

Traffic Control Manual for Work on Roadways

REVISED AND CONSOLIDATED, 1999



BRITISH
COLUMBIA

Ministry of Transportation
and Highways

Engineering Branch

Pursuant to the Occupational Health & Safety Regulation 296/97, traffic control procedures for all public roads in British Columbia must conform to the principles and applications as described in this manual.

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ACKNOWLEDGMENTS

This edition of THE TRAFFIC CONTROL MANUAL FOR WORK ON ROADWAYS was developed by a Committee for Traffic Control on Construction and Maintenance Projects which was organized by the British Columbia Ministry of Transportation and Highways (Highway Operations Department).

The principal purpose of the Committee was to review and update current traffic control standards on all types of projects. The review focused on activities involving short duration, long duration, and freeway conditions. The duties, responsibilities, and certification of flagpersons was also reviewed by a separate committee. The traffic control standards are organized in a way that non-Ministry organizations such as utility companies and municipalities, can readily use them.

Comments and suggestions from members of the Committee were greatly appreciated.

British Columbia Ministry of Transportation and Highways

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HOW TO USE THIS MANUAL

The Decimal Indexing System

The Traffic Control Manual for Work on Roadways (Office Edition) abbreviated to T.C.Manual (O.E.) consists of five chapters. Each chapter is divided into sections and, where necessary, into subsections. Sections and subsections are identified by a decimal numbering system; for example the notation 1.4.2 refers to Chapter 1 (General Instructions), Section 1.4 (Traffic Control [Work] Zones), Subsection 1.4.2 (Transition Area). These numbers should not be confused with the Sign Numbers which are used to identify individual signs and for sign ordering.

Each section or subsection deals with one subject (or a particular aspect of that subject) and as individual pages throughout the Manual are not numbered, location of any subject within the text depends entirely on the decimal indexing system and the numerical progression through each chapter.

Revisions and Additions

From time to time it may be necessary to add new sections and subsections or to revise some of the existing ones. By using a decimal indexing system and excluding page numbers, it will be possible to insert additional material and still maintain numerical continuity.

It is important that new or revised pages be placed in the Manual as soon as received so that they do not become lost. Out of date pages should be removed and discarded at the same time to ensure the Manual is up to date. Each side of each page has a publication date at the bottom corner. Subsequent pages will be marked similarly with the date of issue. Insertion of new or revised pages should be recorded on the second sheet following the inside title page.

Abbreviations

The following abbreviations have been used in the text:

Sign Group Reference Letters

C = Construction and Maintenance	R = Regulatory
TW = Temporary Warning	W = Warning

Sign Shapes

Diam. = Diamond	Oct. = Octagonal	Rect. = Rectangular
Sq. = Square	Tri. = Triangular	Par. = Parallelogram

Sign Colours

B = Black	G = Green	Or. = Orange
R = Red	W = White	Y = Yellow
Bl. = Blue		

Miscellaneous

Bgd. = Background

FAB = Flashing Arrow Board

Fl. = Fully

HLWD = High Level Warning Device

(Suffix) L = Left

Mess. = Message

Refl. = Reflectorized

(Suffix) R = Right

Sy. = Symbol

TCP = Traffic Control Person

(Suffix) T = Tab Sign

MUTCDC = Manual of Uniform Traffic Control Devices for Canada

TDP = Temporary Delineator Posts

T.C. Manual = Traffic Control Manual for Work on Roadways

TRAFFIC CONTROL MANUAL

FOR WORK ON ROADWAYS (OFFICE EDITION)

(Abbreviated to T.C. Manual)

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CHAPTER 1

GENERAL INSTRUCTIONS

1.1 GENERAL

Traffic control is required when traffic must be moved through or around highway or street construction, maintenance operations or utility work on or adjacent to a roadway. **The traffic control described and illustrated herein is generally the minimum required.** No one standard sequence of signs or other control devices can be set up as an inflexible arrangement for all conditions and locations, due to the variety of conditions encountered. It should also be recognized that while the Traffic Control (T.C.) Manual for Work on Roadways contains mandatory language such as “shall” there may be circumstances where strict compliance with such requirements is not reasonable and it will be necessary to deviate from the requirements.

Throughout this Manual, the term “work zone” , as also defined in Subsection 1.1.2, means an area in which construction, maintenance or utility activities take place, on or adjacent to a roadway, to the extent that the passage of public traffic may be influenced. Where cyclists and/or pedestrians are likely to be present in work zones, due consideration must also be given to their safety requirements.

This T.C. Manual sets forth basic principles and prescribes standards for the design, application, installation and maintenance of the various types of traffic control through work zones. These include signs, signals, lighting devices, markings, barricades, channelization, and hand signaling devices. Minimum standards of application are prescribed for typical situations and for methods of controlling traffic through work zones. A number of typical situations are illustrated to show the recommended application of standard protective devices for pre-planned, scheduled, work on roads and streets in British Columbia.

It is understood that in emergency situations it may not be possible to meet these minimum standards.

1.1.1 FUNDAMENTAL PRINCIPLES

All traffic control devices used in work zones should closely conform to the applicable specifications of this T.C. Manual.

Work zones can present motorists, cyclists and pedestrians with unexpected or unusual situations as far as traffic operations are concerned. Because of this, special care should be taken in applying traffic control techniques.

Principles and procedures which experience has shown to enhance the safety of road users and workers in the vicinity of work areas include the following:

- .1 Traffic safety in construction zones is an integral and high priority element of every project from planning through design and construction. Similarly, maintenance and utility work should be planned and conducted with the safety of road users and workers kept in mind at all times.

1.1.1 FUNDAMENTAL PRINCIPLES *(continued)*

- a. The basic safety principles governing the use of permanent traffic control on undisturbed roadways and roadsides should also govern the design of traffic control in work zones. The goal should be to route traffic through such zones with traffic control devices as nearly as possible comparable to those for normal situations.
- b. A traffic control plan in detail appropriate to the complexity of the project, should be prepared and understood by all responsible parties before work begins. Any changes in the agreed traffic control plan should be pre-approved by the road authority before implementation.
- .2 Traffic movement should be inhibited as little as possible.
 - a. The traffic control plans for work zones should be designed on the assumption that motorists will only reduce speed if they clearly perceive a need to do so. Reduced speed zones should only be used where a clearly demonstrated need exists.
 - b. Any changes in traffic pattern, such as lane narrowings, dropped lanes or other main roadway transitions requiring rapid maneuvers, should be avoided.
 - c. Where emergency vehicles will pass through a work zone it may be necessary to make special provision for such vehicles especially on high speed or high volume roadways.
 - d. Construction time should be minimized to reduce exposure to potential hazards.
- .3 Motorists should be guided in a clear and positive manner while approaching and traversing work zones.
 - a. Adequate warning, delineation and channelization by means of proper pavement marking, signing and use of other devices which are effective under varying conditions of light and weather should be provided to assure motorists of positive guidance in advance of and through work zones.
 - b. Inappropriate pavement markings should be removed for long duration work to eliminate any misleading cues to drivers in all conditions of light and weather. On short term maintenance projects, however, it may be determined that such removal is more hazardous than leaving the existing markings in place. If so, special attention must be paid to providing additional guidance by other traffic control measures.
 - c. Traffic control persons (TCPs), when used, can provide positive guidance to motorists traversing work zones. TCPs must be employed when all other methods of controlling traffic are considered inadequate to warn, direct and regulate drivers.
- .4 To ensure acceptable levels of operation, routine inspection of traffic control devices should be performed.

1.1.1 FUNDAMENTAL PRINCIPLES (continued)

- a. Individuals who are trained in the principles of traffic control should be assigned responsibility for safety at work sites. The most important duty of these individuals is to ensure that all traffic control devices are in conformity with the traffic control plan and are effective in providing safe conditions for motorists, pedestrians, cyclists and workers.
 - b. From time to time, modification of traffic controls may be required in order to expedite traffic movement and to ensure safety. It is essential that the individual responsible for traffic control also has the authority to control the progress of work on the project in its relation to maintaining safe conditions, including the authority to modify controls or halt work until remedial safety measures are taken.
 - c. Work sites should be carefully monitored under varying conditions of traffic volume, light and weather to ensure that traffic control measures are operating effectively and that all devices used are appropriate, clearly visible, clean and in good repair.
 - d. When activity in a work zone ceases, for whatever reason or duration, it is very important that adequate traffic control is maintained to guide, warn and regulate public traffic through any hazards or unusual traffic patterns; keeping in mind the most adverse conditions that could reasonably be expected to occur, prior to the recommencement of work.
 - e. When warranted, an engineering analysis should be made of all accidents occurring within work zones. Work zones should be monitored to identify and analyze traffic accidents or conflicts. As examples, skid marks or damaged traffic control devices may indicate needed changes in the traffic control.
 - f. Work zone accident records should be analyzed periodically to guide officials in improving work zone operations.
 - g. **When no longer needed, traffic control devices must be removed or covered.**
- .5 The maintenance of roadside safety requires constant attention during the life of the work zone because of the potential increase in hazards.
- a. To accommodate errant and disabled vehicles, it is desirable to provide an unencumbered roadside recovery area that is as wide as practicable.
 - b. Channelization of traffic should be accomplished by the use of pavement markings and signing, flexible posts or drums, delineators, cones, barricades and other lightweight devices which will yield if hit by errant vehicles.
 - c. Whenever practicable, construction equipment and materials should be stored clear of the travelled roadway. If this is not possible, such obstructions should be clearly marked and the path around them delineated.

1.1.2 DEFINITIONS

Buffer Vehicle

A vehicle positioned in advance of an active stationary or moving work site to protect workers from errant vehicles (such vehicles shall display either a FAB or 360° light and 4-way flashers).

Construction Speed Zone

A lowered legal speed zone, normally through a long duration work zone, as authorized by the road authority.

Continuous Slow Moving Work

Work which is continuously moving such that the use of regular traffic control procedures is impracticable (e.g., grading, striping, hydroseeding, mowing, brushing, flushing, sweeping, spraying for dust control etc.).

Detour Route

A route which takes traffic off the regular route and, using existing or newly made temporary roadways, guides traffic around a work zone. The detour route must be clearly identified by appropriate detour signs. (Prior to the closing of a roadway and the opening of a detour, it is desirable to erect "Closing Notice" signs at strategically selected locations at least one week in advance of the actual closing.)

Downstream Direction

The direction towards which traffic flows.

Emergency and Brief Duration Work

Work, generally of an unprogrammed emergency nature, requiring very little time, usually less than 15 minutes (e.g. unblocking catch basins, removal of fallen tree limbs, water valve operation, cleanup of material spills, filling isolated potholes, etc.)

Freeway

A public highway with a continuous nontraversable dividing median, grade separated interchanges and typically with a posted speed limit of 80 km/h or greater.

Highway

A roadway or roadways, typically in a higher speed zone, carrying inter-regional vehicular traffic.

Intermittent Moving Work

A maintenance activity which involves a work zone that changes frequently (e.g. some mowing operations) or involves frequent stops not exceeding 30 minutes duration (e.g. temporary patching, group relamping of street lights, Benkleman beam testing, crack sealing, etc.)

Long Duration Work

Programmed construction, maintenance and utility activities which require a separate work area for more than one daytime shift. Thus most work at night should, therefore, be considered long duration.

1.1.2 DEFINITIONS (continued)

Low Volume/High Volume Roadway

A low volume roadway is one which carries less than 1,000 vehicles per day. A high volume roadway thus carries 1,000 or more vehicles per day. (For a two-way roadway, the applicable volume is the daily total carried in both directions.) Traffic volumes can be obtained from the local road authority.

Line-type Vehicles

A truck with a large cable spool mounted on the rear of the vehicle, typically used by power and telephone companies when for installing new power or communications lines.

Ministry

Means the Ministry of Transportation and Highways

Multilane Roadway

A roadway with two or more lanes in at least one direction including climbing and passing lanes.

Temporary Lane Control Signal

An electrical device, with one traffic signal head per direction, which may be used as an alternative to TCPs in short duration work for controlling a temporary one-way traffic section on a normally two-way roadway.

Roadside Diversion

A deviation from the normal roadway where work closes a section of a road and a short detour, usually within the right-of-way, is required to bypass the work area.

Roadway

The portion of a street or highway that is ordinarily used for vehicular traffic, but, does not include the shoulder; and where a highway includes two separate roadways, the term “roadway” refers to any one roadway separately and not to both of them collectively.

Shadow Vehicle

A vehicle used mainly in continuous slow moving operations, as a mobile advance warning and sign support. (Such a vehicle will normally travel as far over on the shoulder as possible, i.e. shadow vehicles do not block travelled lanes as do buffer vehicles.)

Short Duration Work

Programmed work which requires a separate work area for not more than one daytime shift.

Street

A public road used for the movement of vehicles in a local area.

Tangent Distance

The distance between the end of one taper and the beginning of the next taper for the same direction of travel.

1.1.2 DEFINITIONS (continued)**Taper and Taper Length (Lane or Shoulder Closure)**

The gradual narrowing of a lane or shoulder using successive cones or markers to safely guide drivers into the next lane. Taper length is the distance along a section of roadway required to achieve full closure of one lane or shoulder.

Temporary Speed Zone

A lowered legal speed zone imposed at the discretion of a supervisor with C-1 or C-2 signs in a short duration work zone.

Temporary Traffic Control Signal

A signal used (a) to control traffic at an intersection with a temporary roadway, truck access route and pedestrian crossing, etc., or (b) to assign right-of-way on long duration work (such as bridge resurfacing), in place of TCPs or a portable lane control signal, where traffic moving in both directions must use a single lane on a normally two-way roadway. (The design specifications for temporary signals require prior approval by the appropriate road authority).

Traffic Control Person (TCP)

A person trained to conduct traffic through a work zone; having in mind both the safety of workers and public traffic.

Two Lane Two-Way Roadway

A two-way roadway with one through lane per direction.

Upstream Direction

The direction from which traffic flows.

Work Zone

An area in which surveying, construction, maintenance or utility activities take place, on or adjacent to a roadway, to the extent that the passage of public traffic may be influenced.

1.1.3 DRIVER INFORMATION NEEDS IN WORK ZONES

The usefulness of traffic control devices intended to assist motorists in guidance and navigation tasks depends on whether the devices satisfy a driver's need for information. Both the message content and the placement of the traffic control devices must be carefully considered.

Inappropriate or unclear messages and/or incorrect placement of signs, markings, and other traffic control devices can mislead and confuse the motorist.

In work zones there are usually three types of traffic control device message content. These are the warning of potential hazards, posting of applicable regulations such as maximum speeds, and the delineation of traffic paths.

Positive guidance principles should be considered when determining which traffic control devices will be used and where they will be located.

1.1.3 DRIVER INFORMATION NEEDS IN WORK ZONES *(continued)*

The more serious instances of driver misunderstanding and non-compliance result from:

- providing contradictory or misleading information;
- presenting a sign with inaccurate distance information; and
- using nonstandard messages or using inappropriate standard signs.

1.1.4 TRAINING

Personnel whose actions affect work zone safety should receive training appropriate to the job decisions those individuals are required to make. Only those individuals who are qualified in safe traffic control practices and have a basic understanding of the principles established by applicable standards and Regulations, should supervise the selection, placement and maintenance of traffic control devices in work zones.

1.1.5 SUMMARY

The following list of items can be used for the general guidance of those involved with work zone traffic control activities:

- Retain the motorist's respect and the agency's credibility by not providing misinformation.
- When work is not in progress or devices are no longer needed, remove or cover them.
- Do not assume that drivers, cyclists and pedestrians will see or recognize the workers or hazards in a work zone. Remember that the visibility of hazards/workers can be greatly diminished in darkness and/or poor weather conditions.
- Maintain the controls as if every driver were approaching the area for the first time and in less than ideal conditions.
- The philosophy of good work zone traffic control must be understood by field personnel so they can perform their work with a minimum of exposure to traffic, be on the lookout for problems and be capable of replacing or reporting any damaged or missing devices.

1.2 APPLICATION OF TRAFFIC CONTROL

1.2.1 AUTHORITY

The authority for the placement of traffic control devices on all streets and highways in British Columbia is contained in various Provincial acts and municipal bylaws.

No work should commence on a public roadway without first obtaining a work permit providing approval by the road authority concerned. Road authorities generally grant continuing permits for specific routine and emergency operations such as those conducted by utility companies.

1.2.2 JURISDICTION

Jurisdiction for traffic control is as follows:

- for municipal streets, the municipality having jurisdiction over the area;
- for Provincial highways, and roads in unorganized areas, the Ministry of Transportation and Highways

Workers Compensation Board Industrial Health and Safety Regulations require that adequate precautions are taken to protect workers from hazards to which they may be exposed. The regulations require protective clothing, equipment, devices and work procedures that protect workers from hazards caused by public and construction traffic.

1.2.3 RESPONSIBILITY

It is important that the road authorities having jurisdiction require proper traffic control, that responsibility be clearly assigned, adequate training of personnel be provided, and that there be adherence to the principles and applications provided in this T.C. Manual.

1.2.3.1 Responsibility of Management

It is the responsibility of management to ensure that all crew and supervisors are thoroughly trained and familiar with applicable safe working practices, and that they take immediate and decisive action when safe and approved work methods are not followed.

1.2.3.2 Responsibility of the Crew Supervisors

It is the responsibility of the crew supervisors to ensure that each member of the crew wears the required personal safety clothing when working on or crossing the highway. It is also the crew supervisor's responsibility to ensure that the work area is protected by the use of the various signs, cones, flashing lights, TCPs, etc., generally as outlined in this Manual.

1.2.4 TRAFFIC CONTROL PLAN

Planning for traffic control in work zones is very important. Traffic control plans should be formulated by qualified personnel and the plans should be reviewed as work progresses. The principles of pre-planning and review should always apply, regardless of the project size.

The traffic control plan may range in scope from a reference to standard plans, a section of this Manual, or to a very detailed design solely for a specific project. The needed detail in the plan depends on the complexity of the work and on the conflicts between traffic and the work. The plan should include such items as provision for adequate separation of public traffic and work areas, the limitation of work periods (where necessary) and for lane closures based on careful consideration of anticipated traffic volumes and minimum exposure of workers.

The plan for traffic control should also include, but not be limited to, such items as signing, application and/or removal of pavement markings, roadway lighting, methods and devices for delineation, channelization and placement and maintenance of all devices.

1.2.5 ENGINEERING STUDY REQUIRED FOR COMPLEX SITUATIONS

The decision to use a particular device or devices at a particular location should be made on the basis of a study of the location. Thus, while this Manual provides standards for design and application of traffic control devices, it is not a substitute for engineering judgment. It is the intent that the provisions of this Manual be minimum recommended standards for traffic control. They are, however, recommendations but not legal requirements.

For complex projects, supervisors are required to exercise judgment in the selection of traffic control devices, just as they do in designing the roads and streets which the devices complement. Jurisdictions with responsibility for traffic control, that do not have qualified engineering staff, should seek assistance from a qualified traffic engineering consultant.

1.2.6 APPLICATION OF STANDARDS

The provisions for vehicular, pedestrian, cyclist and worker protection established herein are for application by:

1. The Provincial and Municipal road authorities in British Columbia and their contractors.
2. Public utilities and their contractors and others who have approval to work on or adjacent to public roadways.

The standards in this Manual should be adopted by all road authorities and utility companies concerned with street and highway work, and should be given effect by official instructions to employees and by incorporation into the specifications for all roadwork contracts.

1.2.6 APPLICATION OF STANDARDS *(continued)*

The general principles outlined in this Manual are applicable to both rural and urban areas. Since it is not practical to prescribe detailed standards of application for all the situations that may 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 exist. The protection prescribed for each situation is based on the speed and volume of traffic, the duration of operations and the public exposure to hazards.

Traffic conditions on urban streets are characterized by lower speeds, a wide range of traffic volumes, limited maneuvering space, frequent turns and cross movements, 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 surfacing, pavement marking renewal and encroachments by adjacent building construction. Work on high volume, urban streets should be restricted to off peak hours to minimize conflicts with traffic.

On rural highways traffic conditions are also characterized by a wide range of volumes and higher speeds but less interference from pedestrians, turns and encroachments.

Freeways and other multilane highways present traffic control problems requiring special attention. Both high speeds and high volumes may be anticipated. Any work carried out in daylight may have to be limited to relatively short periods when volumes in the off-peak direction are sufficiently light.

The difficulties associated with the completion of work on lanes carrying high volumes of traffic may make it necessary, in some instances, to schedule construction and/or maintenance operations at night. While night scheduling avoids peak flows, the problems associated with the need for greater visibility of work site delineation and warning devices are increased.

For situations not specifically illustrated in this Manual, traffic control procedures must be established by appropriate modification of existing examples and/or application of the general control principles set out herein.

1.3 TRAFFIC CONTROL DEVICES

1.3.1 FUNCTION

The function of traffic control devices is to ensure roadway safety by providing for the orderly and safe movement of vehicles and pedestrians, throughout the public road system and to provide such guidance, regulation and warning as needed to ensure the safe passage of all the individual elements of the traffic stream.

