

This Manual of Barricading Standards, Specifications, Methods and Materials for the City of Omaha issued pursuant to Chapter 34, ARTICLE I, SECTION 34-1, of the Omaha Municipal Code, approved by the Public Works Director and approved by the City Council by Resolution 480, adopted March 3, 1992.

The penalty for non-compliance for each offense is a maximum of \$500.00 or six (6) months in jail or both.

PREFACE

NEED AND PURPOSE OF MANUAL

The primary function of streets and highways is to provide for the movement of people and goods from property to property. A secondary use of the street right-of-way is to provide space for the placement of utilities. In order to adequately serve the primary function and provide optimum safety and convenience to the general public, street and utility construction and maintenance must be fully coordinated between all interested agencies.

The purpose of this Manual is to set forth basic principles and to prescribe standards for the design, application, installation, and maintenance of the various types of traffic control devices required for road or street construction, maintenance operations, and utility work on or adjacent to the roadway. These include signs, signals, lighting devices, markings, barricades, channelizing, and hand signaling devices. Minimum standards of application are prescribed for typical situations, and for methods of controlling traffic through work areas. As part of these standards, a number of typical situations are illustrated, showing the proper application of standard protective devices.

The general principles outlined in the Manual are applicable to urban areas. Since it is not practical to prescribe detailed standards of application for all the situations that may conceivably arise, minimum standards are presented here for the most common situations. It is emphasized that these are minimum desirable standards for normal situations and that additional protection must be provided when special complexities and hazards prevail. The protection prescribed for each situation shall be based on the speed and volume of traffic, duration of operation, and exposure to hazards.

Traffic conditions on streets are characterized by speed, traffic volume, limited maneuvering space, frequent turns and cross movements, a significant pedestrian movement and other obstructions. Construction, maintenance, and utility operations are more numerous and varied, including such diverse activities as pavement cuts for utility work, pavement patching and resurfacing, pavement marking renewal and encroachments by adjacent building construction. Work on arterial streets should be restricted to off-peak hours to minimize conflicts with traffic.

Limited access highways present problems requiring a special effort by administrators, supervisors, and work forces. Both high speeds and high volumes may be anticipated, with peak flows restricting work to relatively short periods during daylight hours.

The difficulties associated with the completion of work on lanes carrying high volumes of traffic have made it necessary in some instances to schedule construction and/or maintenance operations at night. While night scheduling avoids peak flows, the problems associated with work site delineation and warning device placement are increased.

Although each situation must be dealt with individually, conformity with the provisions established herein is required. In particular situations not adequately covered by the provisions of this Manual, the protection of the traveling public, pedestrians, officers, firepersons, and of the workers on the scene will dictate the measure to be taken, consistent with the general principles set forth herein.

Early project planning for traffic control in construction areas and implementation and surveillance of these controls during construction are very important. To facilitate adequate advance project planning, the plans, specifications and estimates (PS & E) for each project should include provisions for a reasonably specific traffic control plan for moving traffic through or around the construction zone in a manner that is conducive to the safety of the traveling public, pedestrians and workers. This traffic control plan should include, but not be limited to, such items as signing; application and removal of pavement markings; construction; scheduling; methods and devices for delineation and channelization; placement and maintenance of devices; roadway lighting; traffic regulations; and surveillance and inspection.

These principles, procedures, and standards conform as closely as possible to the latest edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highways Administration.

While this Manual provides standards for design and application of traffic control devices, the Manual is not a substitute for engineering judgment. It is the intent that the provisions of this Manual be standards for traffic control devices installation, but not a legal requirement for installation.

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I. BARRICADING STANDARDS, SPECIFICATIONS, METHODS AND MATERIALS FOR THE CITY OF OMAHA

The barricading standards, specifications, methods and materials set forth herein shall be followed and used in barricading and protecting all construction and maintenance activities within any public street or public way in the City of Omaha, by all contractors, utility companies, plumbers, tree trimmers, and any other person, firm, corporation, or agency performing construction or maintenance work within the right-of-way of any public street or public way in the City of Omaha in accordance with Chapter 34, Section 34-1 through 25. The term "agency" as used hereinafter shall mean contractor, utility company, plumber, tree trimmer, person, firm, corporation or agency.

A. General.

All work done in any public street or public way shall be done with due regard for the safety of the workers and the public. Such work shall be performed so that a minimum width of the street is blocked. Access to abutting property must be kept open at all times unless other arrangements are made with the occupant of the property. Sidewalks shall be kept open if possible, and, if blocked, an alternate safe path or temporary sidewalk shall be provided by the agency doing the work.

