Highway—Underground Plant Near Center of Highway

one lane is partially blocked on a *wide* two-lane highway, it may be desirable to place the warning signs as shown in Fig. 4. If one lane of a two-lane highway is blocked, one or more flaggers shall be used.

6.05 Three-Lane Highway: Where the work area is located in the outside lane of a three-lane highway, place warning devices as illustrated in Fig. 4.



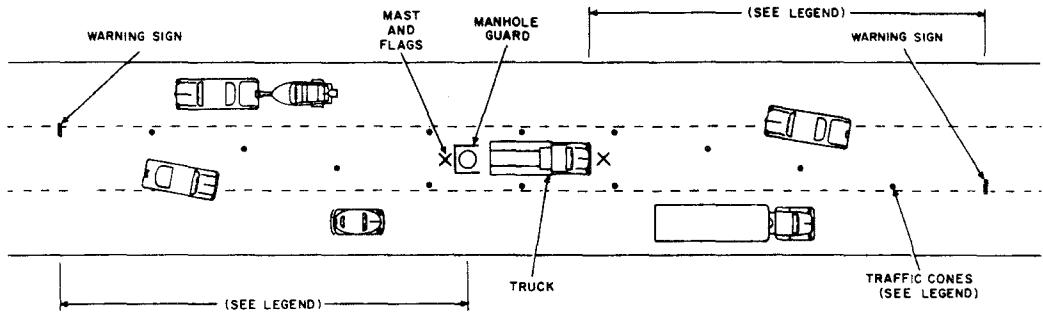
LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	LANE CLOSED	48"	MEN WORKING *	30"

TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED
 * 3" WORKER SYMBOL SIGN MAY BE USED

Fig. 4—Placement of Warning Devices on Three-Lane Highway—Underground Plant in Outside Lane

6.06 Where the work area is located in the center lane of a three-lane highway, place warning devices as illustrated in Fig. 5.



LEGEND

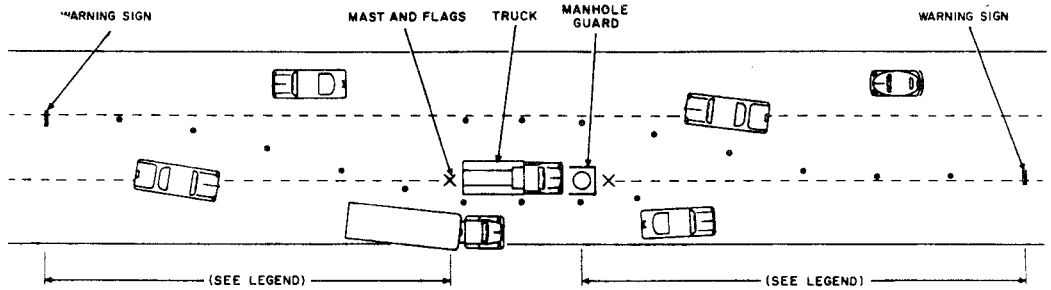
POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	LANE CLOSED	48"	MEN WORKING *	30"

TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 TAPER LENGTH - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 36" WORKER SYMBOL SIGN MAY BE USED

Fig. 5—Placement of Warning Devices on Three-Lane Highway—Underground Plant Near Center of Highway

6.07 Where the work area is located between two lanes of a three-lane highway, place warning devices as illustrated in Fig. 6.



LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	LANE CLOSED	48"	MEN WORKING *	30"

TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 TAPER LENGTH - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 36" WORKER SYMBOL SIGN MAY BE USED

Fig. 6—Placement of Warning Devices on Three-Lane Highway—Underground Plant Between Two Lanes

6.08 **Four-Lane Highway:** Where the work area is located in an inside lane of a four-lane highway, place warning devices as illustrated in Fig. 7.

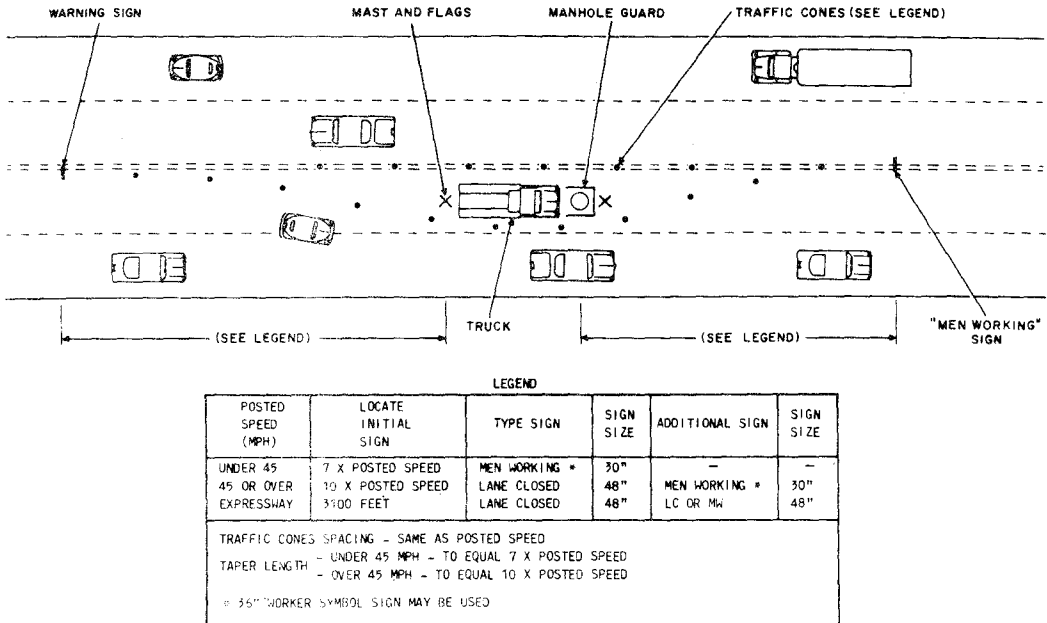


Fig. 7—Placement of Warning Devices on Four-Lane Highway—Underground Plant in Inside Lane

6.09 Where the work area is located in an outside lane of a four-lane highway, place warning devices as illustrated in Fig. 8.