For vehicle operators, traffic control devices are provided to assist in the guidance and navigation tasks required to safely traverse any facility open to public travel.

1.3.2 REQUIREMENTS IN WORK ZONES

This Manual sets forth the basic principles and warrants for the design and use of traffic control devices in work zones. These principles and warrants appear throughout the text relating to the specific devices or groups of devices. It is important that principles and warrants be given primary consideration in the selection and application of each device.

The Manual details traffic control device standards for work zones on all streets and highways open to public travel; regardless of the type of roadway or the authority having jurisdiction. Where a device is intended only for limited application, or for a specific situation, the text specifies the restrictions imposed on its use.

To be effective, all traffic control devices must meet five basic requirements. These are to:

- Fulfill a need.
- Command attention.
- Convey a clear, simple meaning.
- Provide adequate time for a proper response.
- Command respect of road users.

Uniformity of meaning is vital to effective traffic control devices.

Five basic considerations are employed to ensure that these requirements are met. They are: design, placement, application, maintenance and uniformity.

The placement, size and sign messages should be such that attention is drawn to them, that they are legible, their meaning is clear, the regulation is reasonable and there is adequate time for response. In situations where messages are required other than those herein provided for, the signs should have the same shape, colour, dimensions and illumination or reflectorization as signs of the same classification. Symbols, wording and lettering should conform as closely as possible to signs of the same type.

1.3.2 REQUIREMENTS IN WORK ZONES *(continued)*

Consistent application should ensure that appropriate devices are installed in a standard fashion to meet the traffic control requirements at any given location. Furthermore, devices must be placed in a uniform and consistent manner to ensure that vehicle operators can be expected to respond properly to the devices based on their previous exposure to similar traffic control situations.

Maintenance of devices should be to a high standard to ensure that legibility is retained, that the devices are visible and that they are only in place when needed. Clean, legible and properly mounted devices, in good condition, command the respect of vehicle operators, cyclists and pedestrians. In addition to physical maintenance, functional maintenance is required to adjust needed traffic control devices to current conditions and to remove any which are unnecessary. The fact that a device is in good physical condition should not be a basis for retaining it if the message is inappropriate. Furthermore, carelessly executed functional maintenance can destroy the value of a group of devices by throwing them out of balance. For example, replacement of a sign in a group or series by one that is disproportionately larger or smaller.

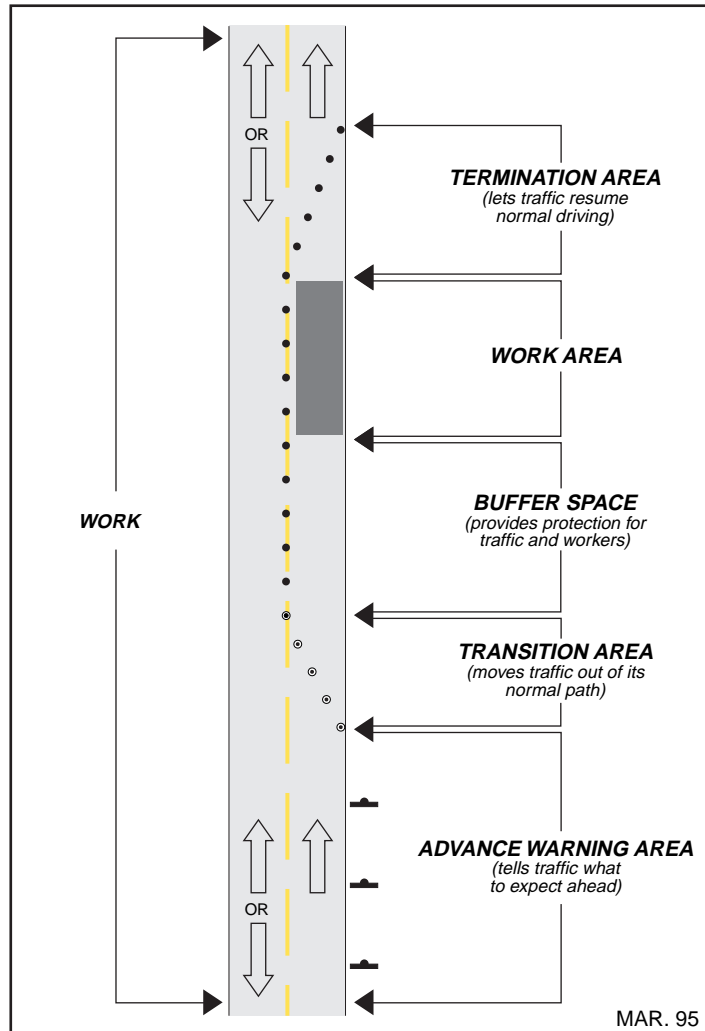
Uniformity in the design of traffic control devices simplifies the task of the road user because it aids in recognition and understanding. It also provides economy in manufacture.

Simply stated, uniformity means always treating similar situations in the same way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a nonstandard device; in fact, this may be worse, in that such misuse may result in public disregard for the device at other locations where it is needed.

The actions required of drivers, cyclists and pedestrians by regulatory devices must be specified by Provincial statute, and/or municipal by-law.

1.4 TRAFFIC CONTROL (WORK) ZONES

Figure 1.4 Elements of a Traffic Control Work Zone



When traffic is affected by construction, maintenance, utility, or similar operations, traffic control is needed to safely guide and protect road users, and workers in a work zone. The work zone is the area between the first advance warning sign and a point beyond the work where traffic is no longer affected.

Most work zones can be divided into the following parts, as illustrated above:

- Advance Warning Area.
- Transition Area.
- Buffer Space.
- Work Area.
- Termination Area.

If no lane or shoulder closure is involved, the transition area will not be used. In this section, each of the “Parts” will be examined for one direction of travel. If the work activity affects more than one direction of travel, the same principles apply to traffic in both directions.

1.4.1 ADVANCE WARNING AREA

An advance warning area is necessary for all traffic control zones because drivers need to know what to expect ahead. Before reaching the work area, drivers should have enough time to adjust their driving patterns. The advance warning area may vary from a series of signs, starting 2 km in advance of the work area, to a single sign or flashing lights on a vehicle.

Advance warning signs are not needed when the work area, including access to the work area, is entirely off the roadway and shoulder and the work does not interfere with traffic. An advance warning sign or signs should be used when any problems or conflicts with the flow of traffic might possibly occur.

Length of the Advance Warning Area

The advance warning area, from the first sign to the start of the next area, should be long enough to give the motorists adequate time to respond to the conditions.

In Chapters 3, 4 and 5, Tables A and B and the typical sign layouts indicate recommended sign locations.

1.4.2 TRANSITION AREA (AND TAPERS)

When work is performed within one or more travelled lanes, a lane closure(s) is required. In the transition area, traffic is channelized from its normal highway lane(s) to another path in order to move traffic around the work area. The transition area contains the tapers which are used to close lanes.

The transition area should be made obvious to drivers. The correct path should be clearly identified with pavement markings and/or channelizing devices so drivers will not attempt to follow the old path. Where practical, for long duration work zones, existing pavement markings should be removed when they conflict with the transition and new markings should be added. Pavement marking arrows are also useful in transition areas.

With moving operations, the transition area moves with the work area. A shadow vehicle may be used to warn traffic and/or guide it into the proper lane. Refer to the section 2.2.4, Shadow Vehicles, for additional guidance.

Tapers

A taper is identified by a series of channelizing devices and possibly pavement markings placed on an angle to the normal travel path to move traffic out of its normal path.

Four types of tapers used in traffic control zones are:

- Lane closure tapers are those necessary for closing lanes of moving traffic on a one-way roadway (sometimes referred to as channelizing tapers).

1.4.2 TRANSITION AREAS AND TAPERS (continued)

- Two-way traffic tapers are those needed to control two-way traffic where traffic is required to alternately use a single lane when a traffic signal, lane control signal or traffic control persons are present.
- Shoulder closure tapers are those needed to close shoulder areas.
- Downstream tapers are those installed to direct traffic back into its normal path.

Lane Closure Taper (One-way Roadway)

The length of a taper used to close a lane is determined by the speed of traffic and the width of the lane to be closed (the lateral distance that traffic is shifted). The taper lengths shown in line 1a* of Table A and line 1 of Table B are for normal lane widths. For greater lane widths use the taper ratios shown on the same lines. **If restricted sight distance is a problem (e.g., a sharp vertical or horizontal curve), the taper should begin well in advance of the sight restriction. The beginning of a taper should not be hidden downstream of curves.**

Generally, tapers should be lengthened, not shortened, to increase their effectiveness. Traffic should be observed to see if the taper is working correctly. Frequent use of brakes and evidence of skid marks is an indication that either the taper is too short or the advance warning is inadequate.

Merging of two lanes of traffic into one lane where the combined volume exceeds 1,200 to 1,500 vehicles per hour will cause extensive delays.

Two-Way Traffic Taper (Single lane open)

The two-way traffic taper is used in advance of a work area that occupies part of a two-way road in such a way that the remainder of the road is used alternately by traffic in either direction. In this situation, the function of the taper is not to cause traffic to merge, but, rather to resolve the potential head on conflict. A short taper is used to cause traffic to slow down by giving the appearance of restricted alignment. Drivers then have time at reduced speed to decide whether to proceed cautiously past the work area or to wait for opposing traffic to clear. One or more traffic control persons, a temporary traffic signal or temporary lane control signal are usually employed to assign the right-of-way in such situations.

Two-way traffic tapers should be 5 m to 15 m long, with not less than three devices used to provide clear delineation of the taper. Flashing arrow boards (in the arrow mode) should never be used with a two-way traffic taper.

1.4.2 TRANSITION AREA (AND TAPERS) (continued)**Shoulder Closure Taper**

When an improved shoulder is closed adjacent to a high speed roadway, it should be treated as a closure of a portion of the travelled roadway because motorists expect to be able to use the shoulder in the event of an emergency. The work area on the shoulder should be preceded by a taper that may be as short as for a two-way traffic taper, and if the shoulder is being used as a travel lane, either through practice or due to construction, a full lane closure taper should be placed on the shoulder.

Downstream Taper

A downstream taper is used at the far end of the work area to indicate to drivers that they can move back into the lane that was closed. It is placed in the termination area. While downstream tapers are optional, they may be useful in smoothing traffic flow. They may not be advisable when work vehicles move into or leave the work area from the downstream end.

1.4.3 BUFFER SPACE

The buffer space is the open or unoccupied space between the transition and work areas. Where space permits and it is considered desirable, a buffer zone should be included even though it may not be indicated on the typical sign layout or the traffic control plan. With a moving operation, the buffer space is the space between the shadow vehicle, if one is used, and the work vehicle.

The buffer space provides a margin of safety for both traffic and workers. If a driver does not see the advance warning or fails to negotiate the transition, a buffer space provides room to stop before the work area. It is important for the buffer space to be free of equipment, workers, materials and workers' vehicles. The only exception to the above would be if a buffer vehicle is required. In such a case, the vehicle would be parked upstream of the work zone.

When designing or setting out a traffic control plan, the following guidelines should be considered for buffer spaces:

- Place channelizing devices along the edge of the buffer space.
- Situations occur where opposing streams of traffic are moved over so one lane of traffic uses a lane that normally flows in the opposite direction. In these situations, a buffer space should be used to separate the two tapers for opposing directions of traffic because it could help prevent head on collisions.

1.4.4 WORK AREA

The work area is that portion of the roadway which contains the work activity and is closed to traffic and set aside for exclusive occupation by workers, equipment and construction materials. Work areas may remain in fixed locations or may move as work progresses. An empty buffer space may be included at the upstream end. The work area is usually delineated by barricades or other channelizing devices to exclude public traffic.

1.4.4 WORK AREA (continued)

Conflicts and Potential Hazards

Conflicts between traffic and the work activity are potential hazards. These increase as:

- The work area is closer to the travelled lanes.
- Physical deterrents to normal operation exist; such as uneven pavements, vehicles loading or unloading.
- Speed and volume of traffic increase.
- The change in travel path gets more complex, for example, by shifting traffic across the median and into lanes normally used by opposing traffic as compared to moving it over a short distance.

Work areas that remain overnight have a greater need for delineation than day time operations.

Every reasonable effort should be made to minimize conflicts. Some suggestions include:

- Use traffic control devices to make the travel path clearly visible to traffic.
- Place channelizing devices between the work area and the travelled way. Devices placed on a tangent (along the work area) to keep traffic out of a closed lane should be spaced in accordance with the extent and type of activity, the speed limit of the roadway, and the vertical and horizontal alignment such that it is apparent that the lane is closed. For low speed or urban streets, closer spacing may be required.
- Provide a safe entrance and exit for work vehicles.
- Protect moving operations with adequate advance warning of the work and/or shadow vehicles.

1.4.5 TERMINATION AREA

The termination area provides a short distance for traffic to clear the work area and to return to the normal traffic lane or lanes. It extends from the downstream end of the work area and may include a short downstream taper.

There are occasions where the termination area could include a transition. For example, if a taper is used to shift traffic into an opposing lane of a multilane roadway, then the termination area should have a taper to shift traffic back to its normal path. This taper would then be in the transition area for the opposing direction of traffic. It is advisable to use a buffer space between the tapers for opposing traffic.

Avoid “gaps” in the traffic control that may falsely indicate to drivers that they have passed through the entire work zone. For example, if the work area includes intermittent activity throughout a 2 km section, the drivers should be reminded periodically that they are still in work zone.

1.4.6 LOWER SPEED ZONES IN WORK AREAS

Where it is felt that warning signs and other devices do not adequately provide for the safety of workers and the public it may be necessary to establish a speed zone of one of the following two types. Figures 3.8.2 and 4.1.1 illustrate use of the two types of lower speed limits typically used in work areas.

1.4.6.1 Construction Speed Zones

A Construction Speed Zone requires the approval of the road authority. For roads under the jurisdiction of the Ministry of Transportation and Highways the District Highways Manager is the approving official.

The beginning of a construction speed zone is marked with R-3 and R-4 signs together with C-22 tabs. The end is marked with an R-4 sign showing the normal speed limit.

Construction Speed Zones which are unnecessarily restrictive in any way must be avoided if good driver observance of this control measure is to be maintained. Unnecessarily restrictive features are: excessive length of zone, excessive hours during which the zone is in effect, and too low a specified speed. A construction speed zone may be required either 24 hours a day, or only while work is in progress, or only when work is not in progress. An example of where it may only be required when work is not in progress would be a site controlled during construction hours by TCPs or pilot cars.

When imposition of a Construction Speed Zone for a long duration or freeway work zone would result in a reduction of 40, 50 or 60 km/h below the normal speed limit, installation of a transition or buffer speed zone, generally a minimum of 500 m in length, should also be considered. For a drop of 40 or 50 km/h, the buffer should be 20 km/h above the Construction Speed Zone limit and for a drop of 60 km/h, the buffer should be 30 km/h above the Construction Speed Zone limit. This will ensure that the normal speed limit is not reduced in decrements exceeding 30 km/h.

1.4.6.2 Temporary Speed Zones

A Temporary Speed Zone is established with C-1 or C-2 signs and requires the approval of a crew supervisor. Survey crews should use the C-2 Survey Crew Maximum 30/50 km/h signs rather than C-1 Crew Working Maximum 30/50 km/h signs. A temporary speed zone is terminated with a C-23 sign.

Temporary Speed Zones should be used as sparingly as possible in order to preserve driver respect for this form of speed control, and must be removed when no longer required.

1.5 INSTALLATION, MAINTENANCE AND INSPECTION OF TRAFFIC CONTROL

Before the scheduled commencement date for work, designated representatives of the road authority and as applicable, the contractor and/or the utility should check the availability of all signs, pavement marking material and channelizing devices that are to be used. All devices should be:

- Standard in size, shape, colour and message.
- Clean and in good condition.
- Reflectorized for night use.

If a particular device does not meet all of the above requirements it should be replaced with one that does. Additional devices should be available to replace any that may be damaged while the work is in progress. On construction, the designated representatives of the road authority and, as applicable, the contractor and/or utility should be in agreement that all devices are satisfactory before they are placed on the roadway.

Reflectorized devices need extra care when handling and transporting to ensure that the reflectorizing elements are not damaged.

Signs in place that do not apply during construction, maintenance, or utility work, should be removed or have the faces completely covered with opaque materials. At night, non-opaque materials let the messages be seen because headlights reflect the messages through such materials.

Signs that are installed before traffic patterns are changed should be covered until required.

As many maintenance, utility, and emergency operations require the same devices for each job, vehicles should be equipped with an adequate supply of commonly used portable devices.

1.5.1 INSTALLATION AND REMOVAL OF DEVICES

Order of Installation

Traffic control devices should be placed in the order that drivers will encounter them, starting with the sign or device farthest upstream from the work area and the others successively as the work area is approached. If traffic in both directions will be affected, such as with work in the centre lane of a multilane roadway, the devices can be placed in both directions at the same time, starting at each end farthest from the work.

1.5.1 INSTALLATION AND REMOVAL OF DEVICES *(continued)*

On multilane roadways, as shown in figure 4.3.4 for example, traffic travelling in, say, direction “A” may have to be moved around a work area by crossing the median into the left lane normally available only to traffic travelling in the opposing “B” direction. Where this has to be done, it is essential that control devices be installed first to ensure that the “B” traffic is confined to its right lane before traffic in the “A” direction is moved over the median.

When signs or channelizing devices are to be installed and removed several times during the work operation, spots can be painted to mark device locations, so that the installation can be repeated quickly and with proper placement assured. The devices should be stored off the roadway, out of sight, or transported to another location when not required.

Motorists do not expect to encounter workers in the roadway setting up a traffic control zone. Since the goal is to make the entire operation safe, high level warning devices, traffic control persons, or flashing vehicle lights should be used to warn the drivers of the presence of workers. Flashing arrow boards are valuable to assist the workers during placement or removal of channelizing devices for lane closures.

Order of Removal

As soon as the work is completed and traffic control devices are no longer needed, they should be removed. Any cones and channelizing devices on the travelled roadway should be removed first, followed by the signs. Flashing arrow boards, high level warning devices, traffic control persons and/or flashing vehicle lights should be used in the removal process. No workers shall ride on the rear outside of a vehicle while it is reversing.

On low volume roadways, devices should be removed in the opposite order of installation by first removing those closest to the work area and continuing progressively upstream away from the area.

On high volume roadways, devices may be removed as for low volume or they may be removed with the flow of traffic provided there is a buffer vehicle, which may be equipped with a rear-mounted impact attenuator.

Pavement Marking Removal

Motorists use pavement markings as a primary source of guidance. Temporary pavement markings, using preformed adhesive-backed traffic tape or raised pavement markers can be used with channelizing devices to provide guidance in work zones. Any pavement markings that are not applicable, and which may confuse drivers, should be removed as soon as practicable for long duration work.

Typical methods of removal include grinding, burning, chemical treatment, sandblasting, shot blasting and high pressure water jetting. Painting over inappropriate markings with black paint or bituminous material has proved unsatisfactory as the original lines eventually reappear when overlying material wears away under traffic. In addition, lines which are covered in this way are still visible under certain conditions (low angles of illumination or in wet weather).

1.5.2 INSPECTION AND MAINTENANCE OF TRAFFIC CONTROL

The requirements of this section are intended to be comprehensive enough to cover most traffic control situations but not all requirements will necessarily apply to every operation; particularly to some short duration, emergency or brief duration work which requires minimal use of traffic control devices.

On road construction projects, maintenance of traffic control is generally the responsibility of the contractor.

Once the work zone is installed, it is important to ensure that it functions as intended and that any subsequent modifications resulting from an inspection process, are implemented and also maintained.

Maintenance is needed to service the equipment and make corrections that may be required due to changes in conditions or any combination of the following factors:

- Traffic Accidents.
- Devices displaced by vehicles, workers, wind, truck slipstream, etc.
- Damage caused by construction activities.
- Weather created damage.
- Dead/low flashing light batteries or burned out bulbs.
- Low fuel levels for electrical generators.
- Wear and tear.
- Dirt on devices.
- Vandalism or theft.

Elements of an Inspection Program

A comprehensive inspection program should include the following elements:

- A formal traffic control plan, for reference.
- A defined inspection procedure.
- A repair and replacement procedure.
- Assurance of adequate inventory of devices for emergency replacement or repair.
- Follow-up procedures to ensure that repairs are made.
- A review to ensure that the public travel path is clearly marked through the entire work zone, both day and night, and particularly at the end of a work day, keeping in mind the possibility of poor weather and light conditions.
- Documentation of inspections and repairs made.

Personnel designated to carry out inspections will be faced with the need to make decisions during the inspections and must exercise judgement in establishing appropriate practices.

A key element of the program is a procedure that ensures the required maintenance is performed. When corrective action is taken, it should be recorded in order that documentation is complete.