All work shall proceed with dispatch until completed. When directed by the City Traffic Engineer an agency having a project which necessitates making an excavation in a paved street, which is classified as an arterial street on the current urban area "Functional Classification of Streets" Map shall work continuously and diligently without interruption and without regard for regular hours of work on the project until the completion of same in accordance with Chapter 34, Section 34-24 of the Omaha Municipal Code.

B. Specific Barricading Requirements.

All excavations in any public street or public way deeper than 1-1/2 inches shall be barricaded. Barricade fencing shall supplement barricades on all excavations deeper than 3 feet. Fencing shall have reflective stripes for night use. All mud or dirt spills or trackings which create a hazard to traffic shall be barricaded or warning signs posted until cleaned. All debris blocking public streets or public ways or creating a hazard to traffic shall be barricaded until the debris is removed.

C. Identification.

All traffic control devices shall be marked with the owner's name for identification as follows:

1. Signs — On the rear of the sign blank.
2. Barricades - On the rear of the lower panel.
3. Other devices — On the rear of the panel or some member of the frame.

This identification shall be in one color and non-reflective with letters not to exceed 2 inches in height.

The agency performing the work shall be identified at each work site by posting a sign which is readable from a vehicle, containing the agency name and telephone number, see Figure 28. The agency sign shall be posted at all job sites where four or more barricades are in place. Agencies shall identify vehicles at the worksite with a sign containing, as a minimum, the agency name.

II. RETIREMENT OF SUBSTANDARD EQUIPMENT

A. General

All traffic devices used in the City of Omaha on street construction or maintenance work, shall conform to the applicable specifications of this Manual and the latest Manual on Uniform Traffic Control Devices for Streets and Highways, U. S. Department of Transportation, Federal Highway Administration. All devices not specifically covered in this Manual or the latest Manual on Uniform Traffic Control Devices shall be approved by the City of Omaha's Traffic Engineer.

B. Inspection

The Public Works Department will perform random inspections of barricading devices. Devices found to be defective (i.e. damaged signs such as non-readable and/or non-reflective, etc., due to physical damage, mud, dirt or other reasons) will be marked with a tag, sticker or similar method identifying the device as defective and the company will be notified to replace the defective barricading device. The defective barricading device shall be repaired/replaced before being used again.

III. NORMAL PROCEDURE FOR OBTAINING PERMISSION TO WORK IN CITY STREETS

Whenever it is necessary to work in the street right-of-way of any street in the City of Omaha, the agency doing such work must, before starting the work, obtain the required permit(s) and/or approval from the appropriate Department(s) of the City of Omaha, in accordance with Chapter 34, 43 and/or other applicable Chapters of the Omaha Municipal Code. (Agencies under contract to the City of Omaha for such work are excluded from permit requirements. Ref. Chapter 34, Omaha Municipal Code.) Authorization to work in city streets must be applied for by a representative of the agency doing the work at least 24 hours before the work is initiated. Street closures when deemed necessary must be requested at least two working days in advance of the time the work is to be started.

IV. PROCEDURE FOR PERFORMING WORK IN A CITY STREET ON AN EMERGENCY BASIS

If an emergency occurs during normal office hours (8:00 A. M. - 4:30 P.M., Monday through Friday), the "24 hour prior to work initiation" requirement for permits is waived. Barricading shall be done as required, however, the agency must obtain the required permits before starting the actual work.

If the emergency occurs during other than normal work hours, the applicant is required to phone the Public Works Dispatcher at 444-4925 and give the Dispatcher the location and nature of the emergency before starting the work. The applicant shall obtain the necessary permits the first working day thereafter.

V. NOTICE TO THE CITY

After obtaining all required permits, the agency doing any work within a public street or public way shall notify the City Traffic Engineering Division (444-4978), 24 hours (working days) in advance of a street restriction or 48 hours (working days) in advance of a street closing and supply the following information:

1. The location of the work.
2. The date and time the work is to begin and end.
3. The type of work to be done.

4. The name and telephone number of the agency doing the work.
5. The name of the barricade company if other than the agency doing the work.

VI. ONE CALL SYSTEM

Prior to commencing any work in streets or public ways, the agency shall call 344-3565 (Underground Hot Line) to obtain the location and depth of all underground utilities. This system will assist in contacting all agencies, including the City of Omaha, who may have buried utilities within the surrounding areas.

V. PRE-CONSTRUCTION CONFERENCE

The City Engineer or his representative shall have the responsibility of outlining those projects, which are large enough to scope to warrant a pre-construction conference.

The conference may involve representatives of the utility companies. Public Works Department, Public Safety Department and the construction agency representative.