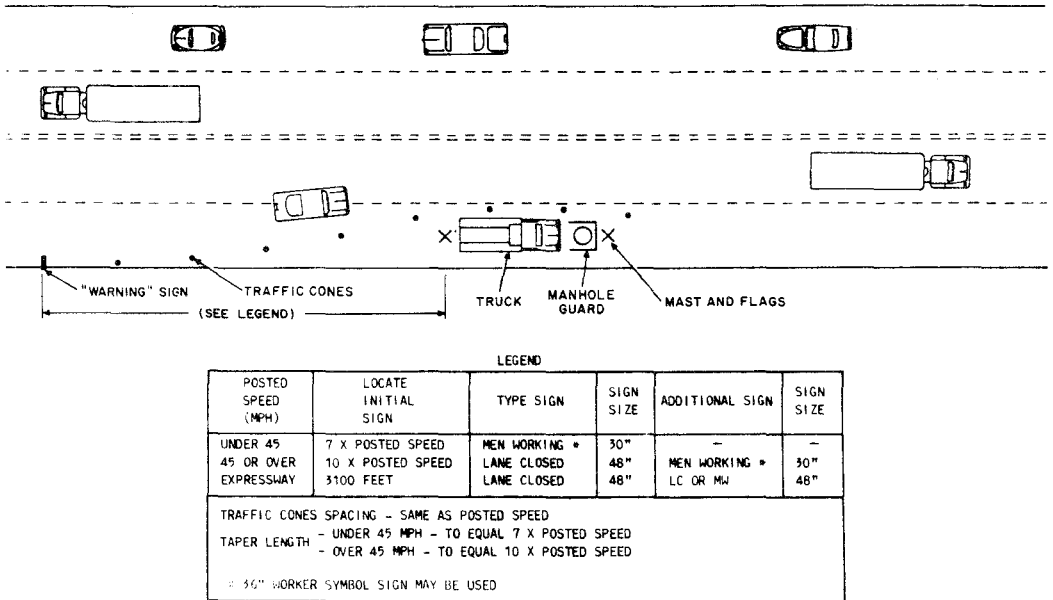
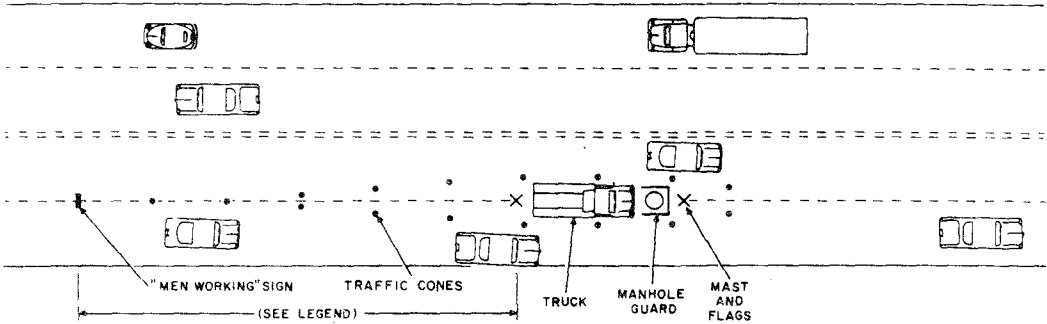


Fig. 8—Placement of Warning Devices on Four-Lane Highway—Underground Plant in Outside Lane

6.10 Where the work area is located between inside and outside lanes of a four-lane highway, place warning devices as illustrated in Fig. 9.



LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	MEN WORKING	48"	MEN WORKING *	50"
EXPRESSWAY	3100 FEET	MEN WORKING	48"	MEN WORKING	48"

TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 5" WORKER SYMBOL SIGN MAY BE USED

Fig. 9—Placement of Warning Devices on Four-Lane Highway—Underground Plant Between Inside and Outside Lane

6.11 *Divided Highway:* Where the work area is in a traffic lane of a divided highway, place warning signs according to the appropriate plan given in paragraphs 6.08 through 6.10. When the work area is in a narrow median of a divided highway, place warning signs as illustrated in Fig. 10. If the median is wide and the work area is adjacent to one of the inside lanes, warning signs may only be necessary on one side of the highway.

7. WORKING IN CITY STREETS AND ALLEYS

7.01 Generally, city streets and alleys are characterized by relatively low speeds, wide ranges of volumes, limited maneuvering space, significant pedestrian movement, and other obstructions. Therefore, adjustments in positioning warning devices may be required to compensate for such conditions.

7.02 When work is performed where congested conditions exist, take the following precautions.

- (a) Use additional warning devices
- (b) Obtain permission from local authorities to block off parking spaces near the work area
- (c) Schedule work to avoid peak traffic flow
- (d) Schedule continuous tours to complete the work in a minimum amount of time.

7.03 Where city streets are sufficiently wide to park a truck at the manhole, the plans for placing warning devices given in Part 6 may generally be used. Where a truck is not used, or cannot be used because the street is too narrow, place warning devices according to the following paragraphs.