1.5.2 INSPECTION AND MAINTENANCE OF TRAFFIC CONTROL *(continued)***Responsibility for Inspection and Maintenance**

For each project, an individual should be assigned the supervisory responsibility for establishing and maintaining traffic control. On construction projects, the contractor and/or utility should designate a specific person or persons. In addition, on large projects, the traffic control responsibility should also be assigned to an employee of the road authority. Routine inspections of traffic control should be carried out by these individuals.

Less frequent but periodic inspections should be performed by senior staff of the contractor (typically the superintendent) and the road authority (the resident engineer and/or the traffic engineer).

Lines of communication and responsibility should be clearly established between individuals in charge of routine maintenance of traffic control devices and those with greater authority so that, if necessary, problems can be brought promptly to the attention of officials who are in a position to respond immediately.

Inspection Frequency

To determine the frequency with which inspections should be performed, the following factors should be considered:

- Project size and duration.
- Nature of the work activity.
- Complexity of traffic control.
- Frequency at which damage occurs.
- Number of problems observed in previous inspections.

Traffic control that is required and left in place overnight should be inspected during hours of darkness. Inspections should be continued, day and night, through holidays, weekends and other times when long duration work is not active.

1.5.3 DOCUMENTATION OF TRAFFIC CONTROL

Good record keeping is necessary for traffic control related to road work. Such records are essential in the case of a traffic accident involving litigation. Although such record keeping can be time consuming, particularly for a moving operation, it is important to record significant traffic control actions taken by field crews. Records should desirably include, but not be limited to the following:

- Photologging.
- Photographs either keyed to a diary or accompanied by brief descriptions of time, location, direction and photographer's name.
- Maintaining up-to-date traffic control plans by notes on construction plans, or preferably updated traffic control plans.
- Daily diary entries of times, locations and names of individuals involved in the installation, change and removal of traffic control devices.

1.5.3 DOCUMENTATION OF TRAFFIC CONTROL *(continued)*

When the inspection process reveals a condition that requires changes, the documentation should include the following:

- Description of change needed, when it was noted, and by whom.
- Instructions given to make changes.
- What and when changes or replacements made and, if deferred, why.

1.5.4 POTENTIAL FOR TRAFFIC ACCIDENT LITIGATION

The objective of road authorities, contractors and utilities should be to avoid traffic accidents within work zones. The following will help to accomplish this objective:

- Know and comply with safe and effective principles of traffic control.
- Ensure that the proper devices are in place in the work zone; including times when the zone is unattended at night, weekends, holidays, etc.
- Follow all safety regulations.
- Document all actions taken on or related to traffic control placed in the work zone.
- Inspect the work zone with a view to detecting and correcting observed deficiencies in traffic control.
- Remove all material and equipment not needed at the site as soon as possible, including traffic control devices no longer required.
- Provide adequate warning, guidance and protection for motorists, pedestrians, cyclists and workers for and from all foreseeable conflicts and hazards that could result from the work being done.

In spite of the best efforts outlined above, traffic accidents may still occur and some of these may result in lawsuits against the road authority. Defense against such lawsuits relies to a considerable degree on records that have been kept of job related activities and of traffic control maintained in the work zone. Documentation of changes made, as and when seen to be needed, should be viewed as indication of an effort always to provide adequate traffic control. Documentation should be kept as outlined in Section 1.5.3.

CHAPTER 2

TRAFFIC CONTROL DEVICES

2.1 TRAFFIC SIGNS

2.1.1 GENERAL

Standard signs that are used temporarily for construction, maintenance and utility work are shown in this section. They are classified as Construction and Maintenance (C), Temporary Warning (TW) and Regulatory (R) Signs.

Construction and Maintenance (C) Signs

This group contains both regulatory and warning-type signs that are only required for temporary conditions and do not have equivalents in the “R” or “W” groups. Except for the possibility of mounting on temporary supports, however, the same rules apply as for the use of permanent “R” and “W” signs.

Temporary Warning (TW) Signs

Temporary Warning signs are used to give notice of conditions that are potentially hazardous to public traffic and workers. They should be used only when such conditions exist and are particularly important when the hazard is not obvious. Warning signs should not be over used or they will lose their attention getting value and their credibility with motorists.

- Design – Warning signs are typically diamond shaped with one diagonal vertical. Permanent warning signs have black messages on yellow backgrounds. Temporary warning signs have black messages on orange backgrounds. The orange colour is used to indicate the temporary nature of the condition and the additional potential hazard in the work zone.
- Exceptions – Some warning messages cannot be accommodated adequately in a diamond shape. In such cases, square or rectangular formats may have to be adopted but the black and orange colour combination must be maintained. Other than for the standard temporary warning signs contained in this section, warning signs requiring a special shape and/or message must be pre-approved by the road authority.
- Placement – Warning signs should generally be placed sufficiently in advance of the condition for which warning is given to permit motorists time to understand the information and make any required response. There are some exceptions where warning signs are placed in the immediate vicinity of a hazard. e.g. TW-62 CHEVRON ALIGNMENT markers for abrupt changes in alignment.

2.1.1 GENERAL (continued)

Regulatory (R) Signs

Regulatory signs impose legal requirements and they may not be used without permission of the road authority. For example, on highways under the jurisdiction of the Ministry, construction speed zones shall only be installed with the approval of the District Highways Manager.

- Design – Regulatory signs are typically square, or rectangular with the long dimension vertical. The standard colours are black messages on white backgrounds, or the reverse. On some signs a red circle with a diagonal slash, or a green circle are used with black symbols to indicate prohibited and required maneuvers respectively.
- Exceptions – Red is used as the predominant colour for such signs as STOP and YIELD. Unique shapes and colour schemes increase the target value of these important signs.

Selecting Signs

Signs, as shown in the T.C. Manual, should be used wherever possible. Drivers are familiar with these signs and know how to react to them whereas nonstandard signs may be confusing. All signs should be made professionally as “homemade” signs do not command driver respect.

When choosing signs, the following should be considered:

- Choose signs that are appropriate; signs that accurately describe the work situation.
- Choose signs with messages clearly indicating the actions drivers are required to take. Use larger signs where greater emphasis is required, as for areas of higher speed or volume. Avoid messages with only local meaning as these may not be understood by visitors.
- Start with general sign messages at the beginning of the work zone. Then use signs with more specific messages, stating what action should be taken, closer to the actual work area.
- The overall effect of signs should be to make drivers aware of what they are approaching and what action(s) will be required of them.

Sign Placement and Spacing

Recommended **minimum** advance placement distances for initial signs and distances between subsequent signs in a series are shown as dimensions “4*” in Table A at the beginning of Chapters 3 and 4 and in Table B at the start of Chapter 5. Also:

- On urban streets, advance placement distances may have to be shortened due to the length of city blocks. Additional advance warning signs may be required due to the extra “intersections” created by alleys and accesses. Care should be taken that signs are not hidden by parked vehicles.
- As speed limits increase, so do the advance placement distances

2.1.1 GENERAL (continued)

as shown in Table A.

- Where cyclists and/or pedestrians are likely to be present, their need for safe and convenient passage must be considered; particularly when signs and other devices are being installed.
- On divided roadways and one-way streets, with two or more lanes in the same direction, signs should be placed on both sides of the roadway, if space is available. A sign mounted in the median should be approximately 60 m upstream from the same sign on the shoulder.
- Signs should not block the sight lines of traffic entering a roadway from side roads or accesses.
- All signs should be placed for best visibility.
- If traffic is heavy and backs up into the Advance Warning Area, additional warning signs should be placed upstream of the back up.

Other Considerations

Existing signs which do not apply during the work activity must be covered or removed.

Drive through checks should be made periodically, both night and day, to ensure that signs are properly located to allow adequate driver response time.

As personnel in charge of traffic control tend to be quite familiar with their work zone, they should attempt to look at it as through the eyes of a visiting driver arriving at the zone in the worst foreseeable conditions.

Typical Traffic Control Layouts

While most of the typical layouts shown in Chapters 3, 4 and 5 call for C-4 or C-18 signs in advance of work sites these may be replaced by other appropriate warning signs.

Each typical layout shown in Chapters 3, 4, & 5 is intended to mark a single work zone. If a second work zone abuts or overlaps the first, a special traffic control design may be required.

Sign Supports

Signs may be attached to posts or to portable supports. Most signs should be post-mounted on long-term projects. Temporary STOP and YIELD signs should be mounted at approximately the same height and in approximately the same position as for permanent installations. Portable sign supports are more practical for short duration work and for signs which need to be repositioned often. Work zone sign supports should be lightweight, yielding or have the same breakaway features as for permanent installations. To avoid illegibility due to glare from direct reflection of headlights, signs may be slightly tilted back or rotated a few degrees away from the roadway.

Figure 2.1.1. mainly shows the minimum mounting heights and lateral offsets for signs mounted on posts. Signs on portable supports should be as high as possible up to the mounting height for fixedpost installations. Mounting heights above the minimum requirements may

2.1.1 GENERAL (continued)

be used if it is necessary to increase visibility of signs.

Signs up to 75 cm x 75 cm may be mounted on one post. Larger signs normally require two posts to prevent twisting and turning of assemblies caused by wind or air movement from passing trucks.

Illumination and Reflectorization

- Signs shall be illuminated or reflectorized to show the same colours and shapes by night as by day.
- The road authority may specify the level of reflective sheeting that shall be used on specific signs, but as a minimum all sheeting shall be “enclosed lens sheeting” (engineering grade).
- All sign sheeting material for signs used for works on provincial highways must meet CGSB Standard 62-GP-11M
- Effective April 1, 2001 all orange construction signs used for works on provincial highways must meet CGSB Standard 62-GP-11M, Level 1, “encapsulated lens reflective sheeting (“High Intensity”) unless other wise specified by the Chief Highway Engineer.
- Sign condition should be inspected to ensure proper reflectivity. This may be done by driving through the work zone at night, using low beam headlights only and assessing the legibility of each sign. Signs may also be checked using a photometer or reflectometer to determine retroreflectivity levels. Generally, signs that show a 50% loss of reflectivity based on the manufacturer’s specification, should be replaced. All traffic control devices, including signs, used in work zones are subject to severe service conditions and generally have a shorter life expectancy than permanently mounted signs. Signs that are visibly damaged, cracked, glazed, pitted or in any other way marred to such an extent that they are rendered ineffective, shall be considered unacceptable as a traffic control device and replaced immediately.
- Illuminated signs should be considered whenever reflectorized signs are not effective. e.g. When background light sources or other uncontrollable distractions reduce visibility of signs.
- Signs or sign locations can be emphasized by use of Type A flashing yellow lights mounted on the sign supports or on adjacent Class 1A barricades.

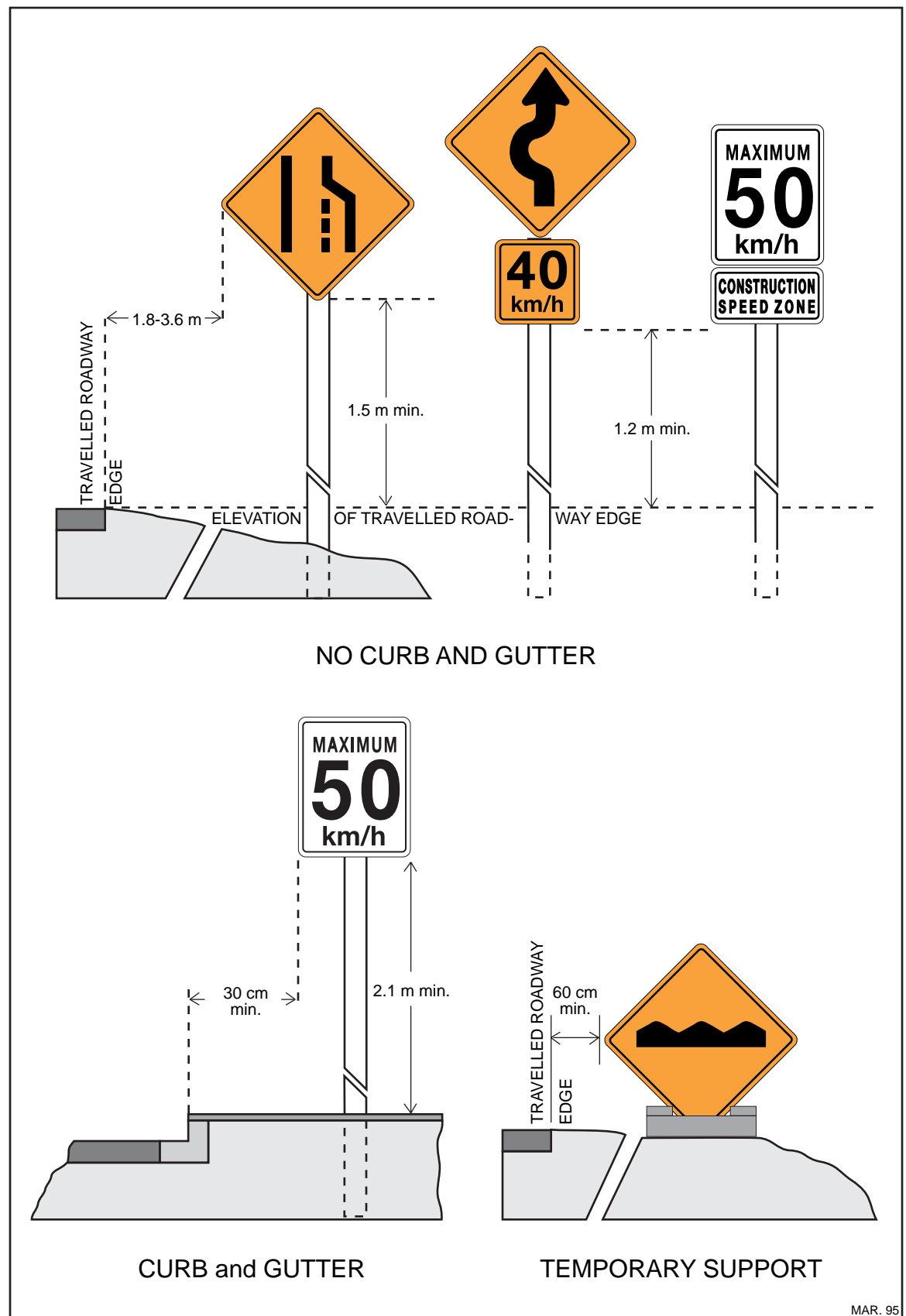
Sign Colour Codes

Standard sign colours and acceptable tolerances shall be as per CGSB Standard 62-GP-11M.

Standard Sign Patterns

The sign illustrations in this Manual are only representations of the true designs and should not be used as patterns for sign manufacture. Enlargeable production patterns for all British Columbia standard traffic signs are available from the Transportation Association of Canada (T.A.C.) 2323 St Laurent Blvd. Ottawa Ontario, K1G 4J8 Tel. (613) 736-1350, Fax (613) 736-1395

Figure 2.1.1 Typical Sign Installations Showing Heights and Lateral Clearances



2.1.2 SIGN DIMENSIONS

For the purposes of this section, the standard traffic signs normally used for temporary conditions have been placed in three categories. These are Construction and Maintenance (C), Temporary Warning (TW) and Regulatory (R). In total, the three categories contain signs of the regulatory and warning types.

In Subsections 2.1.4 through 2.1.8, which contain the intended uses and individual warrants for the signs, the acceptable minimum sizes are shown directly below the title line for each sign.

The minimum dimensions for Regulatory signs should be as shown in the warrants. In any given work zone, however, Regulatory sign sizes should not be smaller than those normally required on a roadway with a similar legal speed limit.

For some “C” and “TW” warning-type signs; there are two sets of dimensions shown. In such cases, the smaller dimensions shall be the minimums applying to all two lane two-way roadways and all multilane roadways where the speed limit (normal or construction speed zone) is 60 km/h or less. The larger dimensions apply to multilane roadways with a speed limit (normal or construction speed zone) of 70 km/h or higher; provided there is sufficient room clear of the travelled roadway to accommodate the larger signs.

All sign dimensions are shown in centimetres.

Recommended Letter Heights for Custom Construction Signs:

< 50 km/h	150mm
60-90 km/h	200mm
>90 km/h	250mm (minimum) 300mm (desirable)

2.1.3 SIGN ILLUSTRATIONS AT A GLANCE

2.1.3.1 Construction and Maintenance (C)



C-1



C-2



C-3



C-3 (x2)



C-3L



C-3R



C-4



C-5



C-5L



C-5TL



C-5R



C-5TR



C-6



C-6L



C-6R



C-7



C-8



C-9



C-10



C-11



C-12



C-13L



C-13R



C-14



C-15



C-16



C-17



C-18

2.1.3 SIGN ILLUSTRATIONS AT A GLANCE (continued)

2.1.3.1 Construction and Maintenance (C)



C-19



C-20



C-21



C-22



C-23



C-24



C-25



C-26



C-27



C-27



C-28



C-29



C-30



C-31



C-32



C-33L



C-33R



C-34

See Appendix E
for examples



C-35



C-36



C-37

C-38



C-39



C-40D

2.1.3 SIGN ILLUSTRATIONS AT A GLANCE (continued)

2.1.3.1 Construction and Maintenance (C)



C-41



C-41S



C-42L



C-42R



C-42S
(Back of some
C-42Rs)



C-43



C-44



C-45



C-45S



C-46



C-47



C-48



C-49

See Appendix E for examples

C-50

C-51



C-52L



C-52R



C-53



C-54



C-55



C-56



C-57



C-58

2.1.3 SIGN ILLUSTRATIONS AT A GLANCE (continued)

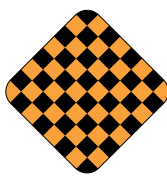
2.1.3.2 Temporary Warning Signs (TW)



TW-11



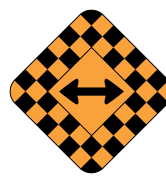
TW-12



TW-14



TW-15



TW-16



TW-20



TW-22



TW-24



TW-26



TW-27



TW-36L



TW-36R



TW-37L



TW-37R



TW-38



TW-41



TW-49



TW-51



TW-51T



TW-54



TW-54L



TW-54R



TW-55W



TW-55Y

*2.1.3 SIGN ILLUSTRATIONS AT A GLANCE (continued)***2.1.3.2 Temporary Warning Signs (TW)**

TW-59



TW-61L



TW-61R



TW-61T



TW-62

2.1.3 SIGN ILLUSTRATIONS AT A GLANCE (continued)

2.1.3.3 Regulatory Signs (R)



R-1



R-1T



R-2



R-3



R-4



R-10



R-12



R-14R



R-15L



R-15R



R-18



R-20



R-12T



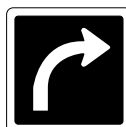
R-22



R-23



R-33L



R-33R



R-35L



R-35R



R-56



R-125

2.1.4 LIST OF CONSTRUCTION AND MAINTENANCE (C) SIGNS

Sign Number	Message or Title	Minimum Size(s)	Shape	MUTCDC Number
C-1	Crew Working (Sy.) Maximum 30/50 km/h	45 x 90	Rect.	—
C-2	Survey Crew (Sy.) Maximum 30/50 km/h	45 x 90	Rect.	—
C-3	Barricade Reflectors (Triangles)	18/18/25	Tri.	—
C-3L & R	Barricade Reflectors (Parallelograms)	18 x 25	Par.	—
C-4	Crew Working Ahead (Sy.)	75 x 75	Diam.	WD-A41
C-5	Detour Marker (Thru)	60 x 45	Rect.	ID-1T
C-5L & R	Detour Marker Left/Right	60 x 45	Rect.	ID-1T
C-5TL & R	Detour Marker Left/Right Ahead	60 x 45	Rect.	ID-1T
C-6	Detour Ahead	75 x 75 120 x 120	Diam.	—
C-6L & R	Detour Left/Right Ahead	75 x 75 120 x 120	Diam.	—
C-7	Workers Below (Structure) Ahead	60 x 60	Sq.	—
C-8	Grader Working Ahead	75 x 75	Diam.	—
C-9	Blasting Zone—Shut Off Your Radio Transmitter	60 x 75	Rect.	—
C-10	Blasting Zone Ends	60 x 60	Sq.	—
C-11	Washout Ahead	75 x 75	Diam.	—
C-12	Soft Shoulder Ahead	75 x 75	Diam.	—
C-13L & R	Low Shoulder on Left/ Right Ahead (Sy.)	75 x 75 120 x 120	Diam.	WD-A49
C-14	Fresh Oil Ahead	75 x 75	Diam.	—
C-15	Temporary Slow Marker	30 x 30	Diam.	—
C-16	Temporary Hazard Marker	30 x 30	Sq.	—
C-17	Bridge Repair Ahead	75 x 75	Diam.	—
C-18	Construction Ahead	75 x 75 120 x 120	Diam.	—