VI. DETOURS

The City Traffic Engineering Division will determine the need for the detour route. During normal working hours detour routes may be requested by telephoning the Traffic Engineering Division, 444-4978. On other than normal working days, an emergency closing must be reported by notifying the Dispatcher of the Police Division at 911 and the Public Works Dispatcher at 444-4925.

When streets are ready for reopening the City Traffic Engineering Division must be notified by the agency 24 hours in advance of reopening.

VII. COVER PLATING

In order to reduce traffic congestion and traffic hazards, small cuts such as manhole or utility adjustment cuts, shall be covered with metal plates, or an approved equal. On construction projects containing excavations of such a nature and size that they cannot be cover plated, work will continue utilizing only the blocked lane or lanes. All other lanes shall be opened to traffic.

Work should be scheduled so that cuts can be made and holes filled, etc., during other than peak hours of traffic movements (6-9 AM and 4-6 PM, weekdays).

Cover plates may be required by the City Traffic Engineering Division at the following locations, during peak hours of traffic movement (6-9 AM and 4-6 PM, weekdays) and at all other hours when work is not in progress:

1. Near signalized intersections.
2. On any major street carrying two or more lanes of traffic in one direction.
3. On any major street when parking is prohibited during peak hours of traffic movement.

Plating shall be secured in place so that it will not shift out of position during usage.

Minimum plating shall consist of three-quarter (3/4) inch thickness steel plate, or an approved equal, extending six (6) inches in all directions beyond the street opening, securely anchored by the use of three-fourths (3/4) inch diameter bolts. Bolts shall be a minimum of two (2) inches long, located at the corner of the plate.

No cover plates will be permitted during the period December 1 to March 15. Special winter patching procedures as set forth by the Public Works Department will be utilized during this period.

The agency shall be responsible for any damages or liability arising out of the usage of cover plating under the requirements of any permit or contract issued for street work and shall hold the City harmless from any liability arising out of such plate usage.

X. MEANINGS OF "SHALL", "SHOULD", AND "MAY"

In the Manual sections dealing with the design and application of traffic control devices, the words "shall", "should" and "may" are used to describe specific conditions concerning these devices. To clarify the meanings intended in this Manual by the use of these words, the following definitions apply:

Shall — denotes a mandatory condition.

Should — advisory in nature.

May — a permissive situation.

XI. TRAFFIC CONTROL DEVICES AND THEIR USES

A. General Requirements

The permit holder shall provide and maintain all signs required under the provisions of these specifications except those signs which the permit indicates will be provided and maintained by the Traffic Engineering Division of the Public Works Department. The City Traffic Engineering Division will be responsible for designating no parking areas for the purpose of expediting the flow of traffic.

Street reconstruction, excavation or maintenance work within the parking meter district which may involve the use of the metered parking stall space, will require that the meter be hooded or removed by the City Traffic Engineering Department during such work. The agency involved shall give at least 24 hours advanced notice to the City Traffic Engineer of the date, time, and meter location before work in the parking lane shall begin. Work within the traffic lanes may also require that meters be hooded to expedite traffic. The agency involved shall pay a fee for each meter that is hooded or removed. This fee includes those that are hooded for the purpose of expediting the flow of traffic. Parking meters shall not be hooded for private parking of agency personnel.

All traffic control devices used on street construction or maintenance work shall conform to the specifications of this Manual and the Manual on Uniform Traffic Control Devices or shall be as approved by the Traffic Engineer. Traffic control devices shall be set up prior to the start of construction or maintenance operations and shall be properly maintained during the time such conditions exist. They shall remain in place only as long as they are required and shall be removed when work is completed and/or roadway is safe for travel. Where operations are performed in stages, there shall be in place only those devices that apply to the condition present during the stage in progress. Signs that do not apply to existing conditions shall be removed, covered, or turned so as not to be readable by oncoming traffic. Temporary signs such as "Survey Crew" or "Flagman Ahead" shall be covered or set aside out of view of traffic at times when they do not apply.

Existing traffic signs and control devices must remain in place until construction or maintenance activities are started. Only the Traffic Engineering Division will remove and replace such signs. The Permit Holder will be responsible for costs incurred by the City due to removal or relocation of traffic control devices and any damage resulting from failure to maintain or protect such devices.

In long-term work areas, permanent pavement markings, which are inconsistent with temporary travel paths, shall be removed. For short-term operations, existing markings may be left in place, unless doing so would result in a definite hazard. Where markings inconsistent with temporary travel paths are retained, special attention should be given to highlighting the intended paths with other traffic control devices. Temporary restrictions, (two hours or less at one location) for example a traffic signal person replacing burned-out signal bulbs, shall be exempt from providing advance warning signs, lights, barricades, or cones, providing all mobile equipment shall be equipped with flashing beacons to provide warning to moving vehicles and with adequate safety provisions for the safety of the agency's crew. These flashing beacons shall be in conformance with the regulations of the State Department of Motor Vehicles.