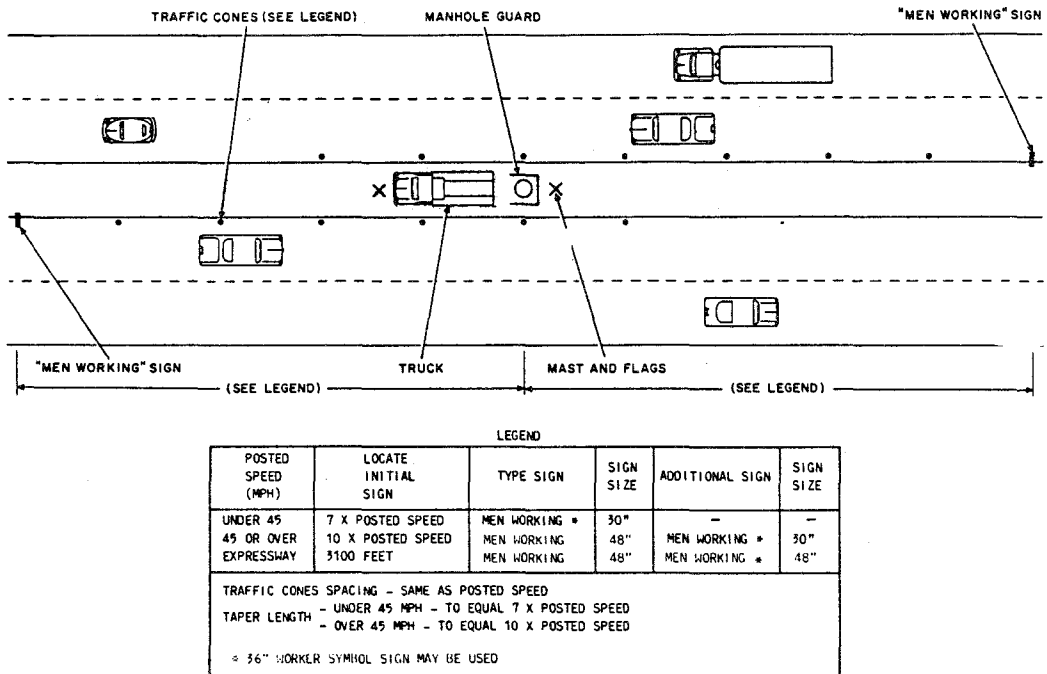


Fig. 10—Placement of Warning Devices on Four-Lane Divided Highway—Underground Plant in Median

7.04 **City Street—Underground Plant:** Where the work area is near the center of a city street, place warning devices as illustrated in Fig. 11.

7.05 Where the work area is at the side of a city street, place warning devices as shown in Fig. 12. If vehicles are parked along the side of the

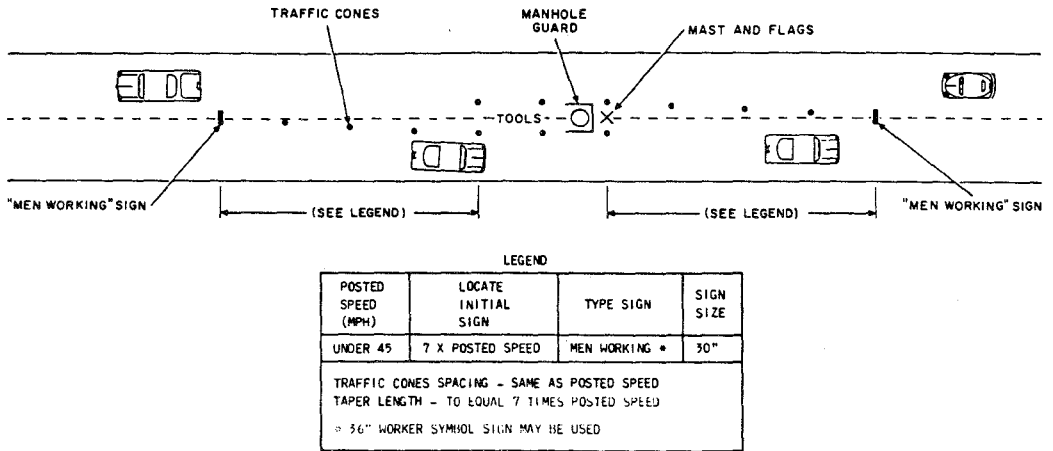


Fig. 11—Placement of Warning Devices on City Street Without Truck—Underground Plant Near Center of Street