TRAFFIC CONTROL DEVICES**2.1.4** *LIST OF CONSTRUCTION AND MAINTENANCE (C) SIGNS (continued)*

Sign Number	Message or Title	Minimum Size(s)	Shape	MUTCDC Number
C-19	Construction Ahead ___ km	120 x 120	Diam.	—
C-20	Paving – Next ___ km – Please Obey Signs	120 x 90	Rect.	—
C-21	Sealcoating – Loose Gravel – Next ___ km	120 x 90 240 x 120	Rect.	—
C-22	Construction Speed Zone Tab	60 x 30	Rect.	—
C-23	Thank You – Resume Speed	45 x 90	Rect.	—
C-24	Single Lane Traffic Ahead	75 x 75	Diam.	—
C-25	Bump or Rough Roadway Ahead (Sy.)	75 x 75	Diam.	WD-A22
C-26	Broken Pavement Ahead	75 x 75	Diam.	—
C-27	Traffic Control Paddle (C-27H with Handle)	40 x 40	Oct.	—
C-28	Traffic Control Person Ahead (Sy.)	75 x 75	Diam.	—
C-29	Prepare to Stop Ahead	75 x 75	Diam.	—
C-30	Centre Lane Closed Ahead	75 x 75 120 x 120	Diam.	—
C-31	Reduce Speed Ahead	120 x 120	Diam.	—
C-32	Mower Working Ahead	75 x 75	Diam.	—
C-33L & R	Uneven Pavement on Left/Right Ahead	75 x 75 120 x 120	Diam.	—
C-34	Uneven Pavement Ends	60 x 60	Sq.	—
C-35	Highway Improvement Project	240 x 170 300 x 210	Rect.	—
C-36	Survey Crew Ahead (Sy.)	75 x 75	Diam.	WD-A46
C-37	Sweeper Working Ahead	75 x 75	Diam.	—
C-38	Truck Stopped on Road Ahead Next 2 km	120 x 120	Diam.	—
C-39	Caution – This Truck Stops Frequently	75 x 30	Rect.	—

2.1.4 LIST OF CONSTRUCTION AND MAINTENANCE (C) SIGNS (continued)

Sign Number	Message or Title	Minimum Size(s)	Shape	MUTCDC Number
C-40D	Prepare to Stop (Double Sided)	240 x 90	Rect.	—
C-41	Road Marking in Progress Ahead Next ___ km	120 x 120	Diam.	—
C-41S	Cone Means Wet Paint Ahead Next ___ km	120 x 120	Diam.	—
C-42L & R	Pass This Side Left/Right	90 x 60	Rect.	—
C-42S	Traffic Control Person Operating	90 x 60	Rect.	—
C-43	Caution Paint Spray Truck Ahead	120 x 90	Rect.	—
C-44	Slow Vehicle Ahead Next ___ km	120 x 120	Diam.	—
C-45	Slow Vehicle Ahead	75 x 75	Diam.	—
C-45S	Slow Vehicles Ahead	120 x 120	Diam.	—
C-46	Follow Pilot Car Ahead	75 x 75	Diam.	—
C-47	Pilot Car – Do Not Pass	90 x 60	Rect.	—
C-48	Grooved Pavement Ahead	75 x 75 120 x 120	Diam.	—
C-49	Use Headlights – Extreme Dust Ahead	75 x 75 120 x 120	Diam.	—
C-50	Joint Road Project – Secondary Highway Program	180 x 150	Rect.	—
C-51	Joint Road Project – Revenue Sharing Act	180 x 150	Rect.	—
C-52L & R	Roadside Diversion on Left/ Right Ahead (Sy.)	75 x 75 120 x 120	Diam. Diam.	WD-A43 WD-A43
C-53	Lane Closure Arrow (Sy.)	75 x 75 120 x 120	Diam.	—
C-54	Work Zone Ends	60 x 60	Sq.	—
C-55	No Road Lines Ahead	75 x 75	Diam.	—
C-56	Temporary Road Lines Ahead	75 x 75	Diam.	—
C-57	Avalanche Control Ahead	75 x 75	Diam.	—
C-58	Accident Scene Ahead	75 x 75	Diam.	—

2.1.5 WARRANTS FOR INDIVIDUAL (C) SIGNS

C-1 CREW WORKING MAXIMUM 30/50 km/h (45x 90)

These signs may be used in conjunction with appropriate warning signs to protect crews working on a travelled roadway which has not been physically closed to traffic by means of barricades and/or cones.

The CREW WORKING – MAXIMUM 30 km/h sign may be required where the normal legal speed limit is 60 km/h or less. This sign, however may also be used where the speed limit is above 60 km/h if, in the opinion of the supervisor or crew chief, the degree of hazard to workers, equipment or to the travelling public is such that a temporary 30 km/h limit is required.

Generally, the CREW WORKING – MAXIMUM 50 km/h sign may be used where the normal legal speed limit is 70 km/h or higher. The crew supervisor, however, may authorize its use in lower speed zones if a temporary 30 km/h limit appears overly restrictive.

C-23 THANK YOU – RESUME SPEED signs are used to mark the ends of such temporary zones which must be kept as short as practicable.

Any R-3 or R-4 signs located within a temporary speed zone must be covered while the temporary zone is in place.

Signs are to be moved as often as necessary to keep the temporary speed zone as short as practicable.

As C-1 signs create temporary lower speed zones, it is most important that they be removed whenever crews are not working on or immediately adjacent to the travelled roadway.

Where warranted, survey crews should use C-2 in place of C-1 signs

Where traffic lanes are less than 3.6 m wide, C-1 signs shall be erected on the shoulders. However, if traffic lanes are 3.6 m or more in width, C-1 signs may be placed on the centreline. In such cases it may be convenient to attach C-23 signs to the backs of opposing C-1 signs to form 'A' board assemblies.

Whenever a C-1 sign is placed on the centreline, a cone shall also be placed on centreline a short distance in advance of the appropriate shoulder-mounted warning sign.

C-1

B on Or.
Bgd. Refl.



B on W
Bgd. Refl.
"3" Tab on Back

C-2

B on Or.
Bgd. Refl.



B on W
Bgd. Refl.
"3" Tab on Back

C-2 SURVEY CREW – MAXIMUM 30/50km/h
(45 x 90)

If conditions warrant the imposition of a temporary lower speed zone for survey crews, C-2 signs, along with C-23 and C-36 SURVEY CREW warning signs may be used. All the other conditions and requirements applying to C-1 signs apply equally to C-2 signs.

C-3 (x2)



C-3L&R
Refl. Or.



C-3 BARRICADE REFLECTORS (Triangles)
(18 x 18 x 25)

C-3 L & R BARRICADE REFLECTORS (Parallelograms)
(18 x 25)

These reflectors are intended for use on Class 1, 2 and 3 Barricades. If the reflective 45 degree parallelograms are made from C-3 triangular sections, both left and right equivalents can be formed from the same components. One piece parallelogram-shaped reflectors may also be cut, on a 45 degree angle from retro-reflective sheeting but separate supplies of C-3L and C-3R equivalents will be required.

The application of reflectors to Class 1, 2 and 3 Barricade rails is addressed in Section 2.2.2.5.

C-4



B on Or.
Bgd. Refl.

C-4 CREW WORKING AHEAD
(75 x 75)

The C-4 is the basic warning sign for short duration work areas. It warns of crews and equipment carrying out a variety of tasks on or adjacent to a travelled roadway.

C-5 DETOUR MARKERS (60 x 45)

On a detour route, C-5 DETOUR markers, showing appropriate directional arrows, should be used in advance of and, where necessary for confirmation, beyond all decision points to assure motorists that they are following the intended path.

Where the detour involves a numbered route, appropriate C-5 markers should be erected below the appropriate Numbered Route Marker.

The approach to the detour start will generally be indicated by the more pronounced C-6 DETOUR AHEAD signs.

For other than short duration work, C-5 DETOUR markers will generally be post-mounted.

C-5



B on Or.
Bgd. Refl.

C-5L



B on Or.
Bgd. Refl.

C-5TL



B on Or.
Bgd. Refl.

C-6 DETOUR AHEAD (75 x 75) (120 x 120)

The C-6 sign is used to warn traffic of a detour start where the departure from the normal roadway onto the detour is relatively smooth (i.e. a gentle transition). If the departure is abrupt, which is often the case in an urban block system, it may be necessary to:

- (a) substitute C-6L or R signs or, in higher speed/volume situations,
- (b) use both a C-6L or R in advance of the detour and a C-6 sign further upstream.

If the bypass route is short and adjacent to a work area on the normal route (i.e. probably still within the highway right-of-way), use of a C-52L or R ROADSIDE DIVERSION AHEAD sign would be more appropriate

C-6



B on Or.
Bgd. Refl.

C-6L & R DETOUR LEFT/RIGHT AHEAD (75 x 75) (120 x 120)

These signs are required in advance of a detour start where the departure from the normal route is abrupt. They may also be used on a detour route, in place of C-5TL & R markers for turns where special emphasis is required.

C-6L & R



B on Or.
Bgd. Refl.

C-7

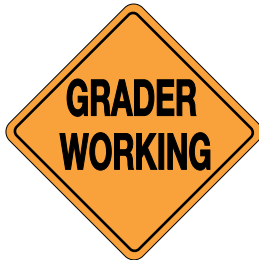


B & R on W
R & W Refl.

C-7 WORKERS BELOW (Structure) AHEAD
(60 x 60)

The C-7 sign may be required to warn the operators of such vehicles as flusher trucks, snowplows and snow blowers that a crew is working below a structure ahead. Need for the sign shall be determined by the supervisor of the crew working below after considering such factors as visibility and exposure of the crew, approach sight distance, approach speed and prevailing road/ weather conditions.

C-8



B on Or.
Bgd. Refl.

C-8 GRADER WORKING AHEAD
(75 x 75)

The C-8 sign shall be used to inform drivers that a grader is working either on the shoulder or the travelled roadway ahead. This is one of the Continuously Slow Moving Work detailed in Figure 3.2.2.

Where speeds and/or traffic volumes are relatively high and a higher degree of potential hazard is foreseeable, C-4 CREW WORKING AHEAD signs should be placed upstream of C-8 signs on both approaches to the work area.

If the grading operation warrants the use of a shadow vehicle on the shoulder behind the sweeper, then the C-8 sign for traffic travelling in the direction of the operation may be displayed conspicuously on the rear of the shadow vehicle.

C-9

R on W



B on W
R & W Refl.

C-9 BLASTING ZONE – SHUT OFF YOUR RADIO TRANSMITTER
(60 x 75)

C-10 BLASTING ZONE ENDS
(60 x 60)

C-9 BLASTING ZONE – SHUT OFF YOUR RADIO TRANSMITTER, and C-10 BLASTING ZONE ENDS signs shall be used on all occasions where blasting is carried out in the vicinity of a public roadway. The C-9 sign shall be placed at least 500 m in advance of the blasting zone, and the C-10, 300 m beyond the blasting area.

C-9 and C-10 signs must be removed or covered immediately after a set of charges has been exploded and should not be replaced until prior to the commencement of loading further drill-holes.

C-10



B on W
Bgd. Refl.

C-11 WASHOUT AHEAD
(75 x 75)

This sign shall be used where a shoulder or part of one travelled lane has washed out but where there is still sufficient width for two vehicles to pass safely at reduced speed.

If the washout has encroached far enough to require the closure of a lane, traffic control as shown in Figure 3.4.1 or 4.3.1 shall be installed.

Class 1 or 1A Barricades, C-16 TEMPORARY HAZARD markers or other delineation devices shall be used to mark the extent of the washout.

C-11

B on Or.
Bgd. Refl.

C-12 SOFT SHOULDER AHEAD
(75 x 75)

The C-12 sign may be used in advance of a section of shoulder which is newly laid and uncompacted or so softened by weather or other condition that it presents a hazard to vehicles pulling off the travelled roadway. If the soft shoulder condition is extensive, confirmatory C-12 signs may be required.

C-12

B on Or.
Bgd. Refl.

C-13 L&R LOW SHOULDER ON LEFT/RIGHT AHEAD
(75 x 75)

The LOW SHOULDER sign shall be used on unfinished paving projects where the shoulders have not been brought up to the level of the new pavement and the drop off is potentially hazardous.

The C-13R sign is erected on the right-hand side of the roadway in advance of a low shoulder. Where traffic is required to use the left side of a roadway with a low shoulder, a C-13L sign is erected on the left-hand shoulder.

C-13R

B on Or.
Bgd. Refl.

C-14

B on Or.
Bgd. Refl.

C-14 FRESH OIL AHEAD

(75 x 75)

On (re)paving, extensive machine patching and sealcoating projects, the C-14 sign shall be used to warn motorists of freshly sprayed liquid asphalt (prime or tack coat) on the road surface. Until the asphalt has cured, it can be slippery and may also result in the objectionable splashing of vehicles.

Even after the spray has cured, C-14 signs shall be retained until the sprayed area has been covered with new pavement or a sand/chip sealcoat.

The C-14 sign is placed in advance of the sprayed area and repeated at intervals throughout long sections.

If a cured sprayed section is to remain exposed when work is not in progress, C-14 signs shall be augmented with TW-41 SLIPPERY WHEN WET signs to warn of potentially increased slipperiness in the event of rain.

C-15

W on R
Fl. Refl.

C-15 TEMPORARY SLOW MARKER

(30 x 30)

C-16 TEMPORARY HAZARD MARKER

(30 x 30)

The C-15 TEMPORARY SLOW marker is intended for emergency use only in conjunction with the C-16 TEMPORARY HAZARD marker. It may be erected in advance of temporary hazards such as shoulder washouts, fallen rock, potholes, frost heaves, etc. If it appears the hazard will not be removed promptly the TEMPORARY SLOW Marker should be replaced by an appropriate temporary warning sign, such as C-25 BUMP or ROUGH ROADWAY, C-26 BROKEN PAVEMENT, C-11 WASHOUT, etc., erected under its particular warrant.

If the severity or length of a hazard is such that either or both TW-22 ADVISORY SPEED and TW-24 ADVISORY DISTANCE tabs are required, then an appropriate temporary warning sign shall be used in place of the C-15 marker.

The TEMPORARY SLOW marker should not be confused with the TW-21 SLOW sign.

C-16 TEMPORARY HAZARD markers are used with C-15 markers and other temporary warning signs. They are erected on the shoulder to mark the actual site of a hazardous condition. In the case of a washout or minor rock fall, a number of C-16 markers may be required to delineate the hazard.

Individual bumps, potholes or pavement breaks will generally require only one C-16 marker for each direction of travel.

C-15 and C-16 markers are generally mounted on stakes driven into the shoulder so that each marker is approximately one metre above the level of the travelled roadway.

C-16

W on R
Fl. Refl.

C-17 BRIDGE REPAIR AHEAD
(75 x 75)

The C-17 sign may be used in place of C-4 and C-18 signs in advance of bridge repair projects when the structure is still open to traffic on a restricted basis.

C-17

B on Or.
Bgd. Refl.

C-18 CONSTRUCTION AHEAD
(75 x 75) (120 x 120)

This sign shall be erected in the Advance Warning Area as indicated in the Typical Traffic Control Illustrations for long duration work.

C-18

B on Or.
Bgd. Refl.

C-19 CONSTRUCTION AHEAD __ km
(120 x 120)

The C-19 sign may be used for long duration work zones on a multilane roadways where the normal speed limit is 70 km/h or higher to extend the Advance Warning Area by 1 km or 2 km.

**C-19**

B on Or.
Bgd. Refl.

C-20

B on W
Bgd. Refl.



B on Or.
Bgd. Refl.

C-20 PAVING – NEXT ___ km – PLEASE OBEY SIGNS
(120 x 90)

The C-20 sign should be erected in advance of all paving projects as shown in Appendix D, Figure D1(a) & (b) of the T.C. Manual. Specify the distance required when ordering. Distance overlays are available for revision of existing signs in good condition. See footnotes for Figures D1(a) & (b).

C-21

B on W
Bgd. Refl.



B on Or.
Bgd. Refl.

C-21 SEALCOATING – LOOSE GRAVEL – NEXT ___ km
(120 x 90) (240 x 120)

The C-21 sign should be erected in advance of all sealcoating projects, as shown in Appendix D, Figure D2(a) & (b) of the T.C. Manual. The sign may be repeated as required throughout projects. Specify distance required when ordering. Distance overlays are available for revision of existing signs in good condition. See footnotes for Figures D2(a) & (b).

C-22



B on W
Bgd. Refl.

C-22 CONSTRUCTION SPEED ZONE TAB
(60 x 30)

The C-22 tab, when erected below R-3 MAXIMUM ___ km/h AHEAD and R-4 MAXIMUM ___ km/h signs, establishes a legally lowered construction speed zone. Signs will normally be post-mounted.

Construction speed zones are generally established for those long duration projects on which a reduction in the prevailing speed limit is considered necessary.

CONSTRUCTION SPEED ZONES MAY ONLY BE INSTALLED WITH THE APPROVAL OF THE ROAD AUTHORITY.

Any R-3 or R-4 signs showing the normal maximum speed that are within or on the approach to a construction speed zone shall be covered or removed whenever the lower speed limit is in effect.

The end of a construction speed zone shall be indicated by an R-4 sign showing the normal maximum speed.

C-23 THANK YOU – RESUME SPEED (45 x 90)

The C-23 shall be used to mark the end of a temporary speed zone established with either C-1 or C-2 signs.

The C-23 sign may also be used at the downstream end of a work area through which traffic has been warned to reduce speed by C-31 or TW-22 signs.

The C-23 is not required where a C-54 is warranted. It is also not required at the end of a construction speed zone, which should be marked with an R-4 showing the normal speed limit, even if the end of the construction speed zone is coincident with the end of a work zone. In the later case a C-54 should precede the R-4 sign.

C-23



B on W
Bgd. Refl.

C-24 SINGLE LANE TRAFFIC AHEAD (75 x 75)

The C-24 SINGLE LANE TRAFFIC AHEAD sign shall be used in advance of work areas on two lane two-way roadways where the useable roadway width has been reduced, and where traffic in both directions is therefore restricted to the alternate use of a single lane. The reduced roadway width at which this condition occurs will depend on such things as traffic composition, speed and volume, highway alignments, sight distance etc., but will generally be about 5.5 m.

The C-24 sign is used in conjunction with other signs and devices as shown in the Typical Traffic Control Illustrations.

C-24



B on Or.
Bgd. Refl.

C-25 BUMP or ROUGH ROADWAY AHEAD (75 x 75)

The C-25 BUMP or ROUGH ROADWAY sign shall be used to warn of sharp changes in the road profile which are sufficiently abrupt to create a potentially hazardous condition. It should replace the C-15 TEMPORARY SLOW Marker in advance of frost heaves, fill settlements, short pot-holed sections, etc., where such hazards are not likely to be removed promptly.

C-25



B on Or.
Bgd. Refl.

C-26



B on Or.
Bgd. Refl.

C-26 BROKEN PAVEMENT AHEAD
(75 x 75)

The C-26 BROKEN PAVEMENT sign shall be used in place of the C-25 where sections of badly broken or pot-holed pavement exceed 20 m in length. The C-26 should also replace the C-15 TEMPORARY SLOW marker where repairs will not be carried out promptly.

Regardless of the above warrants, C-25 and C-26. signs should be used instead of C-15 Markers where the small marker is not adequate or if either or both TW-22 ADVISORY SPEED or TW-24 ADVISORY DISTANCE tabs are required. In the latter cases, signs and tabs should normally be post-mounted.

The C-16 TEMPORARY HAZARD marker is used with C-25 and C-26 signs to mark the actual locations of irregularities.

C-27



W on R
Fl. Refl.

C-27



B on Y
Bgd. Refl.

C-27 TRAFFIC CONTROL PADDLE (C-27H with handle)
(40 x 40)

Approved methods of using the paddle and associated devices are contained in the W.C.B. Industrial Health and Safety Regulations. It is most important that all TCPs are qualified and that they use only the approved methods and devices.

If the message on only one side of the paddle is required, the message on the opposite side shall be covered, or shielded by the TCPs body, to prevent drivers proceeding in the opposite direction from reading an inappropriate message.

The C-27 TRAFFIC CONTROL PADDLE is made with a short hollow handle. Particularly when a paddle is to be used for an extended period, the handle can be extended by fitting a dowel approximately 2.5 cm in diameter and 1.3 m long into the short handle. This will allow comfortable display of a paddle at the recommended height.

C-28 TRAFFIC CONTROL PERSON (TCP) AHEAD
(75 x 75)

This sign shall be used in advance of any point at which a TCP is stationed to control traffic through a work area. It is always used in association with other construction and maintenance signs.

The sign shall be promptly removed or covered whenever the TCP is not on station.



C-28
B on Or.
Bgd. Refl.

C-29 PREPARE TO STOP AHEAD
(75 x 75)

The C-29 sign may be required in advance of the R-56 YIELD TO ONCOMING TRAFFIC, C-28 TRAFFIC CONTROL PERSON AHEAD or TW-12 SIGNAL AHEAD signs in work areas if, for any reason, any of the above signs do not appear to give adequate notice.

The C-29 shall never be used alone to warn of a hazard.



C-29
B on Or.
Bgd. Refl.

C-30 CENTRE LANE CLOSED AHEAD
(75 x 75) (120 x 120)

The C-30 sign is used on a roadway with three lanes in one direction, when it is necessary to close only the centre lane. The sign is generally placed in the Advance Warning Area and in a similar manner to TW-61L & R signs. Where space is available on the median side, a secondary C-30 sign should be erected. See Figure 3.4.5.