During hours of darkness, traffic control devices must be reflectorized or illuminated as further specified in the following information regarding each of these devices. If reflectorized, all signs and barricades shall comply with the following standards:

1. The retro-reflective material used shall have a smooth, sealed outer surface that will display approximately the same color day or night.
2. Candle power in foot candles per square foot of reflective surface shall be equal to or greater than: White — 50; Orange — 25; Red - 14.
3. The reflectivity of the surface, totally wet, shall not be less than 90% of these values.

Devices that are damaged or have lost a significant amount of reflectivity or effectiveness shall be replaced.

In cases where manual control of traffic is required, a flagperson shall be utilized. If necessary, due to location or the length of the construction project, two or more flagpersons shall be utilized. (See Flagger Section, this Manual.)

B. Barricades

1. Function

The functions of barricades and channelizing devices are to warn and alert drivers of conditions created by construction or maintenance activities in or near the traveled way, and to guide and direct drivers safely through the work zone. At the same time, they should be constructed in a substantial manner to provide protection for the workers and road users. The objective should be the development of a traffic control plan which uses a variety of traffic control measures in whatever combination necessary to assure smooth, safe vehicular movement past the work area and at the same time provides maximum safety for the equipment and the workers on the job.

Barricades and channelizing devices are elements in a total system of traffic control devices for use in street construction and maintenance operations, these elements shall be preceded by a system of warning devices that are adequate in size, number and placement for the type of street on which the work is to take place.

2. Barricade Construction.

Barricades shall be one of three types: Type I, Type II, or Type III. The characteristics of these types are shown in Figure 18 and Table 1.

Barricades with stripes which begin at the upper right side and slope downward to the lower left side are to be designated as "right" (R) barricades. Barricades with stripes which begin at the upper left side and slope downward to the lower right side are to be designated as "left" (L) barricades.

Markings for barricade rails shall be alternate orange and white stripes (sloping downward at an angle of 45 degrees in the direction traffic is to pass).

Where a barricade extends entirely across a roadway, it is desirable that the stripes slope downward in the direction toward which traffic must turn in detouring. Where both right and left turns are provided for, the chevron striping may slope downward in both directions from the center of the barricade.

Barricade rails should be supported in a manner that will allow them to be seen by the motorist and provide a stable support not easily blown over by the wind or traffic. For Type I barricades, the support may include other unstriped horizontal panels necessary to provide stability. The name of the agency, contractor, or supplier shall not be shown on the face parts of any barricades. Identification markings may be shown only on the back side of barricade rails. The letters and numbers shall be non-retroreflective and not over 2 inches in height.

The entire area of orange and white shall be reflectorized with a material that has a smooth, sealed outer surface, which will display the same approximate size, shape and color day and night. The predominant color for other barricade components shall be white, except that repainted galvanized metal or aluminum components may be used. Each barricade used in the right-of-way between the hours of sunset and sunrise shall have an approved operating flasher mounted above it.

Barricades are located adjacent to traffic and therefore subject to impact by errant vehicles. Because of their vulnerable position and the possible hazard they could create, they should be constructed of light-weight materials and have no rigid stay bracing for "A" frame designs. Ballast shall not be placed on top of any striped rail. Barricades shall not be ballasted by any deformable objects such as rocks or concrete. Sand bags may be placed on the lower frame or stays to provide ballast.

TABLE 1 Barricade Characteristics Type*			
	I	II	III
Width of Rail	8" min – 12" max	8" min – 12" max	8" min – 12" max
Length of Rail	2 ft min	2 ft min	4 ft min
Width of Stripes**	6 in	6 in	6 in
Height	3 ft min	3 ft min	5 ft 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 wooden barricades nominal lumber dimensions will be satisfactory

** For rails less than 3 feet long, 4 inches wide stripes shall be used

3. Application

Type I barricades may only be used for channelizing traffic. Type II barricades are to be used for channelizing traffic and singly or in groups to mark a specific hazard. Type III barricades shall be used for all street closures (unless the closure is for two (2) hours or less).

C. Traffic Cones

Traffic cones and tubular markers of various configurations are available. These shall be a minimum of 28 inches in height with a broadened base and may be made of various materials able to withstand impact without damage to themselves or to vehicles. Orange shall be the predominant color on cones. They should be kept clean and bright for maximum target value. They shall be reflectorized and may be equipped with lighting devices for maximum visibility. Reflectorized material shall have a smooth, sealed outer surface that will display the same approximate color day and night.