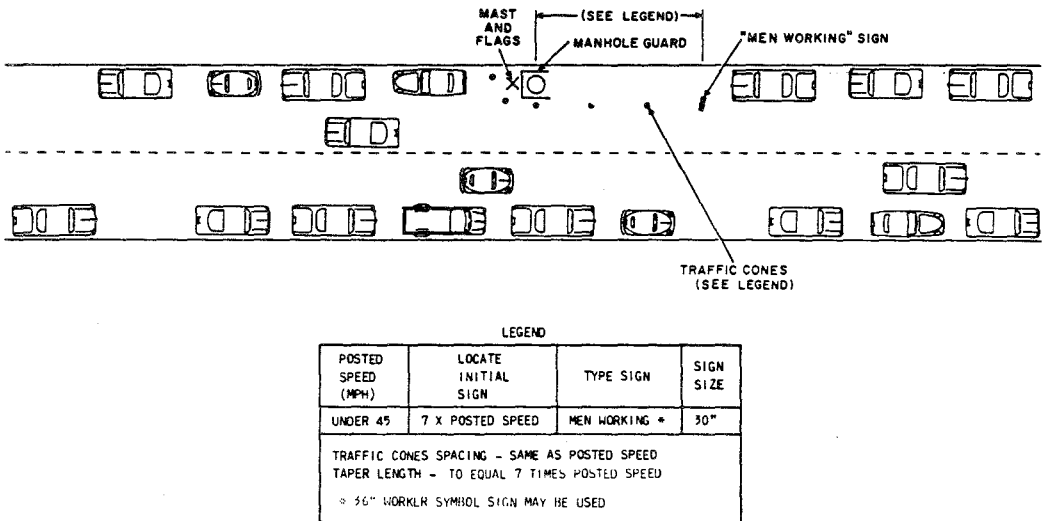
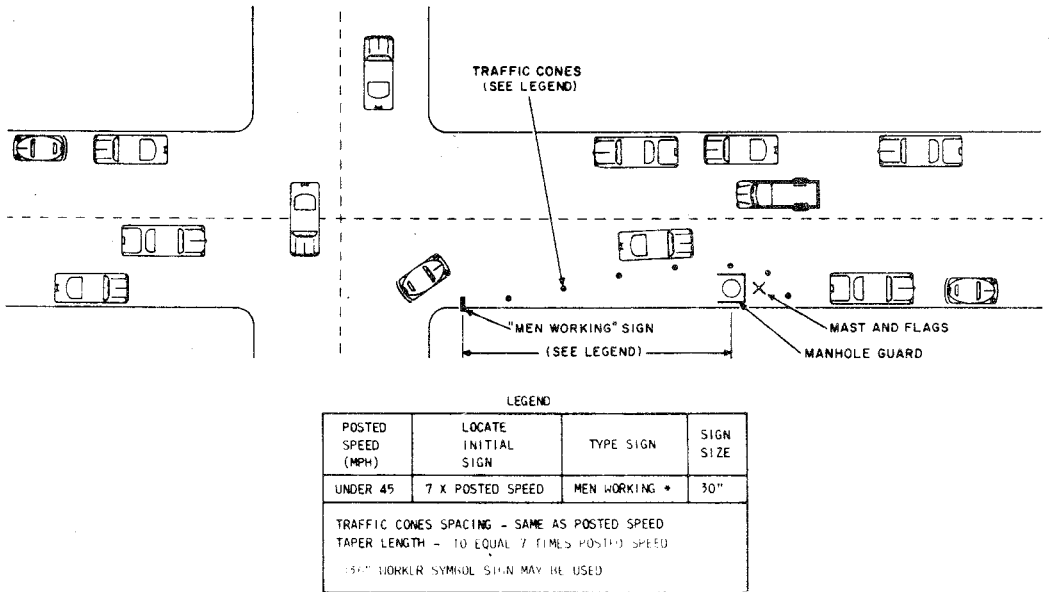


Fig. 12—Placement of Warning Devices on City Street Without Truck—Underground Plant at Side of Street

street in the direction of approaching traffic, place initial warning sign and cones as for traffic under 15 mph. If no vehicles are parked in the direction of approaching traffic, place initial warning sign and cones as nominal traffic speed dictates. Be alert for changing traffic conditions.

7.06 Where the work area is near an intersection, place warning devices as illustrated in Fig. 13.



NOTE: THE PLACING AND SPACING OF WARNING DEVICES MAY HAVE TO BE ADJUSTED WHEN IN A CURVED AREA.

Fig. 13—Placement of Warning Devices on City Street Without Truck—Underground Plant Near Intersection

7.07 Where the work area is in an intersection, place warning devices as illustrated in Fig. 14.

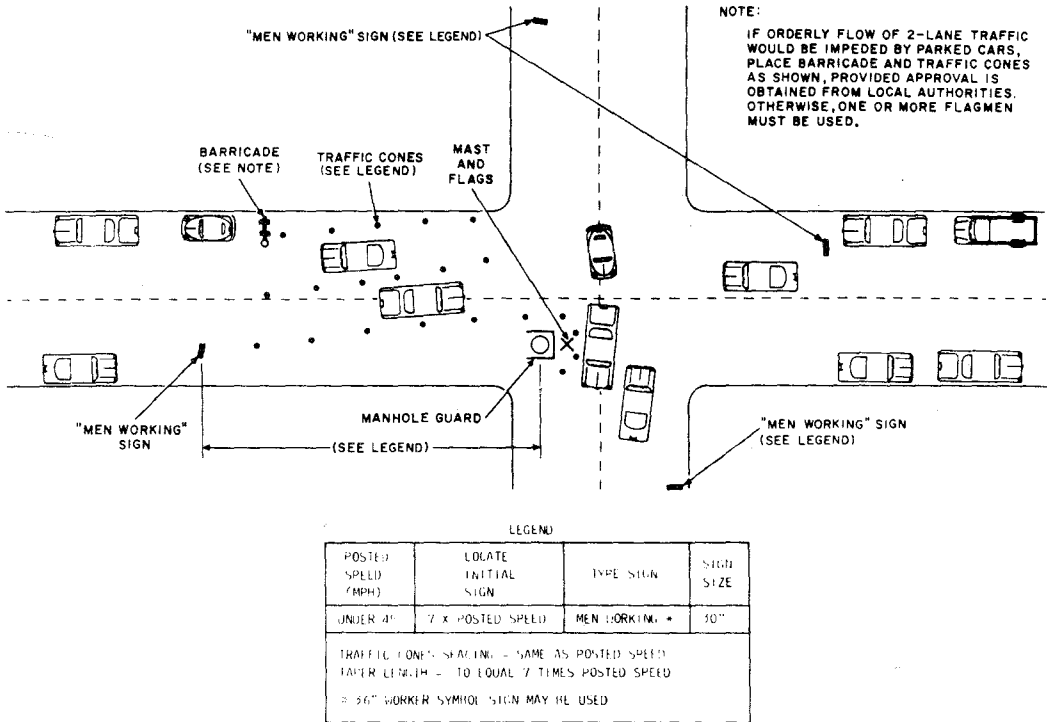


Fig. 14—Placement of Warning Devices on City Street Without Truck—Underground Plant in Intersection

7.08 Where the work area is near an intersection of a city street, and the work operation requires an open trench, place warning devices as illustrated in Fig. 15.