C-30
B on Or.
Bgd. Refl.

C-31



B on Or.
Bgd. Refl.

C-31 REDUCE SPEED AHEAD
(120 x 120)

The C-31 sign may be used in conjunction with the C-30 and TW-61L & R signs, in the Advance Warning Area, on multilane highways where the speed limit is 70 km/h or higher. It is not required where a construction speed zone has been established but can be useful in slowing traffic without the imposition of a lower legal speed requirement.

C-32



B on Or.
Bgd. Refl.

C-32 MOWER WORKING AHEAD
(75 x 75)

This sign shall be used to warn motorists that a mower is working adjacent to the roadway and that the operator, in avoiding such obstructions as culvert ends, delineators and sign posts, etc., may encroach onto the shoulder or even into the travelled lane if the shoulder is narrow. If the mower is consistently working well clear of the travelled roadway and shoulder, the C-32 sign is not required.

If the mowing operation warrants the use of a shadow vehicle on the shoulder behind the mower, then the C-32 sign for traffic travelling in the direction of the operation may be displayed conspicuously on the rear of the shadow vehicle.

C-33L & R UNEVEN PAVEMENT ON LEFT/RIGHT AHEAD
(60 x 60) (120 x 120)**C-34 UNEVEN PAVEMENT ENDS**
(60 x 60)

The C-33L & R signs warn of a difference in elevation between pavement lifts on adjacent travelled lanes. The C-13 LOW SHOULDER ON LEFT/RIGHT signs warn of a difference in elevation between the shoulder and the outer edge of a newly paved roadway.

If traffic is not controlled by TCPs and/or a pilot car, C-33 signs shall be used in a paving work area to warn of uneven pavement lifts at the centreline or lane lines which are potentially hazardous.

On two lane two-way roads, the uneven hazard (high or low) will generally be on centreline and C-33L signs are used, for both directions of travel, in advance of and possibly for confirmation through the section.

On multilane roadways, the uneven hazard will generally be on the lane line. In such cases, C-33L signs are placed on the right shoulder and, where space is available, C-33R signs on the left or median shoulder.

The C-34 sign shall be used to mark the end of an uneven section of pavement.

The locations of C-33 and C-34 signs require frequent adjustment as paving progresses.

C-33L

B on Or.
Bgd. Refl.

C-34

B on W
Bgd. Refl.

C-35 HIGHWAY IMPROVEMENT PROJECT

There are a number of different C-35 and C-50/C-51 HIGHWAY IMPROVEMENT PROJECT signs used for Provincially and jointly funded long duration work zones. These are detailed in Appendix E.

C-36



B on Or.
Bgd. Refl.

C-36 SURVEY CREW AHEAD
(75 x 75)

The C-36 sign shall be used where survey work is in progress on or immediately adjacent to a travelled roadway which has not been closed to traffic. It may be used alone or in conjunction with the C-2 SURVEY CREW – MAXIMUM (Speed) 30/50 km/h signs, if the crew supervisor considers that conditions warrant the imposition of a temporary lower speed zone.

C-37



B on Or.
Bgd. Refl.

C-37 SWEEPER WORKING AHEAD
(75 x 75)

The C-37 sign shall be used in advance of a section where a mechanical sweeper is used to clean a paved roadway or shoulder. This is one of the Continuously Slow Moving Work detailed in Figures 3.2.2 and 3.2.3.

Where a travelled lane, as opposed to a shoulder, is being swept on a two lane two-way roadway, a second C-37 sign shall be erected to face opposing traffic beyond the end of the section being cleaned (maximum 8 km) and an R-56 YIELD TO ONCOMING TRAFFIC sign shall be displayed on the rear of the sweeper.

If the sweeping operation warrants the use of a shadow vehicle, on the shoulder behind the sweeper, then the C-37 sign for traffic travelling in the direction of the operation may be displayed conspicuously on the rear of the shadow vehicle.

C-38



B on Or.
Bgd. Refl.

C-38 TRUCK STOPPED ON ROAD AHEAD NEXT __ km
(Maximum 2 km)
(120 x 120)

As shown in Figure 3.2.1, the C-38 sign shall be used on two lane two-way roadways in advance of Intermittent Moving Work such as Benkleman beam testing, crack sealing, temporary patching, and reflective road stud installation, etc. Either flags or a Type B portable Flashing Yellow Light, as specified in Section 2.2.4, shall be mounted directly above each C-38 sign. The sign may also be supplemented by a HLWD to increase visibility. A C-28 TCP AHEAD sign shall be erected downstream of the C-38 and these pairs of signs may remain stationary as the crew works through a section.

The maximum distance between two opposing C-38 signs should not exceed 2 km except for Falling Weight Deflectometer operations on rural highways where it should not exceed 8 km.

C-39 CAUTION – THIS TRUCK STOPS FREQUENTLY
(75 x 30)

This is a special purpose sign which shall be displayed on the rear of vehicles involved with Intermittent Moving Work on an open travelled lane of a two lane two-way highway. The sign should be removed or covered when work is not in progress and the vehicle is driven at normal highway speeds.



B & R on W
R & W Refl.

C-40D PREPARE TO STOP
(240 x 90)

This is a special purpose double-sided sign that shall be mounted prominently atop Benkleman beam testing vehicles and other vehicles involved with Intermittent Moving Work in a travelled lane on a two lane two-way roadway. It should be lowered or removed whenever the vehicle is no longer blocking the travelled lane.

To alleviate mounting difficulties on some types of vehicles, a squarer version of the C-40D may be considered, provided face area and letter height are not overly compromised.



B on Or.
Bgd. Refl.

C-41 ROAD MARKING IN PROGRESS AHEAD NEXT ____ km
(Maximum 10 km)
(120 x 120)

This sign shall be located in advance of pavement marking operations on two lane two-way rural roads as shown in Appendix B, Figure B.1 of the T.C. Manual. The maximum distance shown on the sign is 10 km. However, it may be necessary, when a striper is operating at higher speed, and there are practical limits on the personnel and vehicles available for signing, to have as many as three sets of these signs in place at one time over a maximum distance of 30 km.



B on Or.
Bgd. Refl.

C-41 S



B and Dayglo Or. on Or.
Bgd. Refl.

C-41 S (Traffic cone Symbol) MEANS WET PAINT AHEAD
NEXT ____ km (Maximum 10 km)
(120 x 120)

This sign is used to supplement the C-41 sign. It is not for use where installation of plastic marking, road studs or prelining marking is being carried out.

This sign is mounted on the back of the same sign blank as a C-41 but rotated 180°.

C-42L



B & R on W
R & W Refl.

C-42S



B & Or.
Bgd. Refl.

C-42 L & R PASS THIS SIDE LEFT/RIGHT
(90 x 60)

C-42 S TRAFFIC CONTROL PERSON (TCP) OPERATING
(90 x 60) (Back of some C-42Rs)

This sign with the appropriate arrow shall be displayed on the rear of a paint striper and the rear of a buffer truck, or as required on other vehicles in a pavement marking operation where a FAB (arrow mode) is not available or used.

This is a double sided sign with a C-42 L & R rotated 180° on opposite sides. It is also available with a C-42S on the reverse side of a C-42R.

The C-42 S is to be displayed on the rear of the striper when a TCP is controlling traffic from the back of a striper.

C-43



B & R on W
R & W Refl.

C-43 CAUTION PAINT SPRAY TRUCK AHEAD
(120 x 90)

This sign shall be displayed on the front of a buffer vehicle preceding a working paint striper. The buffer vehicle with sign, which is straddling the line to be painted, forces opposing traffic away from the striper and in so doing, minimizes the possibility of collision and problems with overspray.

C-44 SLOW VEHICLE AHEAD NEXT _ km (Maximum 8 km)
(120 x 120)

As illustrated in Figures 3.2.2 and 3.2.3, the C-44 sign shall be used in advance of Continuously Slow Moving Work such as hydroseeding, flushing, and sweeping, etc., where a travelled lane is or may be obstructed. Flags or a Type B High Intensity Flashing Yellow Light, as specified in Section 2.2.3.1, is required directly above each C-44 sign. A HLWD may also be used to increase visibility. The maximum distance between two opposing C-44 signs should not exceed 8 km.



B on Or.
Bgd. Refl.

C-45 SLOW VEHICLE AHEAD
(75 x 75)

C-45S SLOW VEHICLES AHEAD
(120 x 120)

For Continuously Slow Moving Work, when a shadow vehicle on the shoulder trails a work vehicle, the C-45 or other appropriate sign shall be displayed prominently on the rear of the shadow vehicle. Examples of other appropriate signs could be C-8 GRADER WORKING, C-32 MOWER WORKING or C-45 SWEEPER WORKING.

As shown in Appendix B, Figure B.1 of the T.C. Manual, the similar C-45S SLOW VEHICLES AHEAD sign shall be displayed downstream of the initial C-41 ROAD MARKING sign for two lane two-way marking operations. Confirmatory C-41 and C-45S signs should also be alternated at intervals throughout a marking work zone.

C-45



B on Or.
Bgd. Refl.

C-46 FOLLOW PILOT CAR AHEAD
(75 x 75)

The C-46 sign is placed in advance of sealcoating, paving and construction projects where traffic is piloted through a work area. It is also used intermittently through the area as a reminder and warning to motorists in a long platoon who may not be able to see the pilot car.

C-46



B on Or.
Bgd. Refl.

C-47



B on W
Bgd. Refl.

C-47 PILOT CAR – DO NOT PASS
(120 x 90)

The C-47 sign shall be mounted prominently on the top of pilot vehicles with the message shown facing to the rear. Only the words "PILOT CAR", on the opposite side of the sign, are displayed to the front. The sign shall be removed or folded down whenever the vehicle is not piloting traffic.

C-48



B on Or.
Bgd. Refl.

C-48 GROOVED PAVEMENT AHEAD
(75 x 75) (120 x 120)

The C-48 sign shall be used in advance of (and as required for confirmation throughout) sections of milled pavement where longitudinal grooves and ridges can radically effect the handling characteristics of two-wheeled vehicles.

C-49



B on Or.
Bgd. Refl.

C-49 USE HEADLIGHTS – EXTREME DUST AHEAD
(75 x 75) (120 x 120)

The C-49 sign should be used in advance of newly sealcoated or other dry gravel or dirt road surfaces where blowing dust, raised by wind or moving vehicles, is thick enough to interfere with visibility. On longer sections, the sign may be repeated for confirmation.

**C-50 JOINT ROAD PROJECT –
SECONDARY HIGHWAY PROGRAM**

C-51 JOINT ROAD PROJECT – REVENUE SHARING ACT

Details of HIGHWAY IMPROVEMENT PROJECT signs for these revenue sharing programs are contained in Appendix E.

C-52L & R ROADSIDE DIVERSION ON LEFT/RIGHT AHEAD (75 x 75) (120 x 120)

A diversion is a “mini detour”, usually adjacent to the normal route, by which traffic is diverted around a short work area. Transition from and back to the normal route should not be abrupt. The C-52L or R sign in advance indicates the path for drivers to follow.

Diversions can involve both lanes of a two lane two-way roadway or one two lane roadway of a multilane highway. In the latter case, C-52 signs should be placed on both sides of the roadway, approaching the diversion, if the highway is divided and space is available for a sign in the median.

C-52R



B on Or.
Bgd. Refl.

C-53 LANE CLOSURE ARROW (75 x 75) (120 x 120)

Where required, for a lane closure on a multilane highway, this sign is erected just inside the closed-off area at the start of the lane closure taper. It is oriented with the arrow 45 degrees above horizontal and pointing in the transverse shift direction. It should be mounted high enough above the taper devices to be seen clearly by approaching traffic.

The C-53 sign may be omitted in situations where a FAB, (in arrow mode) is used in the lane closure taper area. But if either a HLWD or a 360 degree flashing yellow light and 4-way flashers are allowed in place of a FAB, the C-53 sign is required. For an inactive long duration work area, where a FAB in a taper area is replaced, for example, by a series of Type A flashing yellow lights or Type C steady burn yellow lights, the C-53 sign is required.

For a short duration work area in the centre of a two lane two-way roadway, where traffic in both directions is required to pass the site on the right (and FABs are not called for), a C-53 sign may be provided for either or both directions if the intended paths are not self evident.

C-53



B on Or.
Bgd. Refl.

C-54 WORK ZONE ENDS (60 x 60)

The C-54 sign should be used to indicate the end of any work area marked with C-35 HIGHWAY IMPROVEMENT PROJECT signs. It should also be used to mark the end of any other lengthy work area if that point is not self evident to drivers. Very short work areas will generally not require a C-54. A C-54 should be erected at the end of the area in which work is in progress rather than the end of the project. It must not be erected within another work area (e.g., an adjacent active contract). It is not required where a C-23 is warranted.

C-54



B on W
Bgd. Refl.

C-55



B on Or.
Bgd. Refl.

C-55 NO ROAD LINES AHEAD
(75 x 75)

C-56 TEMPORARY ROAD LINES AHEAD
(75 x 75)

See Sec. 2.2.1 regarding requirements for installation of temporary and standard permanent markings.

Where a roadway which would normally have pavement markings has no permanent pavement markings in place, and is carrying traffic, one of these two signs should be installed. A C-55 sign is required if there are no pavement markings in place or a C-56 sign if there are temporary markings in place. Worksites where this typically occurs involve paving, sealcoating, milling, centreline crack sealing etc.

If a section of road without permanent pavement markings exceeds 2 km in length, a TW-24 ADVISORY DISTANCE tab should be mounted below the C-55 or C-56 sign.

C-55 and C-56 signs may be produced back-to-back provided one message is inverted with respect to the other.

C-56



B on Or.
Bgd. Refl.

C-57



B on Or.
Bgd. Refl.

C-57 AVALANCHE CONTROL AHEAD
(75 x 75)

This sign is required with others in advance of road closures for avalanches and avalanche control works. There should be flags or a Type B High Intensity Flashing Yellow Light mounted directly above the sign. For positioning of the sign see Appendix A of the T.C. Manual. All signs relating to avalanche closures must be removed or covered when not required.

C-58



B on Or.
Bgd. Refl.

C-58 ACCIDENT SCENE AHEAD
(75 x 75)

C-58 signs may be used in place of C-4 and C-18 signs for operations where tow trucks are involved in the recovery of motor vehicles and where those operations could effect the normal movements of public traffic.

2.1.6 LIST OF TEMPORARY WARNING (TW) SIGNS **

Sign Number	Message or Title	Minimum Size(s)	Shape	MUTCDC Number
TW-11	Stop Ahead (Sy.)	75 x 75	Diam.	WD-B1
TW-12	Traffic Signal Ahead (Sy.)	75 x 75	Diam.	WD-B4
TW-14	Checkerboard (Plain) (Sy.)	75 x 75	Diam.	WD-A8
TW-15	Checkerboard (Single Arrow) (Sy.)	75 x 75 120 x 120	Diam.	WD-A84R WD-A84R
TW-16	Checkerboard (Double Arrow) (Sy.)	75 x 75 120 x 120	Diam.	WD-A8D WD-A8D
TW-20	Two-way Traffic Ahead (Sy.)	75 x 75 120 x 120	Diam.	WD-B3 WD-B3
TW-22	Advisory Speed Tab	45 x 45	Sq.	WD-A7
TW-24	Advisory Distance Tab	45 x 45	Sq.	—
TW-26	Road Narrows Ahead (Sy.)	75 x 75	Diam.	WD-A23
TW-27	Loose Gravel Ahead	75 x 75	Diam.	—
TW-36L & R	Truck Crossing/Entrance Left/Right Ahead (Sy.)	75 x 75	Diam.	—
TW-37L & R	Merging Traffic Left/Right Ahead (Sy.)	75 x 75	Diam.	—
TW-38	Merge Ahead	75 x 75	Diam.	—
TW-41	Slippery Ahead When Wet (Sy.)	75 x 75	Diam	WD-C5
TW-49	Pavement Ends Ahead (Sy.)	75 x 75	Diam.	WD-A25
TW-51	Narrow Structure Ahead (Sy.)	75 x 75	Diam.	WD-A24
TW-51T	One Lane Tab	60 x 30	Rect.	WD-A24T
TW-54	Double Hazard Marker	30 x 90	Rect.	—
TW-54L & R	Left/Right Hazard Marker	30 x 90	Rect.	—
TW-55W & Y	Delineator Reflectors	7.6 x 20	Rect.	—
TW-59	Slow Moving Vehicle Marker	35/35/35	Tri.	—
TW-61L & R	Left/Right Lane Closed Ahead (Sy.)	75 x 75 120 x 120	Diam.	WD-A33 WD-A33
TW-61T	200 m, 300 m, 400 m Tab	60 x 30	Rect.	—
TW-62	Chevron Alignment Marker (Sy.)	60 x 75	Rect.	WD-A9

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** The prefix letters "TW" identify temporary warning signs.

"TW" signs are almost identical to "W" (permanent) warning signs with the same numbers except that the former have orange backgrounds and the latter yellow. The exceptions are the TW-55W & Y DELINEATOR REFLECTORS which are the same colours as for permanent conditions.

The "TW" signs listed above (and more fully described in the following pages) are some of the most commonly used. For different temporary warning situations, other black and yellow "W" (permanent) warning signs, contained in "The British Columbia Manual of Standard Traffic Signs" or the "Manual of Uniform Traffic Control Devices for Canada" can be converted to their "TW" equivalents by using orange backgrounds.

Black and orange warning-type signs in the "C" series are always used in temporary situations. They differ from "TW" signs only in that they do not have black and yellow "W" equivalents.

2.1.7 WARRANTS FOR INDIVIDUAL (TW) SIGNS

TW-11 STOP AHEAD (75 x 75)

The TW-11 sign is used whenever stopping sight distance of a temporary STOP sign is inadequate for the approach speed or where a STOP sign has temporarily been required in a location where regular users of the route would not expect to stop.



B & R on Or.
R & Or. Refl.

TW-12 TRAFFIC SIGNAL AHEAD (75 x 75)

For short duration work zones, TW-12 signs shall be used in advance of temporary lane control signal installations.

For long duration work zones, TW-12 signs shall be required in advance of all temporary traffic signal installations and in these applications, the signs are normally post-mounted.



B, R, Y & G
on Or.
B not Refl.

CHECKERBOARDS

TW-14 PLAIN (75 x 75)

TW-15 SINGLE ARROW (75 x 75) (120 x 120)

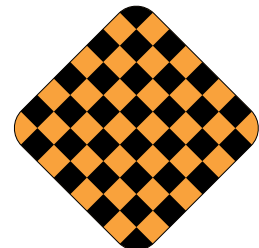
TW-16 DOUBLE ARROW (75 x 75) (120 x 120)

The TW-14 sign may be used in conjunction with Class 3 BARRICADES and the R-12 ROAD CLOSED sign to mark roads which have been temporarily dead-ended and where there is no alternative route available. Where used, the sign should be post-mounted in the centre of the closed roadway and just behind the barricades.

The TW-15 sign should be substituted for the TW-14 and similarly located where an alternative to the closed road is available either to the right or left. The TW-15 may also be used to mark the apex of a sharp temporary curve. Where required in such a situation, it should be post-mounted just off the shoulder on the outside of the curve and directly in line with the path of approaching traffic.

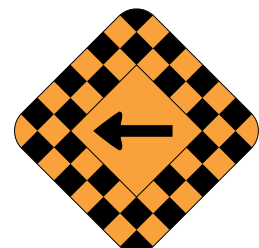
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TW-14



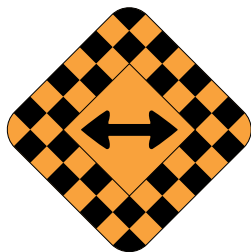
B on Or.
Or. Refl.

TW-15



B on Or.
Or. Refl.

TW-16



B on Or.
Or. Refl.

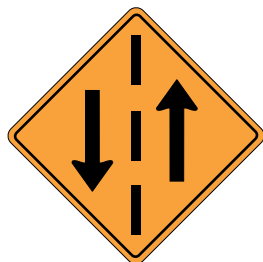
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The TW-16 CHECKERBOARD should be substituted for the TW-14 and similarly located where traffic can either turn to the right or left of the closed road.

The TW-16 may also be used to mark a temporary “T” intersection by post-mounting the sign on the far side of the intersecting road to face traffic approaching from the stem of the “T”. It should be placed in line with the projected centreline of the stem roadway.

If necessary, the mounting height of CHECKERBOARDS may be adjusted above or below the normal height to allow for vertical curvature on the approach. All CHECKERBOARD signs are diamond-shaped Warning signs which should not be mounted as squares.

TW-20



B on Or.
Bgd. Refl.

TW-20

TWO-WAY TRAFFIC AHEAD

(75 x 75) (120 x 120)

This sign is used to warn drivers on a one-way roadway that they are about to enter a two lane two-way roadway. A typical application is where one roadway of a divided highway is closed and the other roadway must carry traffic in both directions. Traffic on a multilane one-way roadway should be merged into a single lane, using appropriate signing and other devices, well in advance of the point where that traffic enters the two-way roadway. A TW-20 sign should be mounted on the right of the single lane section and, if space is available, on the left as well.