Reflectorization of tubular markers shall be a minimum of two, three-inch-wide white bands placed a maximum of 2 inches from the top with a maximum of 6 inches between the bands. Reflectorization of cones shall be provided by a minimum 6-inch-wide white band placed a minimum of 3 inches but no more than 4 inches from the top with an additional 4-inch white band spaced a minimum of 2 inches below the 6-inch band.

D. Vertical Panels

Vertical panels are used to divide opposing streams of traffic, divert a traffic lane, or outline the edge of a construction hazard along the roadway where space is at a minimum. All vertical panels shall consist of a rectangle with a 8-12 inch width by 24 inch height, with the top edge 36 inches minimum above the roadway and mounted on a substantial support. (See Figure 18.) Each vertical panel used in the right-of-way between the hours of sunset and sunrise shall have an approved operating flasher mounted above it. The vertical panel

shall be reflectorized with alternate orange and white stripes 4-6 inches wide at an angle of 45 degrees with the vertical (slanting downward toward the side to which traffic is to pass). When a vertical panel is used to divide opposing streams of traffic, both sides of the marker shall be reflectorized in this manner.

E. Drums

Drums used for traffic warning or channelization shall be approximately 36" in height and a minimum of 18" in diameter. Drums shall be marked with two white and two orange reflectorized horizontal stripes. There shall not be more than a 3-inch wide non-reflectorized space between the stripes. All drums shall be plastic except those used to support signs or posts. See Fig. 19 for the standard plate for steel drums with signs. Each drum (except for steel drums with signs) used in the right-of-way between the hours of sunset and sunrise shall have an approved operating flasher mounted above it. Ballast shall not be placed on the top of a drum.

F. Signs

1. General

Street construction and maintenance signs fall into four categories: Regulatory, warning, guide and agency identification signs. Special construction and maintenance signs must follow the basic standards for design of all highway signs as specified in the Manual on Uniform Traffic Control Devices. The general requirements have outlined the signing responsibilities. The illustrations in the "typical installation" figures show the different types of signs to be used. Signs shall be reflectorized with a material that has a smooth, sealed outer surface, or illuminated.

2. Regulation Signs

Regulatory signs impose legal obligations and/or restrictions on all traffic. Regulatory signs are generally rectangular with their longer dimension vertical, and carry a black legend and border on a white background. The STOP sign is octagonal, and has a white legend and border on a red background. The YIELD sign is a white inverted triangle with red legend and border band. The DO NOT ENTER sign consists of a white square on which is inscribed a red circle with a white band horizontally across the center of the circle and the words DO NOT ENTER in white letters on the upper and lower parts of the circle. The ONE-WAY sign may be either a horizontal or vertical rectangular plate, the latter being used more commonly in cities where space is limited. Commonly used regulatory signs are illustrated in Figure 20.

3. Warning Signs

Warning signs for construction and maintenance shall be diamond shaped (square with one diagonal vertical), having a black symbol or message on an orange background except as provided for herein.

Where any part of the roadway is obstructed or closed, construction approach warning signs are required to alert traffic well in advance of these obstructions or restrictions to normal traffic flow. These signs may be used singly or in combination. Because of their importance, these signs shall have a standard size of 48 inches by 48 inches and shall be the standard diamond shape for warning signs.

Where speeds and volumes are relatively low, a minimum size of 36 inches by 36 inches may be used for construction approach warning signs, provided that a minimum letter size of 5 inches can be accommodated on this size with the appropriate legend. On limited access streets, the advance signs shall be 48 inches by 48 inches and placed on both sides of the roadway.

4. Special Signs

In some circumstances, special wording may be required. If so, such signs may be used only with the approval of the Traffic Engineer or his designated representative. Design of any special sign must conform to the principles outlined in the Manual on Uniform Traffic Control Devices.

5. Installation/Mounting Height

There are several methods of supporting signs. Existing sign posts or metal poles may be utilized providing the normal signs are not hidden or interfered with. Portable sign mounts or barricades may be used, but the bottom of the sign shall not be less than one foot above the pavement elevation. Higher mounting heights are, however, desirable. On streets where parking is allowed, the advance warning signs and stop signs shall be mounted a minimum of 7 feet above the pavement elevation. Stop signs, warning signs and their associated signs may be installed as shown in Figure 19. Advisory plates for warning signs shall be a minimum of 6' above the pavement elevation.

6. Agency Identification Sign

The typical agency identification sign is shown in Figure 28. The agency identification sign shall be used on all projects requiring four (4) or more barricades. The signs shall be mounted on drums, barricades or other approved sign mounting devices, which are not required barricades at the work site.