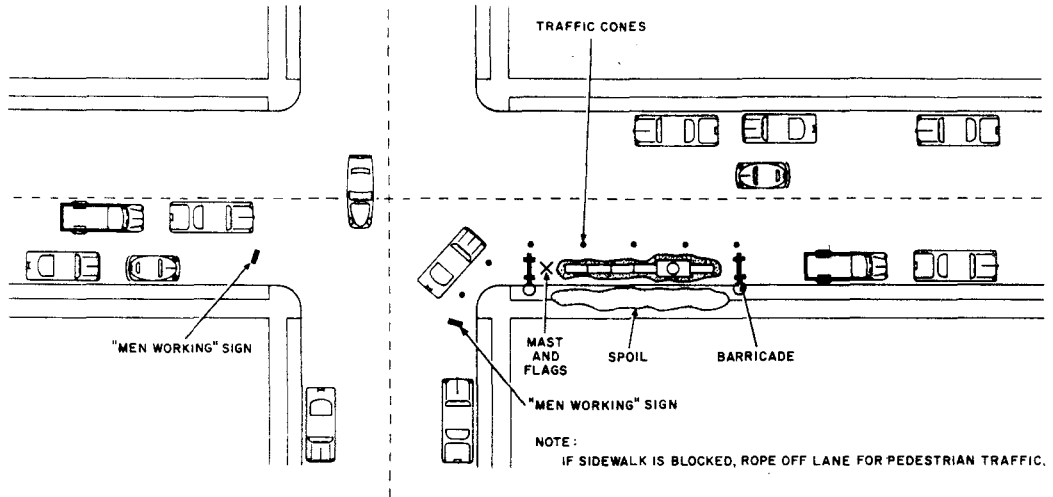
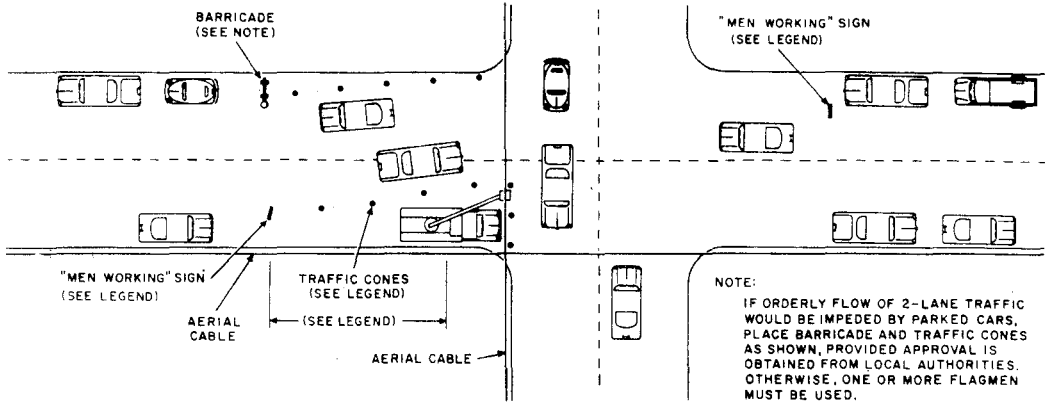


Fig. 15—Placement of Warning Devices on City Street Without Truck—Opened Trench Near Intersection

7.09 City Street—Aerial Plant: Where aerial work is involved on city streets and a truck is used, place warning devices as illustrated in Fig. 16.

7.10 Where the work area is near an intersection of a city street, place warning devices as illustrated in Fig. 16.



NOTE:
IF ORDERLY FLOW OF 2-LANE TRAFFIC WOULD BE IMPEDED BY PARKED CARS, PLACE BARRICADE AND TRAFFIC CONES AS SHOWN, PROVIDED APPROVAL IS OBTAINED FROM LOCAL AUTHORITIES. OTHERWISE, ONE OR MORE FLAGMEN MUST BE USED.

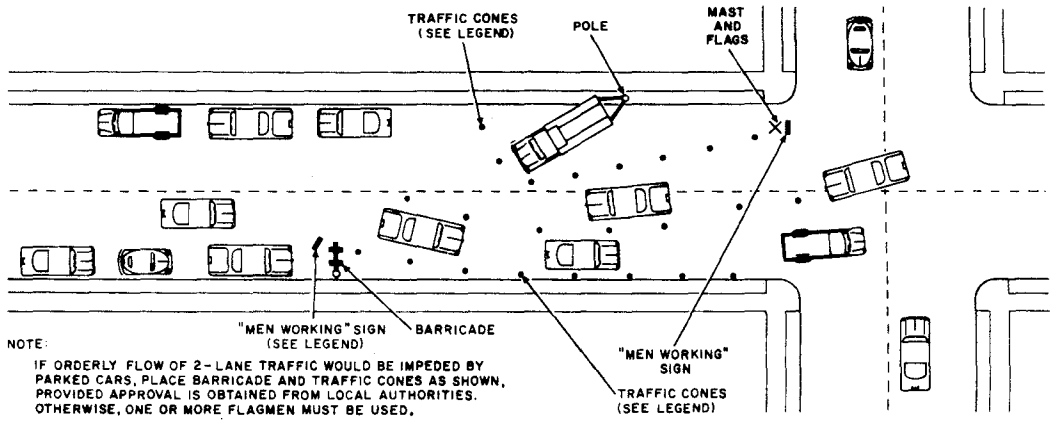
LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"
TRAFFIC CONES SPACING - SAME AS POSTED SPEED TAPER LENGTH - TO EQUAL 7 TIME POSTED SPEED * 30" WORKER SYMBOL SIGN MAY BE USED			

NOTE: THE PLACEMENT AND SPACING OF WARNING DEVICES MAY HAVE TO BE ADJUSTED WHEN IN A CONFINED AREA.