See R-10 for signing at the start of the two lane two-way roadway.

TW-22



B on Or.
Bgd. Refl.

TW-22

ADVISORY SPEED TAB

(45 x 45)

The TW-22 tab may be used with temporary condition warning signs to indicate the maximum advisory speed around a curve or through a hazard. It is not used with any other type of sign and should never be used alone. Where required, the tab should be post-mounted below the sign it modifies with the bottom edge of the tab at least 1.2 m above the travelled roadway edge.

Except in emergencies, TW-22 tabs should not be erected until a suitable speed has been determined by applying accepted engineering procedures.

In any case, the TW-22 tab is only required where traffic must slow at least 20 km/h below the speed limit in order to comfortably negotiate a hazard.

TW-24 ADVISORY DISTANCE TAB
(45 x 45)

This tab may be used below temporary condition warning signs generally when the distance over which the warning is in effect is 2 km or greater. The distance shown on the tab should be to the nearest kilometre.

An assembly requiring a TW-24 tab should be post-mounted. If a TW-22 tab is also required, the TW-24 occupies the lowest position with the bottom of the tab at least 1.2 m above the edge of the travelled roadway.

TW-24



B on Or.
Bgd. Refl.

TW-26 ROAD NARROWS AHEAD
(75 x 75)

This sign shall be used on two-way roads in advance of a temporary reduction in the width of either or both lanes which makes it necessary to warn drivers in order that they may pass in safety. The reduced roadway width at which this condition occurs will depend on such things as, traffic composition, speed and volume, highway alignment, sight distance, etc. but will generally be about 5.5 m. If the narrow section is of such width that it is not possible to pass safely even at reduced speeds, it will be necessary to institute one-way operation. Where work is not in progress, the traffic control layout shown in Figure 4.3.6 describes a means of accomplishing this without a traffic signal or TCP.

The TW-26 sign is not intended for use on narrow minor roads which have low travel speed and carry little traffic.

TW-26



B on Or.
Bgd. Refl.

TW-27 LOOSE GRAVEL AHEAD
(75 x 75)

This sign shall be placed in advance of a loose gravel condition which is potentially hazardous. It may also be required at intervals throughout the length of roadway on which the condition exists; especially before curves.

Examples include freshly graded gravel roads, uncompacted gravel in construction areas, sections of new but unswept chip sealcoat and areas where shoulder regrading has deposited gravel on the pavement edge.

TW-27



B on Or.
Bgd. Refl.

TW-36L



B on Or.
Bgd. Refl.

**TW-36L & R TRUCK CROSSING/ENTRANCE
LEFT/RIGHT AHEAD
(75 x 75)**

This sign should be used temporarily in advance of gravel pit accesses, haul road crossings, etc., where long and/or slow moving trucks frequently cross, enter or leave a roadway. For the directions of travel in which pavement markings indicate overtaking is permissible, R-20 NO PASSING FOR 150 m signs may be post-mounted below TW-36s.

A second TW-36 and if required an R-20 may, if considered necessary, be placed on the left shoulder.

TW-36 and R-20 signs should be covered or removed whenever truck hauls are not in progress.

TW-37R



B on Or.
Bgd. Refl.

**TW-37L & R MERGING TRAFFIC LEFT/RIGHT AHEAD
(75 x 75)**

This sign shall be used in advance of all temporary on-ramps and acceleration lanes under repair. It is required to warn traffic on the main roadway regardless of whether the ramp traffic is controlled by an R-2 YIELD or a TW-38 MERGE sign.

TW-38



B on Or.
Bgd. Refl.

**TW-38 MERGE AHEAD
(75 x 75)**

This sign shall be used in place of an R-2 YIELD sign at a temporary freeway on-ramp where there is an acceleration lane of sufficient length for entering vehicles to reach the freeway speed limit before entering a through lane.

TW-41



B on Or.
Bgd. Refl.

**TW-41 SLIPPERY AHEAD WHEN WET
(75 x 75)**

With the possibility of rain or heavy dew, the TW-41 sign shall be used, particularly on inactive projects, where operations such as extensive priming, tack coating or other work have rendered a finished or unfinished road surface potentially more slippery than normal. In these circumstances, the sign may be used in conjunction with the C-14 FRESH OIL or other warning-type signs and may also be required for confirmation on long sections.

TW-49 PAVEMENT ENDS AHEAD
(75 x 75)

The PAVEMENT ENDS sign shall be used when a paved asphaltic, concrete, or other finished pavement surface ends and a gravel or dirt section begins.



B on Or.
Bgd. Refl.

TW-51 NARROW STRUCTURE AHEAD
(75 x 75)

TW-51T ONE LANE TAB
(60 x 30)

The TW-51 sign is used on a two lane two-way roadway in advance of a bridge which has a temporary clear deck width of 5.5 m or more, but less width than the approach roadway.

Where the temporary clear width of a bridge deck is less than 5.5 m, TW-51T ONE LANE tabs are placed below the TW-51 signs and, as shown in Figure 4.3.6, an R-56 YIELD TO ONCOMING TRAFFIC sign is erected on the approach with the best sight distance across the bridge.

Depending on conditions such as traffic composition, speed and volume, sight distance, approach alignment, etc., it may be expedient to designate some bridges as one-way even when the temporary clear deck width is 5.5 m or more.



B on Or.
Bgd. Refl.

TW-51T



B on Or.
Bgd. Refl.

TW-54



B on Or.
Bgd. Refl.

TW-54L



B on Or.
Bgd. Refl.

TW-54R



B on Or.
Bgd. Refl.

TW-54

DOUBLE HAZARD MARKER

(30 x 90)

TW-54L & R LEFT/RIGHT HAZARD MARKER

(30 x 90)

HAZARD markers shall be used to mark:

- The inside edge of temporary obstructions which encroach into a through lane or onto the normal shoulder of a highway, such as bridge end posts.
- The ends or corners of traffic islands which face, and are adjacent to, oncoming traffic.

When correctly mounted, HAZARD marker stripes slope downward towards the side or sides of the obstruction on which traffic is allowed to pass. The stripes on a TW-54 DOUBLE HAZARD marker therefore resemble a stack of inverted Vs.

TW-54L HAZARD markers are used to mark obstructions on the motorist's left and TW-54R markers for obstructions on the right. Where traffic travelling in one direction is allowed to proceed both to the left and right of an obstruction, a TW-54 DOUBLE HAZARD marker is used.

When used to mark obstructions, such as bridge end posts, TW-54L & R markers are positioned to mark the inside edge of the obstructions.

HAZARD markers are mounted on posts immediately in advance of the obstruction being identified and generally with the bottom of the markers about 1 m above the level of the travelled roadway. As these are low-mounted devices placed very close to traffic, they will tend to become dirty more quickly than other signs. They will therefore require more frequent cleaning; especially to maintain effectiveness at night.

- TW-55W

WHITE DELINEATOR REFLECTOR
(7.6 x 20)
- TW-55Y

YELLOW DELINEATOR REFLECTOR
(7.6 x 20)


DELINEATOR REFLECTORS used in temporary conditions are the same colours as the ones used for permanent installations. They are included here only for convenient reference


The colour of reflectors used on temporary delineator posts depends on location of the delineators. White reflectors replace or enhance lane lines and right lane edge lines. Yellow reflectors serve a similar purpose for directional dividing lines and left lane edge lines on divided roadways.

The application of temporary delineator posts is covered more fully in Section 2.2.2.3.

TW-55W

TW-55Y





W

Y

Refl.

- TW-59

SLOW MOVING VEHICLE MARKER
(36 x 36 x 36)

The Motor Vehicle Act Regulations, Section 7B.01 – .04, require that a TW-59 marker be displayed temporarily on the rear of any vehicle or other mobile equipment, employed in a work area, which is required by the nature of the work to travel on a roadway at a speed of 40 km/h or less. Examples would be vehicles involved in Continuously Slow Moving Work. When such vehicles are travelling at normal highway speeds, the TW-59 markers should be covered or removed.

The marker shall also be displayed on the rear of mobile equipment units, involved in road work, which are incapable of moving consistently at speeds above 40 km/h. On such units, the TW-59 marker may be permanently displayed.

The SLOW MOVING VEHICLE marker shall be mounted, in the orientation shown here, as close as possible to the rear/centre of the unit and between 90 cm and 150 cm above ground level.

TW-59



R Refl. Border

on Fluorescent R Bgd.

TW-61R


B on Or.
Bgd. Refl.

TW-61T


B on Or.
Bgd. Refl.

TW-61L & R LEFT/RIGHT LANE CLOSED AHEAD

(75 x 75) (120 x 120)

TW-61T

200 m (300 m, 400 m, XXX m) TAB

(60 x 30)

In temporary conditions, these signs shall be used on a roadway with two or more lanes in the same direction to indicate that either the left or right lane is closed ahead. As shown, for example in Figures 3.4.3 and 3.4.4, the appropriate TW-61 sign should be repeated where the speed limit in the Advance Warning Area is 70 km/h or higher. The upstream sign of the pair should also display a bottom-mounted tab indicating the distance to the start of the lane closure taper. On conventional highways, the tab should generally read “200 m” for speed limits of 70 or 80 km/h and “300 m” for speeds of 90 km/h. For all normal speed limits on freeways, the tab reads “400 m”, except where a construction speed zone has been imposed and the tab reads 800 m, or other appropriate distance, as shown in Figure 5.6.1(a). Primary signs are generally placed on the right shoulder, but where adequate space is available on the left or median side, the signing should be repeated on the median, with each sign approximately 60 m upstream of the same sign on the right shoulder.

If the centre of three lanes in the same direction is to be closed, the right lane should be closed first (using TW-61R and TW-61T signs, reducing traffic to two lanes) before redirecting traffic to the reopened right lane in advance of the centre lane closure. C-30 CENTRE LANE CLOSED AHEAD signs may be used in advance of the transition from the closed centre lane back to the reopened right lane.

If the TW-61L and TW-61R are to be put on opposite sides of the same blank, one of the symbols should be rotated 90° from the other.

TW-62


B on Or.
Bgd. Refl.

TW-62
CHEVRON ALIGNMENT MARKER

(60 cm x 75 cm)

In conjunction with advance warning signs and other delineation devices, TW-62 markers may be used on the outside of temporary but severe changes in horizontal alignment. Where used, the markers shall be placed so that at least two of them are always visible to drivers as they negotiate the change in alignment.

2.1.8 LIST OF REGULATORY (R) SIGNS

Sign Number	Message or Title	Minimum Size(s)	Shape	MUTCDC Number
R-1	Stop	60 x 60	Oct.	RA-1
R-1T	4-Way (3-Way) Tab	40 x 20	Rect.	RA-1T
R-2	Yield (Sy.)	75/75/75	Tri.	RA-2
R-3	Maximum ___ km/h Ahead	60 x 75 90 x 120	Rect.	RB-5
R-4	Maximum ___ km/h	60 x 75 90 x 120	Rect.	RB-1 RB-1
R-10	Two-way Traffic (Sy.)	60 x 75	Rect.	RB-24
R-12	Road Closed	75 x 60	Rect.	—
R-12T	Local Traffic Only	75 x 30	Rect.	—
R-14L & R	Keep Left/Right (Sy.)	60 x 75	Rect.	RB-25L/R
R-15L & R	No Left/Right Turn (Sy.)	60 x 60	Sq.	RB-12/11
R-18	Turn (Sy.)	60 x 60	Sq.	—
R-20	No Passing for 150 m	60 x 45	Rect.	—
R-22	Do Not Pass (Sy.)	60 x 60	Sq.	RB-31
R-23	Passing Permitted(Sy.)	60 x 60	Sq.	FB-32
R-33L & R	This Lane Turn Left/Right (Sy.)	75 x 75	Sq.	RB-41L/R
R-35L & R	Stop Line Left/Right	60 x 75	Rect.	RC-4L/R
R-56	Yield to Oncoming Traffic	90 x 120	Rect.	—
R-125	Right Lane Must Turn Right	60 x 75	Rect	—

Regulatory signs are the same for both temporary and permanent conditions. The above list contains the Regulatory signs most commonly required for temporary work zones and the following pages provide some usage details for the individual signs. Other Regulatory signs which may be applicable are contained in the “British Columbia Manual of Standard Traffic Signs” or the “Manual of Uniform Traffic Control Devices for Canada”.

Regulatory signs in the “R” category shall not be installed in work zones unless they are specifically called for in an approved Traffic Control Plan or unless otherwise approved by the road authority.

2.1.9 WARRANTS FOR INDIVIDUAL (R) SIGNS

R-1



R on W
Fl. Refl.

R-1 STOP
(60 x 60)

R-1T 4-WAY (3-WAY) TAB
(40 x 20)

R-1 signs may be required to assign right-of-way at temporary intersections. They should be mounted at approximately the same height and in approximately the same position as for permanent installations.

R-1T



B on W
Bgd. Refl.

Where all the approaches to a three or four leg temporary intersection are controlled by STOP signs, they should be supplemented with R-1T tabs indicating the number of approaches involved.

If a temporary STOP sign is not clearly visible for the safe stopping distance on the approach, a TW-11 STOP AHEAD sign is required. A TW-11 sign may also be needed if a STOP sign is to be installed at a location where drivers wouldn't normally expect to find one.

R-2



R on W
Fl. Refl.

R-2 YIELD
(30 x 30 x 30)

The YIELD sign may be used in temporary situations where the normal right-of-way rule cannot be applied safely but where a STOP sign would be overly restrictive. It shall not be used in place of an R-1 sign, however, at a right-angle intersection except for a free right turn movement. The YIELD sign should be mounted at approximately the same height and in approximately the same position as for permanent installations.

An example of usage for the R-2 sign would be at a temporary freeway on-ramp or other such one-way approach which merges with a through roadway at a small angle. If an acceleration lane of sufficient length exists for on-ramp traffic to reach the through roadway speed limit before entering a through lane, a TW-38 MERGE sign is used in place

R-3 MAXIMUM __ km/h AHEAD
(60 x 75) (90 x 120)

R-4 MAXIMUM __ km/h
(60 x 75) (90 x 120)

Mounted above C-22 CONSTRUCTION SPEED ZONE tabs, R-3 and R-4 signs implement a mandatory lower construction speed zone where the need for (and speed limit level of) such a zone has been established by the road authority.

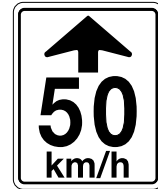
The R-4 and C-22 assembly, showing the approved speed limit, marks the start of the zone and is used for confirmation throughout. The R-3 and C-22 combination, showing the same speed limit, should be placed upstream of the zone start. Wherever possible on freeways and other one-way roadways, secondary assemblies should also be mounted on the median or left side.

A confirmatory R-4/C-22 assembly should be erected from 300 m to 600 m downstream of the zone start. Other confirmatory assemblies may be required beyond all intervening intersections and on-ramps and at other intermediate locations on long uninterrupted rural sections.

The 90 x 120 cm oversized versions of R-3 and R-4 signs are generally only used at the start of a construction speed zone where the reduction from the normal speed limit is 50 km/h or greater. Oversized R-3 and R-4 signs, however, may occasionally be used at other construction speed zone starts if additional emphasis is required. The standard sized 60 x 75 cm R-4 sign may be used for confirmation within the zone.

The end of a construction speed zone is indicated by an R-4 sign showing the normal maximum speed. If the end of a construction speed zone is coincident with the end of a work zone, the R-4 is preceded by a C-54 WORK ZONE ENDS sign.

R-3



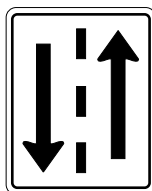
B on W
Bgd. Refl.

R-4



B on W
Bgd. Refl.

R-10



B on W
Bgd. Refl.

R-10 TWO-WAY TRAFFIC

(60 x 75)

Where a one-way roadway continues as half of a two lane two-way roadway, drivers must be warned in advance with W-20 signs. R-10 signs are required on both sides of the two lane two-way roadway at the point where the two-way section starts. Confirmatory R-10 signs should be installed approximately 1 km to 1.5 km along the two-way roadway, and beyond as considered necessary. Locations beyond access points should also be considered. Special care is required where one roadway of a divided facility is being used temporarily to carry two way traffic because, among other things, the pavement markings are not the correct colours.

The R-10 sign should be used at locations where a divided highway illusion may cause motorists to think they are on a one-way roadway, when in fact they are on a two lane two-way highway. Typical situations are construction sites where a two lane highway is being converted to an expressway or freeway; where grading for a full width expressway or freeway has been completed but only two lanes are operational; or on two lane highways following long sections of multilane divided highway.

R-12



B on W
Bgd. Refl.

R-12T



B on W
Bgd. Refl.

R-12 ROAD CLOSED

(75 x 60)

The R-12 sign is used to mark any roadway which has been temporarily closed to all public traffic for the purposes of construction or maintenance, or because of a temporary emergency condition such as high water or a slide. Barricades, as detailed in Section 2.2.2.5 should be used to close off the travelled roadway. An R-12 sign should be mounted on the highest rail of a barricade placed as close as possible to the centre of the travelled way.

R-12T LOCAL TRAFFIC ONLY TAB

(75 x 30)

The LOCAL TRAFFIC ONLY tab is used with the R-12 if access to private property is maintained for local traffic along the closed section. In such cases, barricades erected at the point of closure must have enough room left at one or both sides for local traffic to enter and leave the closed section safely.

The R-12T tab is erected immediately below or to the right of the R-12 sign.

R-14R



B on W
Bgd. Refl.

R-14L & R KEEP LEFT/RIGHT

(60 x 75)

In temporary situations, either of these signs may be used where traffic must be diverted from its normal path and there is no opportunity to use channelizing devices. Such situations can occur in the vicinity of intersections as shown in Figure 4.4.4.

TURN CONTROL SIGNS

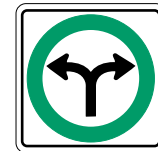
R-15L & R-18 NO LEFT/RIGHT TURN
TURN
 (All 60 x 60)

The signs shown here, which are employed in the Typical Traffic Control Layouts, represent a group known collectively as TURN CONTROL signs. In both permanent and temporary situations, they are used at intersections to indicate, to approaching traffic the turning or through movements which are either prohibited or allowed. The signs are normally post mounted at unsignalized intersections. At a signalized intersection they should be displayed in the vicinity of the applicable traffic signal heads.

TURN CONTROL signs apply to all traffic on an intersection approach. They should never be confused with, or substituted for LANE USE signs which regulate traffic in individual lanes.

R-15L

B & R on W
 R & W Refl.

R-18

B & G on W
 G & W Refl

R-20 NO PASSING FOR 150 m
 (60 x 45)

The R-20 NO PASSING FOR 150 m sign is only used immediately below TW-36 L&R TRUCK CROSSING/ENTRANCE LEFT/RIGHT AHEAD signs. The R-20 is not required where overtaking is already prohibited by a barrier line but should be used in locations where the pavement markings permit passing.

R-20

B on W
 Bgd Refl.

R-22 DO NOT PASS
 (60 x 60)

R-23 PASSING PERMITTED
 (60 x 60)

This pair of signs may be used on two or three lane two-way roads on a temporary basis in circumstances where it is necessary to reinforce barrier line markings, or where normally permitted passing should be prohibited due to construction activity.

When closing either the passing lane or the single lane on a three lane roadway at a point where passing is permitted in the single lane direction an R-22 sign is required at a minimum distance in advance of the closure as follows:

Approach Speed	Distance to Closure
50 km/h	80 m
60 km/h	100 m
70 km/h	120 m
80 km/h	140 m
90 km/h	165 m

The usual signs and other devices are required to mark lane closures and work zones.

If the section of road over which passing must be prohibited is of considerable length, one or more intermediate R-22 signs may be required.

An R-23 PASSING PERMITTED sign should always be used in conjunction with an R-22 sign to mark the end of the no passing zone. (i.e. Neither sign should be used without the other.)

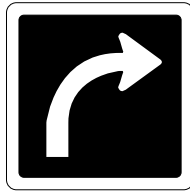
R-22

B & R on W
 R & W Refl.

R-23

B & G. on W
 G. & W. Refl.

R-33R



W on B
W Refl.

LANE USE SIGNS

R-33L & R THIS LANE TURN LEFT/RIGHT
(75 x 75)

The sign shown here, which is employed in the Typical Traffic Control Layouts, is one of a group known collectively as LANE USE signs. In both permanent and temporary situations, LANE USE signs may be used to control traffic approaching intersections. Unlike TURN CONTROL signs, they are placed in advance of intersections and their requirements apply only to specific lanes.

For short duration operations, LANE USE signs may be post mounted. For long duration work, LANE USE signs should either be post mounted or preferably mounted over the centre of the lane or lanes to which they apply.

R-35R



B on W
Bgd. Refl.

R-35L & R STOP LINE LEFT/RIGHT
(60 x 75)

These signs are only required at temporary traffic signal or temporary lane control signal installations where a stop line cannot be placed or where an installed stop line needs additional emphasis.