The agency identification sign shall be provided by the company barricading the work site.

G. Lighting Devices

Construction and maintenance activities often create conditions on or near the traveled way that are potentially hazardous at night when the ability of drivers to see is sharply reduced from daytime conditions. Lighting devices as described in the following paragraphs should be used to supplement the reflectorized signs, barriers, and channelizing devices with lighting devices as conditions warrant.

1. Barricade Warning Lights

Barricade Warning Lights are portable, lens directed, enclosed lights (minimum diameter 7 inches) emitting yellow light. They may be used in either the steady burn or flashing mode. Barricade Warning Lights shall be in accordance with the current ITE Purchase Specifications for Flashing and Steady-Burn Warning Lights, with regard to color, size of lens, flash rate, and minimum on-time.

Warning lights may be added to channelizing devices in area with frequent fog, snow, or severe roadway curvature or where visual distractions are present.

Warning lights shall flash when placed on channelizing devices used alone or in a cluster to warn of a condition. Warning lights placed on channelizing devices used in a series to channelize road users shall be steady-burn.

Type A Low Intensity Flashing Warning Lights are most commonly mounted on Type I or Type II barricades, or on vertical channelizing devices, and are intended to continually warn the drivers that they are proceeding in a hazardous area.

Type B High Intensity Flashing Warning Lights are normally mounted on the advance warning signs or on independent supports. These lights are effective in daylight as well as dark, they are designed to operate 24 hours per day.

Type C Steady Burn Lights are intended to be used to delineate the edge of the traveled way on detour curves, on lane changes, on lane closures and on similar conditions.

2. Advance Warning Flasher or Sequencing Arrow Panels

Advance warning flashing or sequencing arrow panels are intended to supplement existing traffic control devices. They provide additional advance warning and directional information to assist in diverting and controlling traffic around construction or maintenance activities being conducted on or adjacent to the traveled way.

The advance warning arrow panel may be used for day or night closures, slow moving maintenance or construction activities on the traveled way, or extremely hazardous high density and speed conditions.

Necessary signs, barricades, or other traffic control devices shall be used in conjunction with the advance warning arrow panel, except when the arrow panel is used on vehicles making only temporary stops.

Advance warning arrow panels shall meet the requirements of Table 2. Minimum legibility requirements are the distance at which the arrow panel message can be comprehended by a driver on a sunny day or a clear night.

Table 2 Advance Warning Flashing or Sequencing Arrow Panels			
Type	Minimum Size	Minimum Number of Panel Lamps	Minimum Legibility Distance
A	24" X 48"	12	½ mile
B	30" X 54"	13	¾ mile
C	48" X 96"	15	1 mile
D	48" X 24" Arrow	12	½ mile

Type A advance warning arrow panels are appropriate for use on low speed urban streets. Type B are appropriate for intermediate speed facilities and for maintenance or moving operations on high-speed roadways. Type C arrow panels are intended to be used on highspeed, high-volume construction projects. Type D arrow panels are for use on authorized vehicles.

Arrow panels shall have the capability of the following mode selection: Left Arrow, Right Arrow, Left and Right Arrow and Caution. The Caution mode consists of four or more lamps, arranged in a pattern which will not indicate a direction. A vehicle displaying an arrow panel shall be equipped with strobe or rotating lights.

Arrow panels shall be capable of minimum 50 percent dimming from rated lamp voltage. The flashing rate of the lamps shall not be less than 25 times per minute, nor more than 40 times per minute. The minimum mounting height shall be 7 feet above roadway to the bottom of the panel, except on vehicle mounted panels which should be as high as practicable. Arrow panels shall be used on all streets shown on the City of Omaha barricade/arrow panel map available from the City Traffic Engineering Division (444-4978). When arrow panels are used to close multiple lanes, a separate panel

shall be used for each closed lane.

3. Portable Changeable Message Signs

Portable Changeable Message signs should be used as a supplement to and not as a substitute for conventional signs and pavement markings. Their primary purpose is to advise of unexpected situations. Some typical applications include the following: lane or ramp closures, emergency incident management, width restriction information, speed reductions, advisories on work scheduling, road user management and diversion warning of adverse conditions and operation control.

Portable Changeable Message signs should be placed on the shoulder of the roadway or, if practical, further from the traveled lane. They should be delineated with retroreflective temporary traffic control devices or when within the clear zone, shielded with a barrier or crash cushion. When Portable Changeable Message signs are not being used, they should be removed; if not removed, they should be shielded; or if the previous two options are not feasible, they should be delineated with retroreflective temporary traffic control devices.