Fig. 16—Placement of Warning Devices on City Street—Aerial Plant Near Intersection

7.11 When setting a pole at the side of a city street, place warning devices as illustrated in Fig. 17.



NOTE:
IF ORDERLY FLOW OF 2-LANE TRAFFIC WOULD BE IMPEDED BY PARKED CARS, PLACE BARRICADE AND TRAFFIC CONES AS SHOWN, PROVIDED APPROVAL IS OBTAINED FROM LOCAL AUTHORITIES. OTHERWISE, ONE OR MORE FLAGMEN MUST BE USED.

LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"
TRAFFIC CONES SPACING - SAME AS POSTED SPEED TAPER LENGTH - TO EQUAL 7 TIMES POSTED SPEED * 36" WORKER SYMBOL SIGN MAY BE USED			

NOTE: PLACING AND SPACING OF WARNING DEVICES MAY HAVE TO BE ADJUSTED FOR JOB CONDITIONS.

Fig. 17—Placement of Warning Devices on City Street—Setting Pole on Side of Street

7.12 When placing a pole at the side of an alley, it will generally be necessary to block the alley to all traffic until the work is completed. Place warning devices as illustrated in Fig. 18.

8. WORKING AT THE ROAD SHOULDER

8.01 Guard all manholes or excavations on private property, pedestrian lanes, or parkways with

barricades or manhole guards equipped with warning flags and signs. Rope off pedestrian lanes with barricade tape and prominently display warning flags and signs.

8.02 *Manhole on Highway Shoulder:* Where the work area is on the shoulder of a two- or three-lane highway, place warning devices as illustrated in Fig. 19.

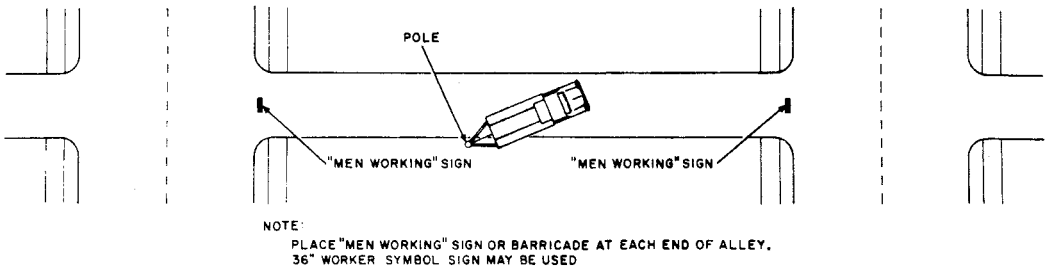
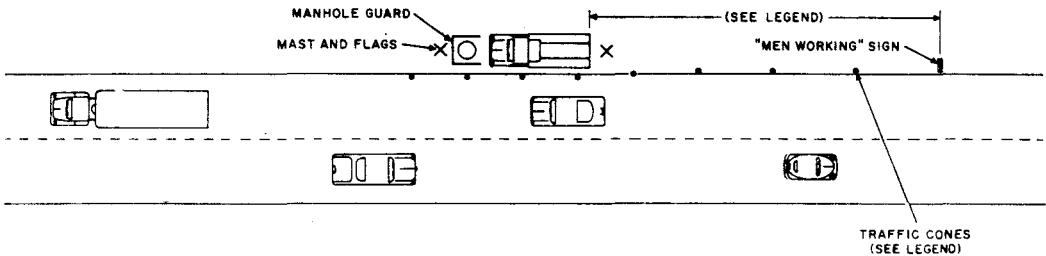


Fig. 18—Placement of Warning Devices in Alley—Setting Pole in Alley



LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	MEN WORKING	48"	MEN WORKING *	30"

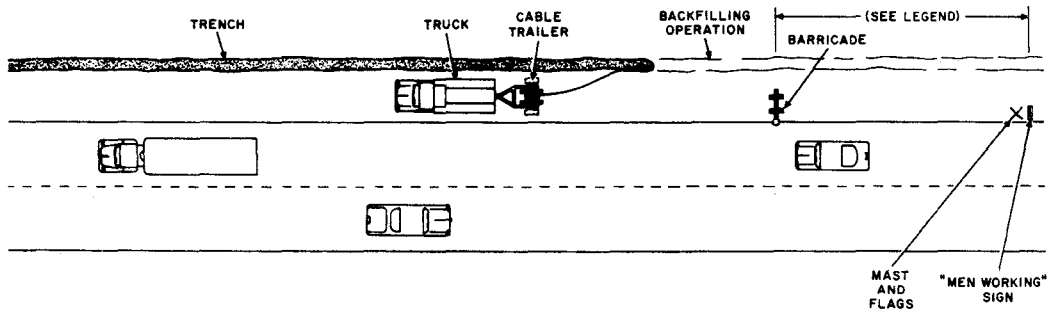
TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 36" WORKER SYMBOL SIGN MAY BE USED

Fig. 19—Placement of Warning Devices on Street or Highway—Underground Plant on Shoulder

8.03 Buried Cable on Highway Shoulder:

When burying cable or wire on a shoulder adjacent to a highway, place warning devices as illustrated in Fig. 20. Backfill as soon as practical to minimize the time the trench is open.