The R-35R sign is the one most commonly used and it should generally be post mounted at the intended stop location and to the right of approaching traffic. On a one-way roadway, or in other situations where more than one lane approaches the temporary signal from the same direction, an R-35L sign should be post mounted on the left side; if a secure location for it can be found. When properly located, the arrows on R-35 signs always point inward towards the travelled roadway.

R-56



B & R on W
R & W Refl.

R-56 YIELD TO ONCOMING TRAFFIC
(90 x 120)

The R-56 sign is used with temporary warning-type signs, such as C-24 SINGLE LANE TRAFFIC or TW-51/TW-51T ONE LANE STRUCTURE, to control a single lane traffic section on a roadway which is principally or usually a two lane two-way facility. It must only be displayed for one direction and must only be used where adequate sight distance, low traffic volumes and low speeds render the use of TCPs, temporary traffic signals, or temporary lane control signals unnecessary.

The R-56 sign shall also be used on the rear of a work vehicle involved in Continuously Slow Moving Work on a two lane two-way roadway.

R-125



B on W
Bgd. Refl.

R-125 RIGHT LANE MUST TURN RIGHT
(60 x 75)

This sign may be used instead of the R-33R THIS LANE TURN RIGHT sign if a suitable location cannot be found to display the latter.

2.2 OTHER DEVICES

2.2.1 TEMPORARY PAVEMENT MARKINGS

Sometimes permanent pavement markings must be destroyed or covered by work such as paving, sealcoating, milling, crack sealing, etc. Where it is not practical to replace the permanent markings the same day, some form of temporary delineation must be provided. Under this condition **every effort should be made, road and weather conditions permitting, to install temporary road markings the same day. If this cannot be done, some type of raised channelization devices must be installed.** First priority should be given to directional dividing lines and second priority to lane lines and other markings. If work is progressing rapidly it may be desirable to install temporary pavement markings periodically throughout the day.

Temporary markings may consist of paint with glass bead, preformed adhesive backed tape, road studs, “L” shaped flexible reflectorized markers etc. A marking of a type which will necessitate pavement damage by its removal should not be used on a final pavement lift. The “L” shaped flexible markers are the only practical marking for sealcoating work and milled pavement; attaching with nails if necessary on rough surfaces. Where for any reason temporary markings cannot be installed, temporary delineation devices should be used, at least to separate traffic travelling in opposite directions, although this may reduce passing opportunities.

Particular care should be taken where crack sealing on centreline may destroy the effectiveness of a barrier line. Use of R-22 and R-23 signs may be considered in such cases.

Use of R-22 and R-23 signs may also be considered in a situation where it is felt that the no passing intention of double yellow temporary directional dividing line may not be sufficiently clear or the consequence of a misunderstanding may be particularly serious.

If it is evident that conflict between permanent and temporary pavement markings or channelizing devices will confuse drivers, the permanent markings will have to be removed. It should be kept in mind that on some pavement surfaces permanent markings which have been effectively removed for dry daylight conditions may under wet conditions still appear to be in place. If this condition is anticipated or found to exist, use of raised pavement markers or special delineation may be required.

Whenever possible, temporary pavement markings should be in place before traffic is moved from its previous path. If this is not feasible, for example; with frequent redirection of traffic paths or where traffic must proceed through surfacing projects without the aid of TCPs or pilot cars, temporary delineation may be accomplished with cones or other channelizing devices.

On sand or gravel (chip) sealcoated surfaces, temporary or permanent pavement markings should be installed as soon as the excess sand or gravel has been removed.

2.2.1 TEMPORARY PAVEMENT MARKINGS *(continued)*

Where the normal limit is 70 km/h or greater and temporary measures as previously described are not possible or may not, by themselves, be considered to provide adequate safety, it may be necessary to establish a construction speed zone. See Section 1.4.6 for application of construction speed zones. A construction speed zone may be required 24 hours a day, only while work is in progress, or only when work is not in progress. An example of where it may only be required when work is not in progress would be a site controlled during construction hours by TCPs or pilot cars.

Temporary directional dividing lines, and lane lines formed with paint or plastic should be approximately 10 cm wide, at least 50 cm long, and separated by gaps not exceeding 8 m. Two yellow markings side by side and approximately 10 cm apart are required wherever passing is prohibited in either direction. Stop lines should be approximately 30 cm wide and pavement arrows at least one third the size of standard arrows.

Raised plastic devices such as reflective road studs or “L” shaped flexible reflectorized markers, etc., may be used to supplement or be used in place of temporary pavement markings. Where used supplementally, these raised devices should be installed immediately downstream of every fourth 50 cm dash or approximately 26 m apart. When used without temporary pavement markings, they should also be installed approximately every 26 m. Regardless of the above maximum spacing, raised markers should be installed frequently enough so that a minimum of four individual markers of four pairs of side-by-side markers are visible from any given point. In most circumstances, these devices are more effective than temporary marking tape; particularly, through changes in horizontal or vertical alignment, in areas where speeds and/or volumes are high and where adverse weather conditions (such as fog or rain) might reasonably be expected in hours of darkness.

Temporary pavement markings and raised marking devices must be reflectorized and display the same colour by night as by day. They must also be the same colour as the permanent markings which they replace.

2.2.2 CHANNELIZING DEVICES – GENERAL

Channelizing devices are used to direct traffic away from, through or around a work area and may also be employed to separate traffic travelling in opposite directions.

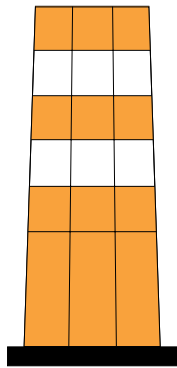
Several types of channelizing devices, such as barriers, barricades, temporary delineator posts, traffic cones, tubular markers and flexible drums, are detailed below. In case they are struck by errant vehicles, the devices themselves must be less hazardous than the hazards they mark.

The minimum reflectorization requirements are specified in this section for channelizing devices used at night.

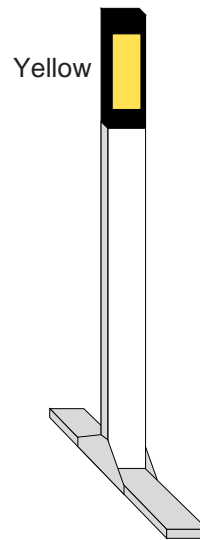
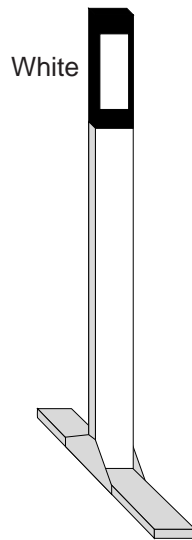
2.2.2 CHANNELING DEVICES – GENERAL *(continued)*

Because they are easily knocked down, displaced or blown over, some channelizing devices need extra weight to keep them in place. Sand bags or lead impregnated plastic collars may be used but solid materials, such as rock, concrete, etc., are not acceptable for this purpose. Extra weights should be placed at the base of devices to provide maximum stability and to avoid the weights becoming projectiles in the event of a collision. Extra weights should be placed in a way that does not reduce the effectiveness of devices.

2.2.2.1 Channelizing Devices at a Glance



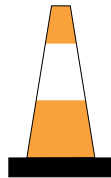
Flexible Drum



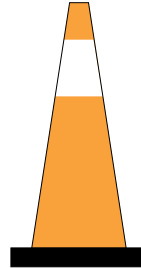
Temporary Delineator Posts



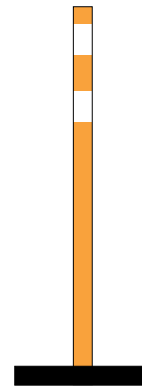
15 cm Cone
Type A



45 cm Cone
Type B



70 cm Cone
Type C



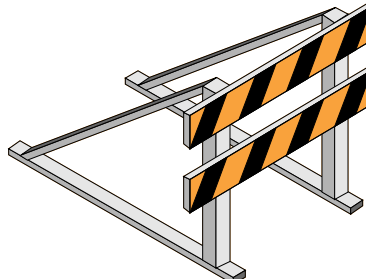
100 cm Tubular Marker
Type D



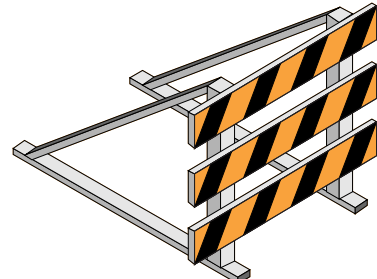
Class 1A
Barricade
W on Or.
Fl. Refl.



Class 1
Barricade
Or. on B
Or. Refl.



Class 2
Barricade
Or. on B
Or. Refl.



Class 3
Barricade
Or. on B
Or. Refl.

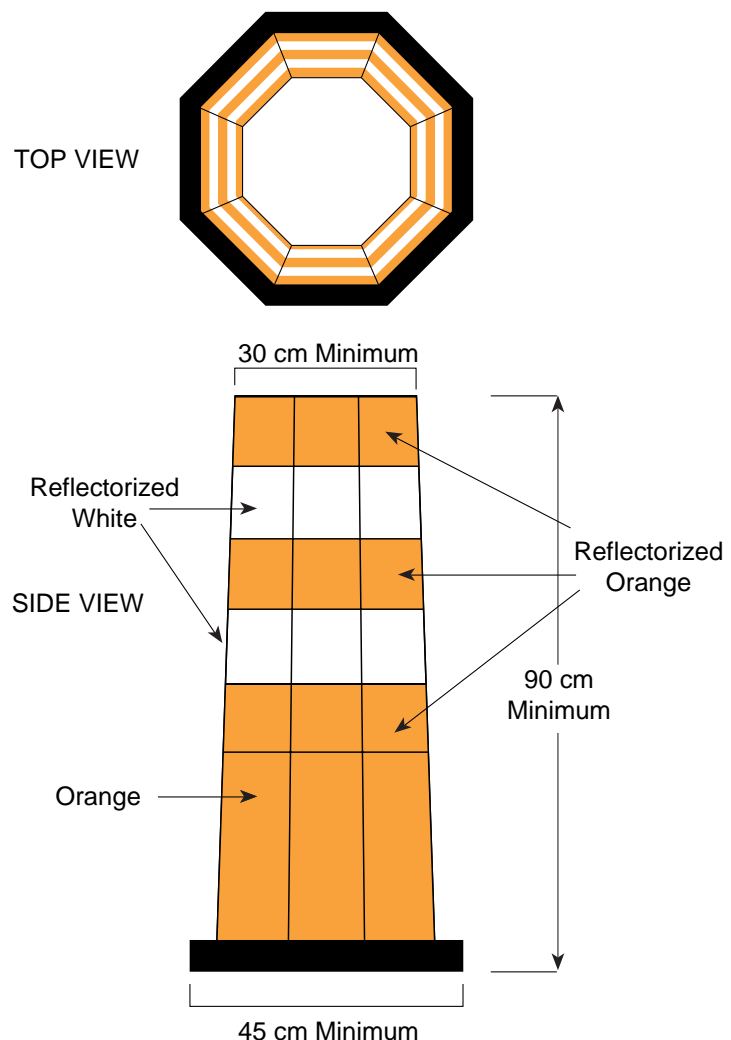
2.2.2.2 Flexible Drums

Flexible drums (hereafter referred to as drums) are used as channelizing devices. They are highly visible, and because they appear to be solid, they command the respect of drivers.

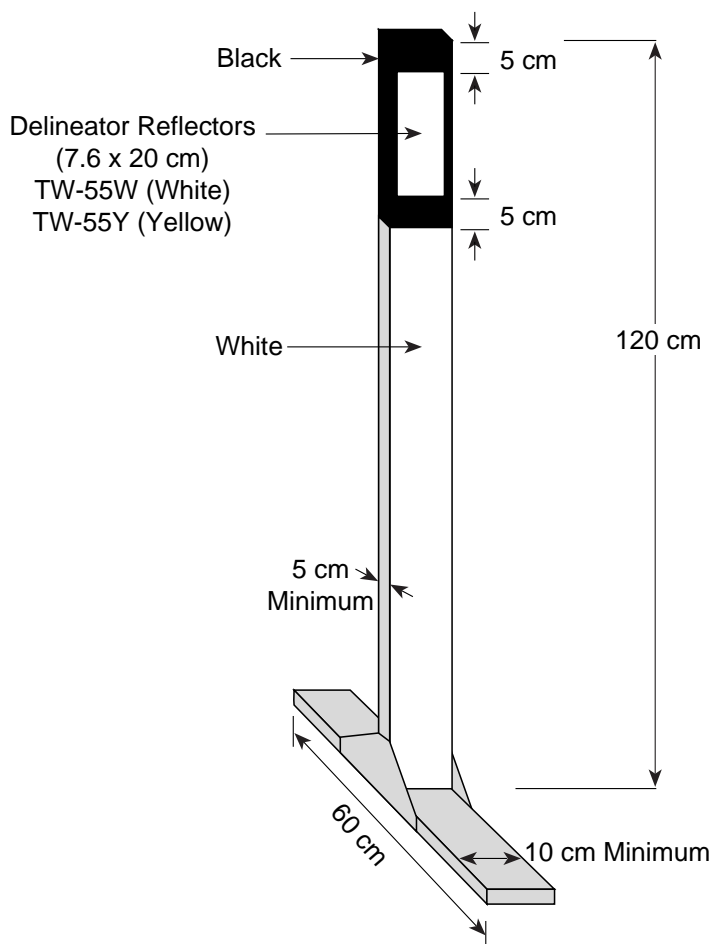
As shown below, drums are predominantly orange. They are generally at least 90 cm tall, a minimum of 45 cm in diameter at the base and a minimum of 30 cm at the top.

For nighttime use drums are reflectorized by application of alternating horizontal orange and white reflectorized bands. There should be a minimum of two white and three orange bands, each a minimum of 10 cm deep, spread between the top and bottom of the device.

The tapered design of the drums allows them to be stacked for easier transportation and storage. Many of the commercially available models have one or more flat sides to preclude rolling. Some are designed to hold flashing yellow lights on top. If extra weights in the form of sand bags are required, they should be added at the base of the drums.



2.2.2.3 Temporary Delineator Posts (TDPs)

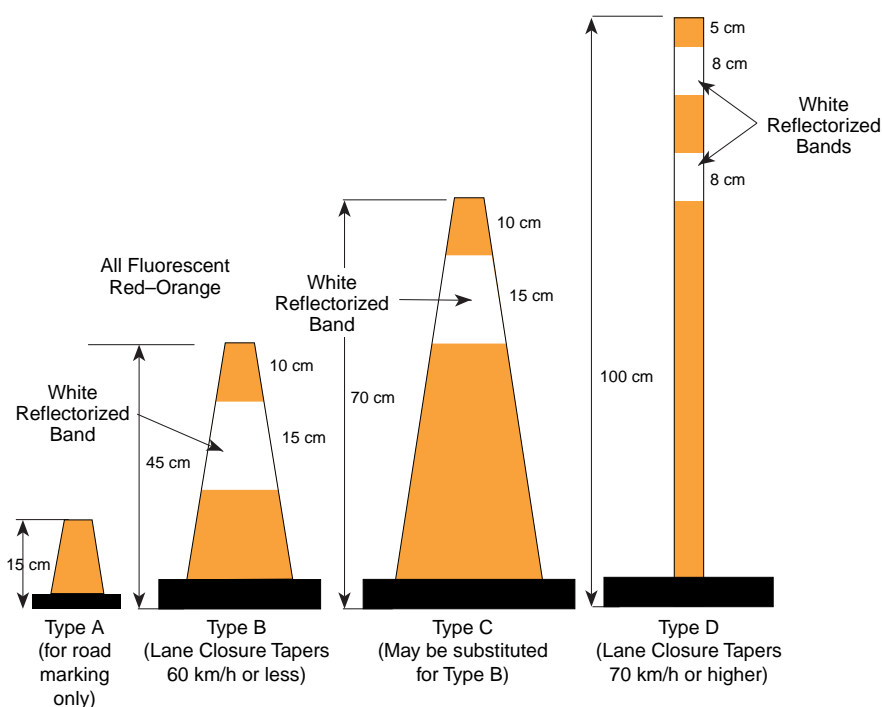


Temporary delineator posts (TDPs) are used to channelize traffic, to separate opposing lanes, to separate lanes of same direction traffic and for outlining work areas. Particularly at night, their use for these purposes may be preferred over Type B or C traffic cones, due to the narrow design and the additional height.

TDPs are generally constructed as shown above with post tops 1.2 m above the edge of the travelled roadway. They may be of the portable type, held down by sandbags placed on the base supports or they may be dug or driven into a roadway or shoulder provided that the standard display height is maintained. As with other channelizing devices, several TDPs should be visible at any one time in any application. Spacing in tapers should therefore be as shown for cones in Tables A and B.

Temporary delineator posts display TW-55 Reflectors of the same colour as the pavement markings they supplement or replace. That is, TW-55W (White) Reflectors are used for right lane edges and (same direction) lane lines and TW-55Y (Yellow) Reflectors separate opposing lanes of traffic and mark the left edge of one-way roadways. Where TDPs separate opposing lanes of traffic, they have yellow reflectors on both approach faces.

2.2.2.4 Traffic Cones and Tubular Markers



Traffic Cones

Cones are lightweight, flexible channelization/delineation devices. They are used primarily for daylight operations but may be used at night if equipped with reflectorized bands as shown above. Cones used at night may be augmented by Type A Flashing Yellow Lights.

To increase cone stability, rubber or sand collars or specially weighted bases may be used. Cones are easy to place and remove and they can be nested for storage and transportation.

Excluding tubular markers, which are considered separately, cones are divided by size and usage into three types:

Type A cones are only used to protect freshly applied pavement markings during the drying process.

Type B cones are the type most commonly employed in traffic control. They are used to delineate work areas and specific hazards in or adjacent to the travel path. Using the dimensions 1b* in Table A, these cones may also be used to form the shorter tapers required for shoulder work or for travelled lanes when traffic is controlled by TCPs, portable lane control signals or temporary traffic signals. If the speed limit is 60 km/h or less and traffic is not under stop and go control Type B cones may be used for full lane closure tapers using dimensions 1a* and 2* from Tables A and B respectively. Regardless, in these lower speed zones, at the discretion of the road authority, smaller 30 cm cones may be substituted for Type B cones in any application.

Type C cones may be substituted for Type B cones in any application where the additional height would be advantageous; provided stability of the higher cones, in those applications, is reasonably assured.

2.2.2.4 TRAFFIC CONES & TUBULAR MARKERS (continued)

As traffic cones cause little or no damage when hit, drivers tend not to respect them as much as other delineation and channelization devices. Consequently, even weighted cones will need to be checked more often for correct positioning.

Tubular Markers

Tubular markers are similar to cones in that they are lightweight and easy to place and remove. They may be set in special weighted bases or fastened directly to the pavement. Due to their increased height and narrow width, tubular markers are particularly suited to delineating traffic lanes or separating two-way traffic for short duration work. For convenience, tubular markers are included in the cone series as Type D.

Tubular markers should be at least 100 cm high. They are principally daytime devices but may be used at night if equipped with reflective bands as shown above.

Tubular markers may replace Type B and Type C cones in any of their applications; provided reasonable stability is assured. They shall be used in place of the lower cones, however, for full lane closure tapers where the speed limit is 70 km/h or higher and traffic is not under stop and go control.

Above are the minimum standards with respect to size, reflectorization and usage for traffic cones and tubular markers. Larger or higher versions of the devices may always be used in place of smaller ones provided the oversized applications are consistent.

Secondary Devices

Where required to increase visibility, secondary devices made of lightweight materials and approved by the road authority may be attached to the tops of devices contained in this section, provided the additions do not significantly decrease stability of the primary devices or increase their hazard potential.

Reflective Sheeting for Cones and Markers

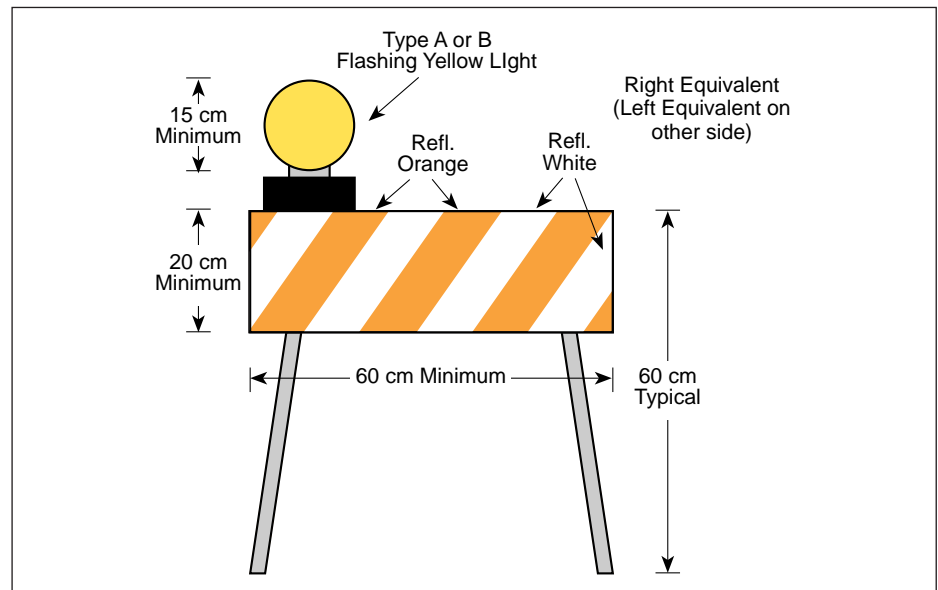
The road authority may specify the level of reflective sheeting that shall be used on traffic cones, tubular markers and temporary delineators, but as a minimum all white sheeting on these devices shall be “enclosed lens sheeting” (engineering grade).