Portable Changeable Message sign trailers should be delineated on a permanent basis by affixing retroreflective material known as conspicuity material in a continuous line on the face of the trailer as seen by oncoming road users.

The front face of the sign should be covered with a protective material. The color of the elements should be yellow or orange on a black background.

Messages should be designed taking into account the following factors:

- a. Each phase should convey a single thought.
- b. If the message can be displayed in one phase, the top line should present the problem, the center line should present the location or distance ahead, and the bottom line should present the recommended driver action.
- c. The message should be as brief as possible
- d. When a message is longer than two phases, additional Portable Changeable Message signs should be used.
- e. When abbreviations are used, they should be easily understood (see Table 3).

The text of the message shall not scroll or travel horizontally or vertically across the face of the sign.

When Portable Changeable Message signs are used for route diversion, they should be placed far enough in advance of the diversion to allow road users ample opportunity to exit the affected highway. The Portable Changeable Message signs should be sited and aligned to ensure legibility. Multiple Portable Changeable Message signs should be placed on the same side of the roadway, separated from each other at distances based on Table 3.

Table 3 Suggested Advance Warning Sign Spacing	
	Distance Between Signs**

Road Type	A	B	C
Urban (low speed)*	100	100	200
Urban (high speed)*	350	350	300
Rural	500	500	500
Expressway/Freeway	1000	1500	2640

* Speed 45 mph and higher

**Distances are shown in feet. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The third sign is the first one in a three-sign series encountered by a driver approaching a temporary traffic control zone.)

Portable Changeable Message signs should be visible from 0.5 mile under both day and night conditions. The message should be legible from a minimum distance of 650 feet. The message panel should have adjustable display rates so that the entire message can be read at least twice at the posted speed, the off peak 85th percentile speed prior to work starting, or the anticipated operating speed.

The mounting of Portable Changeable Message signs shall be such that the bottom of the message signs panel shall be a minimum of 7 feet above the roadway when it is in the operating mode.

H. Taper Lengths

1. General

In channelization of traffic, where a reduction in pavement width is involved, tapers will be laid out in a conformance with Table 3. Channelization devices may be cones, TYPE I or II barricades, vertical panels, barrels, or combinations of the above. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit. Any deviation from the minimum taper shall require the approval of the Traffic Engineer. A shorter taper may require additional warning signs.

Table 4				
Recommended Taper Length and Device Spacing				
Approach Speed of Traffic in Miles/Hour	Minimum Taper Lengths for Lane Widths			Maximum Device Spacing in Feet
	10 FT	11 FT	12 FT	

25	105	115	125	25
30	150	165	180	30
35	205	225	245	35
40	270	295	320	40
45	450	495	540	45
50	500	550	600	50
55	550	605	660	55
60	600	660	720	60
65	650	715	780	65

*** $L = \frac{WS^2}{60}$ for S of 40 MPH or less; L = WS for S of 45 MPH or more.**

60

Taper length shown are rounded to nearest 5 feet.

2. Residential Streets

Residential Street barricading may use a "Road Work Ahead" and a "One Lane Road Ahead" sign (see Fig. 3) instead of a full channelization, unless the work site is situated in a location where the sight distance is limited. In these cases, a full barricade set-up is required.

3. Business District Streets

On streets in the Central, South Omaha, Dundee, and Benson Business Districts that are 30 mph or less, a shorter taper may be used in conjunction with the use of Type III barricades (see Figure 17). When parking is allowed, all advanced signing shall be mounted seven feet above the roadway.

Flaggers

1. General

Since flaggers are responsible for human safety and make the greatest number of public contacts of all construction personnel, it is important that qualified personnel be selected.

The use of an orange vest shall be required for flaggers. For nighttime conditions similar outside garments shall be reflectorized.

Flaggers are provided at work sites to stop traffic intermittently as necessitated by work progress or to maintain continuous traffic past a work site at reduced speeds to help protect the work crew. For both of these functions the flagger must, at all times, be clearly visible to approaching traffic for a distance sufficient to permit proper response the motorist to the flagging instructions, and to permit traffic to reduce speed before entering the work site. In positioning flaggers, consideration must be given to maintaining color contrast between flaggers protective garments and their background.

2. Hand Signaling Devices

Two hand signaling devices, red flags, and STOP/SLOW paddles are used in controlling

traffic through work areas. The sign paddle bearing the clear messages STOP or SLOW provide motorists with more positive guidance than flags and should be the primary hand signaling device.

Flags used for signaling purposes shall be a minimum of 24 by 24 inches in size, made of a good grade of RED material securely fastened to a staff approximately 3 feet in length. The free edge should be weighted to insure that the flag will hang vertically, even in heavy winds. Flag use should be limited to emergency situations and at spot locations; which can best be controlled by a single flagger.