NOTE: AS OPERATIONS PROCEED ADD ADDITIONAL WARNING DEVICES AS REQUIRED. AS BACKFILLING IS COMPLETED, MOVE BARRICADE, "MEN WORKING" SIGNS, AND FLAGS FORWARD.

LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	MEN WORKING	48"	MEN WORKING *	30"

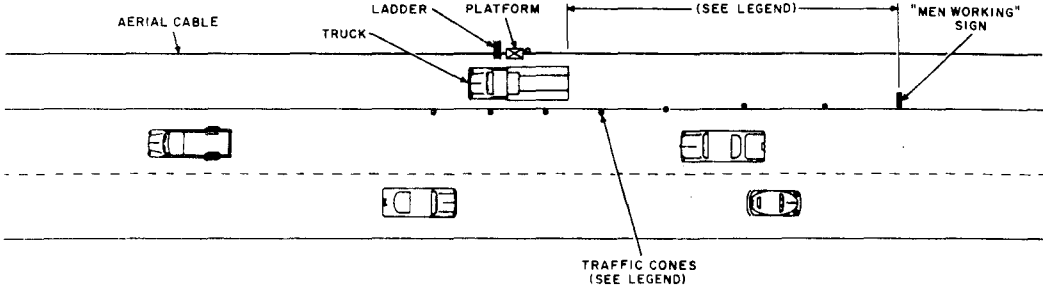
TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 36" WORKER SYMBOL SIGN MAY BE USED

Fig. 20—Placement of Warning Devices on Street or Highway—Underground Cable Placing on Shoulder

8.04 Aerial Cable on Highway Shoulder:

When aerial cable is being maintained on a highway shoulder, place warning devices as illustrated in Fig. 21 (stationary operation).



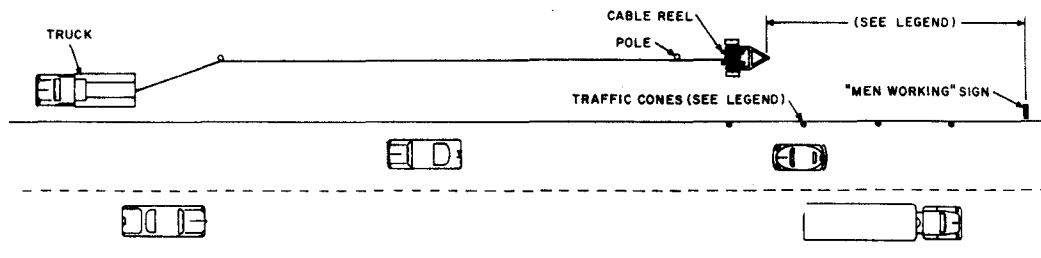
NOTE:
USE SAME PLAN FOR 3-LANE HIGHWAYS.

LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	MEN WORKING	48"	MEN WORKING *	30"
TRAFFIC CONES SPACING - SAME AS POSTED SPEED TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED TAPER LENGTH - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED * 36" WORKER SYMBOL SIGN MAY BE USED					

Fig. 21—Placement of Warning Devices on Street or Highway—Aerial Plant on Shoulder (Stationary Operation—Equipment off Traveled Portion)

8.05 When aerial cable is being placed on a highway shoulder, place warning devices as illustrated in Fig. 22 (moving operation).



NOTE:
USE SAME PLAN FOR 3-LANE HIGHWAYS.

LEGEND

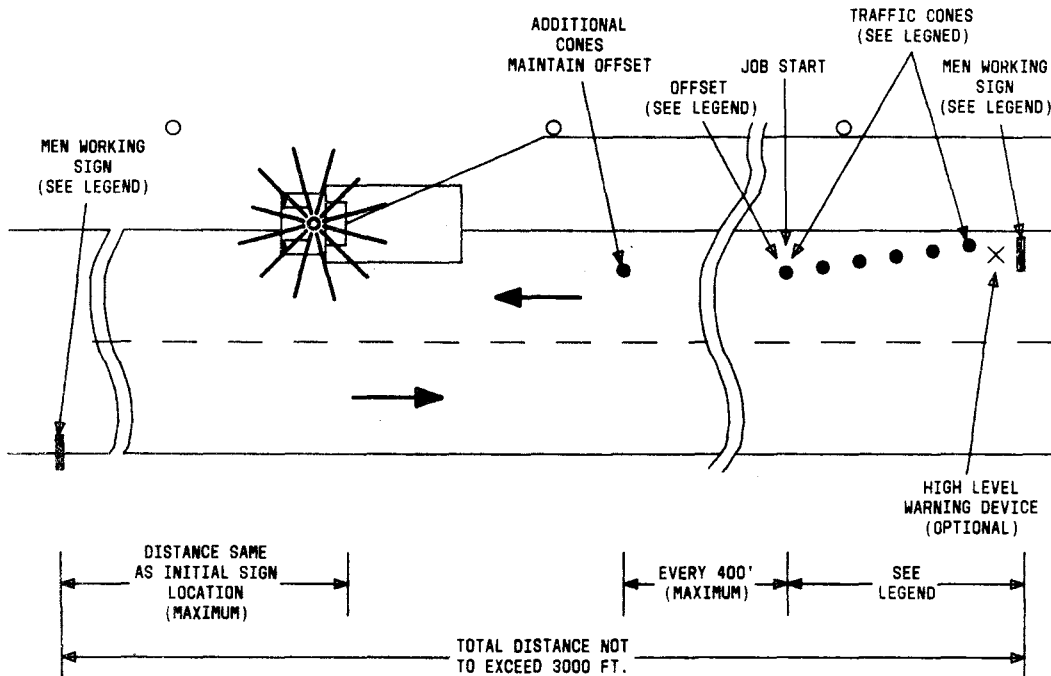
POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	—	—
45 OR OVER	10 X POSTED SPEED	MEN WORKING	48"	MEN WORKING *	30"

TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 36" WORKER SYMBOL SIGN MAY BE USED

Fig. 22—Placement of Warning Devices on Street or Highway—Stringing Aerial Cable on Shoulder (Moving Operation—Equipment off Traveled Portion)

8.06 When aerial cable is being placed with equipment partially on the traveled portion of the highway, place warning devices as illustrated in Fig. 23.



LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING*	30"
OVER 45	10 X POSTED SPEED	MEN WORKING*	36"

TRAFFIC CONE SPACING:
 FOR TAPER - SAME AS POSTED SPEED
 PERIODICALLY ALONG WORK AREA - MAXIMUM 400'
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 OVER 45 MPH - TO EQUAL 10 X POSTED SPEED
 * WORKER SYMBOL SIGN MAY BE USED
 OFFSET DISTANCE IS DISTANCE VEHICLE OVERLAPS TRAVELED POSTING

Fig. 23—Placement of Warning Devices on Street or Highway—Equipment Partially on Traveled Portion (Moving Operation—Two-Way Traffic, Self Regulating)

9. ADDITIONAL PROTECTION DURING HOURS OF DARKNESS

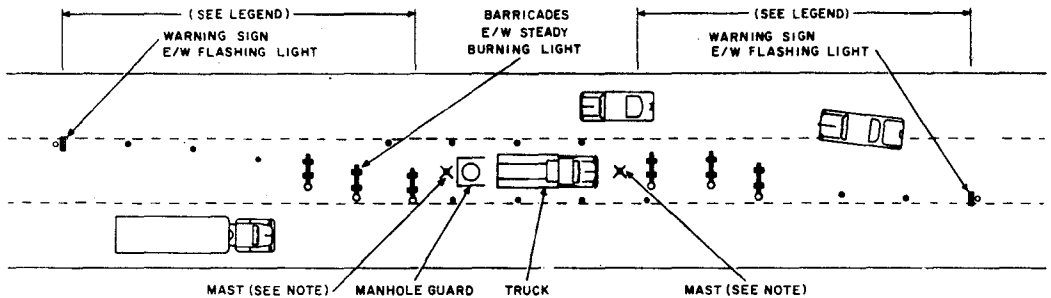
9.01 On dark days or during hours of darkness, additional warning devices may be required, as follows:

- (a) Place a flashing light at the initial warning sign and at additional signs, when required.
- (b) Place steady, burning amber warning lights at the work area to aid in channelization of the traffic flow.

(c) Use barricades in addition to or in place of warning cones.

(d) Use floodlights to illuminate the work area. Place the lights so that they will adequately light the work area but will not cause a glare in the eyes of oncoming motorists from either direction.

9.02 *Underground Plant in Three-Lane Highway:* Where the work area involves underground plant located in the center of a three-lane highway at night and a truck is employed, place warning devices as illustrated in Fig. 24.



NOTE:
 MAST WITH 360° FLASHER OR DIRECTIONAL FLASHER, AND
 B FLOODLIGHT ADJUSTED TO ILLUMINATE WORK AREA.

LEGEND

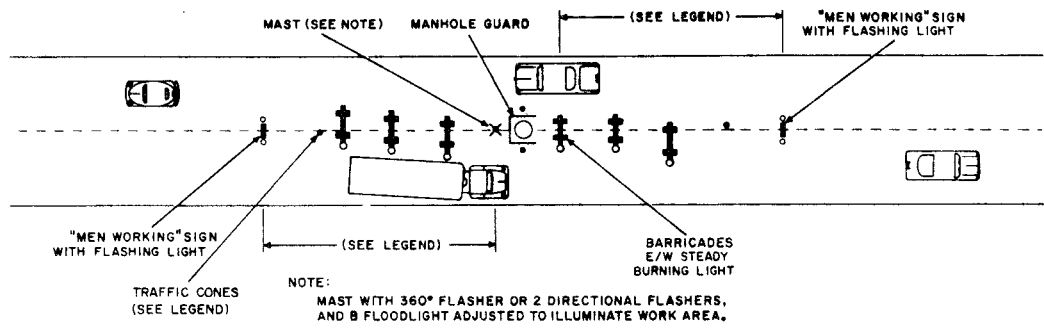
POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	-	-
45 OR OVER	10 X POSTED SPEED	LANE CLOSED	48"	MEN WORKING *	30"

TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED
 * 54" WORKER SYMBOL SIGN MAY BE USED

Fig. 24—Placement of Warning Devices on Three-Lane Highway at Night With Truck—Center Lane Blocked—Underground Plant Near Center of Highway

9.03 Underground Plant in Two-Lane Highway:

Where the work area involves underground plant located in a two-lane highway at night and a truck is not employed, place warning devices as illustrated in Fig. 25.



LEGEND

POSTED SPEED (MPH)	LOCATE INITIAL SIGN	TYPE SIGN	SIGN SIZE	ADDITIONAL SIGN	SIGN SIZE
UNDER 45	7 X POSTED SPEED	MEN WORKING *	30"	-	-
45 OR OVER	10 X POSTED SPEED	MEN WORKING	48"	MEN WORKING *	30"

TRAFFIC CONES SPACING - SAME AS POSTED SPEED
 TAPER LENGTH - UNDER 45 MPH - TO EQUAL 7 X POSTED SPEED
 - OVER 45 MPH - TO EQUAL 10 X POSTED SPEED

* 36" WORKER SYMBOL SIGN MAY BE USED

Fig. 25—Placement of Warning Devices on Two-Lane Street or Highway at Night Without Truck—Underground Plant Near Center of Highway