Sign paddles shall be at least 24 inches wide, with 6-inch series C letters. A rigid handle should be provided. This combination sign may be fabricated from sheet metal or other light semi rigid material. The background of the STOP face shall be octagonal in shape, red with white letters and border. The background of the SLOW shall be diamond in shape, orange with black letters and border. When used at night the STOP face shall be reflectorized red with white reflectorized letters and border, and the SLOW face shall be reflectorized orange with black letters and border.

3. Flagging Procedures

The following methods of signaling with sign paddles should be used:

- A. To stop road users, the flagger shall face road users and aim the STOP paddle face toward road users in a stationary position with the arm extended horizontally away from the body. The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic.
- B. To direct stopped road users to proceed, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body. The flagger shall motion with the free hand for road users to proceed.
- C. To alert or slow traffic, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body.
- D. To further alert or slow traffic, the flagger holding the SLOW paddle face toward road users may motion up and down with the free hand, palm down.

The following methods of signaling with a flag shall be used:

- A. To stop road users, the flagger shall face road users and extend the flag staff horizontally across the road users' lane in a stationary position so that the full area of the flag is visibly hanging below the staff. The free arm shall be held with the palm of the hand above the shoulder level toward approaching traffic.

B. To direct stopped road users to proceed, the flagger shall stand parallel to the road user movement and with flag and arm lowered from the view of the road users, and shall motion with the free hand for road users to proceed. Flags shall not be used to signal road users to proceed.

C. To alert or slow traffic, the flagger shall face road users and slowly wave the flag in a sweeping motion of the extended arm from shoulder level to straight down without raising the arm above a horizontal position. The flagger shall keep the free hand down.

Lights approved by the Traffic Engineer or reflectorized sign paddles shall be used to flag traffic at night. Daytime flagging procedures shall be followed whenever such lights and paddles are used at night.

Whenever practicable, the flagger should advise the motorist of the reason for the delay and the approximate period that traffic will be halted. Flaggers and operators of construction machinery or trucks should be made to understand that every reasonable effort must be made to allow the driving public the right-of-way and prevent excessive delays.

4. Flagger Stations

Flagger stations shall be located far enough in advance of the workspace so that approaching road users will have sufficient distance to stop before entering the workspace.

The flagger should stand either on the shoulder adjacent to the road user being controlled or in the closed lane prior to stopping road users. A flagger should only stand in the lane being used by moving road users after road users have stopped. The flagger should be clearly visible to the first approaching road user at all times. The flagger also should be visible to other road users. At a spot constriction, the flagger may have to take a position on the shoulder opposite the closed section in order to operate effectively. The flagger should be stationed sufficiently in advance of the workers to warn them (for example, with audible warning devices such as horns, whistles, etc.) of approaching danger by out-of-control vehicles. The flagger should stand alone, never permitting a group of workers to congregate around the flagger station.

Flagger stations on major streets and where safety requires it, shall be adequately protected and preceded by proper advance warning signs. At night, flagger stations should be adequately illuminated.

XII. TYPICAL INSTALLATION

The following figures show typical street installations, type and placement of traffic controls around construction areas. The controls shown are considered minimum standards for typical construction sites. Additional devices shall be used where conditions require them for safety of workers or public. All devices used will comply with this Manual and the Manual on Uniform Traffic Control Devices for Streets and Highways, or be approved by the Traffic Engineer.

**EXCAVATION CHECKLIST
PRIOR TO START OF JOB**

1. PERMITS	All necessary permits acquired. (24 hours prior, except emergencies)
2. NOTICE TO CITY	City Traffic Engineering called and given location, time, type of work and agency name.
3. PRE-CONSTRUCTION CONFERENCE (If required)	Scheduled and completed.
4. SEARCH FOR UNDERGROUND UTILITIES	One Call System – 344-3565 called (24 hours prior) and utilities representatives met at job site and utilities marked. NOTE: Areas where signposts are to be used must be checked also.
START OF JOB	
5. ADVANCED WARNING & BARRICADES	Advanced warning signs and barricades placed and OSHA requirements reviewed.
6. AGENCY IDENTIFICATION SIGNS	Agency identification signs will be placed as shown on the following figures
7. JOB	Proceed with excavation and complete construction/repair.
8. BACKFILL (If required)	Excavation backfilled tamped and tested for compaction.
AFTER COMPETION OF JOB	
9. STREET OPENING (If required)	City Traffic engineer notified of street opening date and time (24 hours prior).
10. AREA CLEAN UP	All debris and spoil removed; all signs and barricades removed; and damaged private property repaired.