All white sign sheeting material for traffic cones, tubular markers and temporary delineators used for works on provincial highways must meet CGSB Standard 62-GP-11M. Level 1, “encapsulated lens reflective sheeting (“High Intensity”) unless otherwise specified by the Chief Highway Engineer.

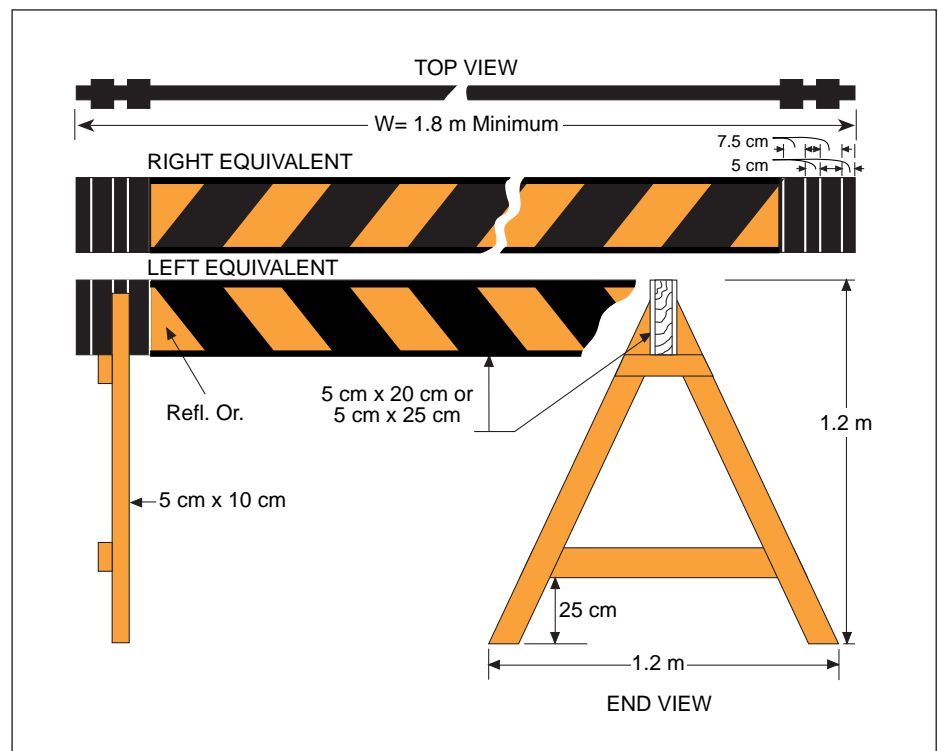
2.2.2.5 Barricades

Barricades are highly visible, relatively frangible warning devices which are used, in a variety of circumstances, to mark areas into which most public traffic is not intended to proceed. Barricades, not to be confused with temporary concrete barriers, are categorized as Class 1A, 1, 2 and 3; each with their own particular applications. Illustrations of typical barricades are shown in the following diagrams:

CLASS 1 A

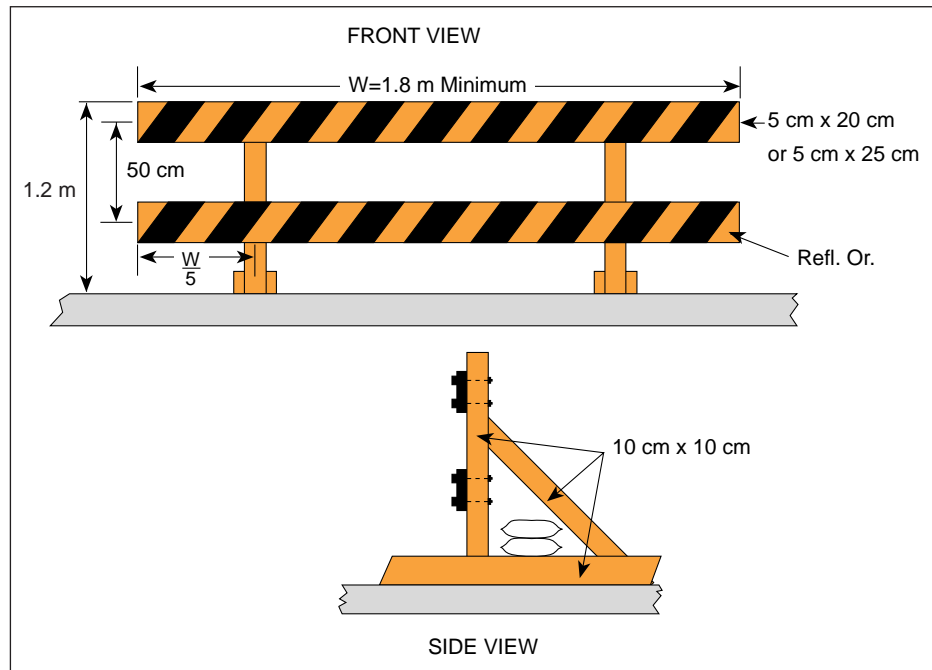


CLASS 1

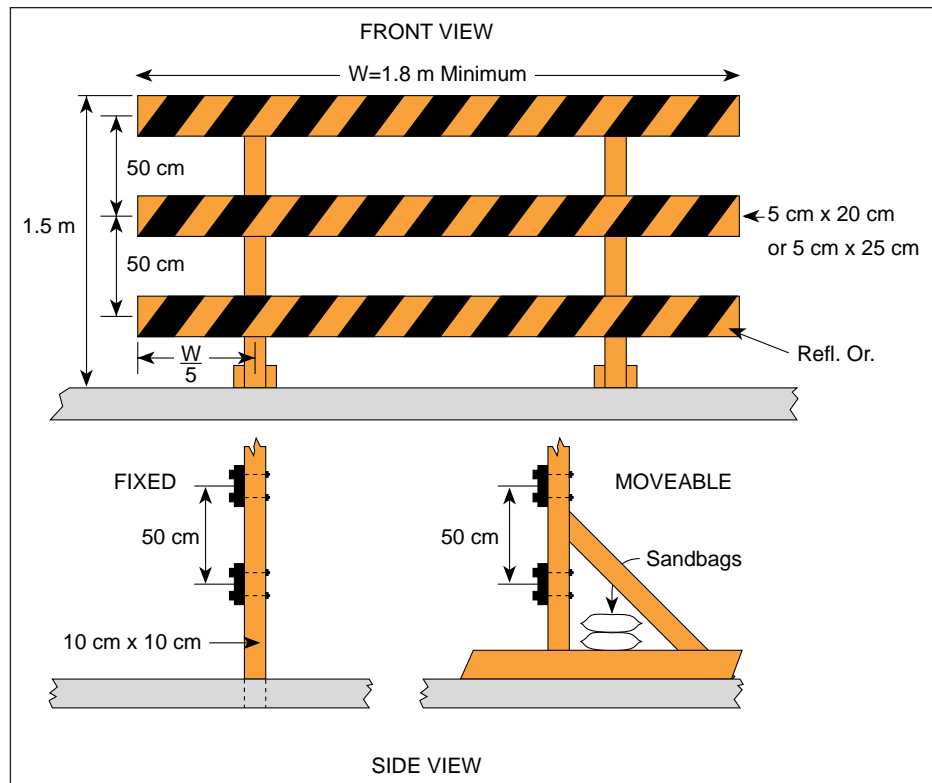


2.2.2.5 BARRICADES (continued)

CLASS 2 (right equivalent)



CLASS 3 (right equivalent)



2.2.2.5 BARRICADES (continued)

Barricades are divided into Classes 1A, 1, 2 and 3. The numerals indicate the number of rails involved. Class 1 and 1A barricades are generally used for marking temporary hazards, delineating areas temporarily closed to traffic and for channelizing vehicles and pedestrians. Class 2 barricades are used for temporary closure of roads of moderate importance and for closures and channelization which, while temporary, is of several days duration. Class 3 barricades are used for permanent closures and more significant temporary closures. If required, a higher class of barricade can be substituted for a lower one in most applications.

C-3, C-3L and C-3R BARRICADE REFLECTORS, detailed in Section 2.1.5, are generally used to make the rails for Class 1, 2 and 3 barricades. For Class 1 and 1A barricades, the left and right equivalents are often made on the opposite sides of the same rail so that both are readily available at the same location. When barricades are used for channelization, reflectors should slope downward towards the side on which traffic is to pass. For a total closure the reflectors should slope down towards the centre of the barricade. If Class 1 or 1A barricades are used to separate opposing lanes of traffic, both sides of the rails should be made as left equivalents.

Class 1, 2 and 3 barricades can also be used as sign supports. Where warranted such signs as R-12 ROAD CLOSED, R-12T LOCAL TRAFFIC ONLY and C-5L or R DETOUR markers may be attached to the (highest) barricade rail.

Class 1A barricades are normally provided with Type A flashing yellow lights for use at night. All barricades, however, can be equipped with Type A or B flashing or Type C steady burn yellow lights to warn of individual hazards, road closures, lane closure tapers, transitions and closed off areas. When used in a series, Type A and B flashing yellow lights should not normally be mixed.

Where required, the stability of portable barricades can be enhanced with the use of sandbags provided they are placed on or close to the barricade bases.

2.2.2.6 Concrete Barriers

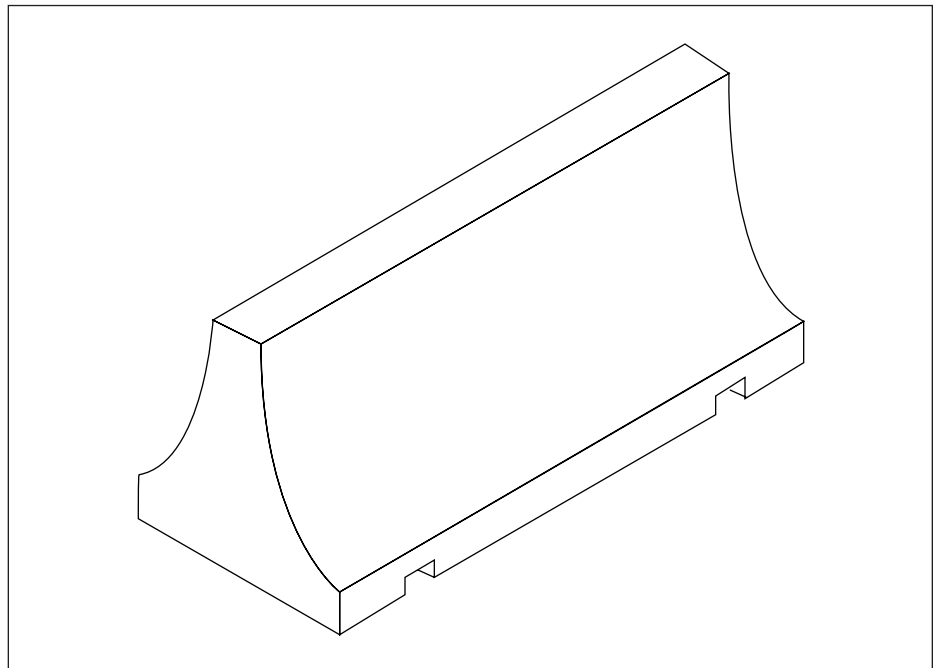
The terms “barrier” and “barricade” are often confused. Barricades, as discussed previously, are relatively frangible devices, normally placed at or near right-angles to approaching traffic, that provide visual identification of hazardous locations or delineate travel paths and are relatively forgiving of errant vehicles. On the other hand, barriers are normally placed parallel or near parallel to approaching traffic. They are solid, continuous installations designed to deflect errant vehicles, at a small angle, that might otherwise enter a closed or hazardous area.

Individual, unconnected sections of barrier are generally not used due to the number of exposed ends and gaps through which vehicles could pass. If it is necessary to have a break in a barrier installation, for access to a work area, then the downstream portion should be offset laterally away from the travelled path and overlapped by extending the upstream portion downstream of the gap. Unlike barricades, barriers are not normally installed at or near right-angles in higher speed zones where they could be severely impacted by errant vehicles.

The design of sectional, precast, concrete barriers used to temporarily separate or delineate traffic is the same as for permanent barrier installations.

Where required, concrete barriers are most commonly used in long duration (but still temporary) work zones to:

- Protect workers.
- Separate motorists from potentially hazardous objects and areas in work zones.



2.2.2.6 CONCRETE BARRIERS *(continued)*

- Separate opposing lanes of traffic where barricades or other delineation devices are not considered adequate.
- Reinforce other channelizing devices in lane closure tapers or other areas where public traffic cannot be allowed to enter.

Barriers are designed to contain and redirect errant vehicles. They are generally precast in sections with connecting devices strong enough to ensure that installations act as smooth continuous barriers. For some applications, it may be necessary to anchor the barrier sections to prevent lateral movement if hit by vehicles. This can be accomplished with drift pins or anchor bolts firmly attached to the road surface.

Barriers used as channelizing devices should be light in colour, to aid visibility, and equipped with delineators/ barricade reflectors, barrier reflectors and/or Type A, B or C yellow lights. If room is available, a solid lane edge line may be installed to indicate shying distance. When used in lane closure situations, as well as the above requirements, barriers shall be preceded by devices placed for a standard lane closure taper.

If the exposed approach end of a barrier cannot be flared away from the intended travel path, it should be protected with attenuation (crash cushion) devices. Connections to any existing barriers or guardrails should be smooth and should not create weak points.

The details for barrier installations should be contained in traffic control plans. Further information on locating and designing temporary concrete barrier installations is available in the Ministry's Design Manual.

2.2.3 LIGHTING DEVICES

2.2.3.1 Yellow Warning Lights

Other than warning lights on vehicles, flashing arrow boards and overhead flashing beacons, which are all considered later, the following three types of yellow lights are commonly used for warning in temporary conditions:

Type A. (Low Intensity Flashing Yellow Lights).

These lights are portable, 6 V battery-operated, normally with a photo-electric switch and with two lenses to provide bi-directional light. They are often used at night to supplement warning signs and channelizing or taper devices such as barriers, barricades (particularly Class 1A) and flexible drums. They may also be used for marking specific hazards and for outlining long duration work areas. Type A lights should be visible for at least 900 m under clear night time conditions. All types of battery-operated flashing yellow lights should be attached firmly to the devices supplemented so as not to fly loose in the event of a collision.

Type A. Modified (Medium Intensity Flashing Yellow Lights).

Modified Type A lights have been re-wired for 12 V operation; mainly for daytime use. As these units have two 6 V batteries wired in series, they will consume more power than Type A's and batteries will require more frequent checking. They have manual switches, one reflector and one lens to provide uni-directional light. They should be visible for at least 300 m in normal daylight conditions. They can be used in place of Type B lights, or flags, for daytime work; particularly in conjunction with C-38 and C-41 signs on portable stands.

Type B. (High Intensity Flashing Yellow Lights).

These lights are also intended for daytime use but, as they are powered by 12 V vehicle-sized batteries, they are quite heavy, compared to Modified Type A's, and not generally suited for some applications such as top-mounting on portable sign stands. They also have manual switches, one reflector and one lens to provide uni-directional light. They are best suited for use on or with heavier channelization devices such as Class 2 or 3 barricades or concrete barriers or they may be used to mark obstructions. Type B lights should be visible for at least 300 m in normal daylight conditions. Flags may be substituted for Type B (or Modified Type A) lights in daytime applications.

Type B (or Modified Type A) lights may occasionally be required at night, in place of Type A lights, if additional emphasis is required. When used in a series, Type A, Modified Type A and Type B flashing yellow lights should not normally be mixed.

Type C. (Steady Burn Low Wattage Yellow Lights).

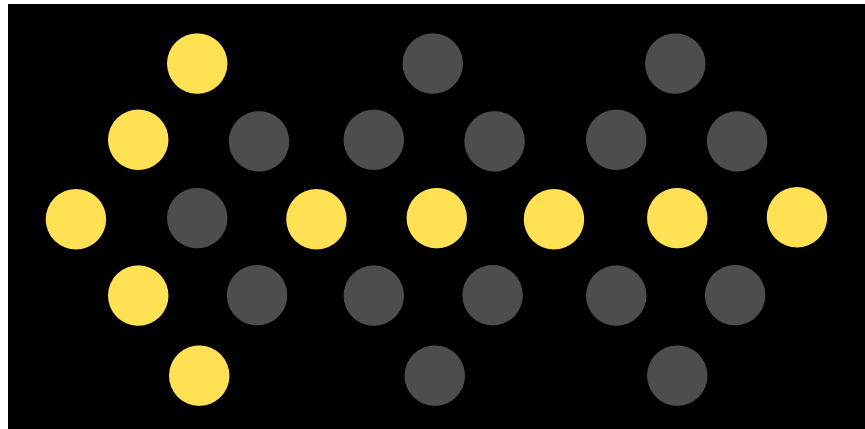
These lights are 110 volt powered and are displayed in strings. They may be used at night to supplement channelization or lane closure taper devices. They may also be used to delineate a work area or to run along the edge of a closed lane or shoulder; particularly where floodlighting or normal street lighting is also in place. Steady burn yellow lights should be visible for at least 900 m under normal night-time conditions.

2.2.3.2 Flashing Vehicle Lights

As potential hazards to public traffic, all work, buffer and shadow vehicles stationed in or near travelled lanes must be equipped with flashing yellow lights. As a minimum, these should consist of standard vehicle equipment of 4-way (emergency) flashers and a 360 degree rotating yellow light. Although this latter device does not actually flash, it appears to do so when viewed from any given point.

The 360 degree flashing yellow lights (FYs) and 4-way flashers should be employed in a work area whenever a vehicle is so positioned that it could influence public traffic.

2.2.3.3 Flashing Arrow Boards (FABs)



Flashing arrow boards (FABs) are traffic signs with a matrix of lights which can be flashed in unison or in sequential displays. They are very effective both day and night. FAB is possibly a misnomer for this device as it can show both directional arrows and non-directional displays. The FAB term is used for convenience.

The main purpose of FABs, on multilane roadways, is to direct traffic from a closed lane to another available lane; using appropriate arrow indications. In this mode, they can be used for static or moving operations. But FABs can also be used without directional indication in place of or in addition to 4-way flashers and 360s, to give a more visible warning display that work is in progress.

FABs can be mounted on trucks or trailers for both stationary and moving operations.

There are two kinds of FABs; flashing and sequencing. Both kinds have three basic operating modes:

- Left arrow.
- Right arrow.
- Warning mode with four or more lamps arranged in a pattern which does not indicate a direction.

Normally only one arrow head is displayed at a time.

Sequencing arrow panels have several arrowheads that flash in a series, directing traffic to the right or left.

2.2.3.3 FLASHING ARROW BOARDS (continued)

The flash rate should be between 25 and 40 flashes per minute. The minimum lamp “on time” should be 50 percent for the flashing arrow and 25 percent for the sequential Chevron.

The minimum recommended sizes for arrow panels are as follows:

Type	Minimum Size	Minimum Number of Panel Lamps	Minimum Legibility	Speed Limit
A	90 cm x 45 cm	9	600 m	≤50 km/h
B	120 cm x 60 cm	12	800 m	≤60 km/h
C	150 cm x 75 cm	15	1000 m	≥70 km/h

Type A FABs may also be used on larger type utility vehicles, where type B or C FABs can not be physically accommodated for short duration work in speed zones higher than 50 km/h on non-freeway roadways.

With smaller FABs special consideration should be given to the light intensity and mounting height to ensure the FAB sign is conspicuous to approaching motorists and that, particularly for lane closures, the arrow shape is retained.

THE FLASHING OR SEQUENCING ARROW MODES SHOULD NOT BE USED UNDER THE FOLLOWING CONDITIONS:

- When the location of the work does not require any lanes to be closed.
- When all of the work is on or outside the shoulder and there is no interference which requires the adjacent travelled lane to be closed.
- When a traffic control person is controlling traffic on a normally two lane, two-way road.

Use of the arrow modes in the above conditions will lead to the loss of credibility when the arrow mode is correctly used for lane closures or moving operations on multilane roadways.

The FAB in warning mode may be used for stationary or moving work on the travelled roadway or shoulder and possibly in conjunction with other devices such as signs, channelizing devices and regular flashing vehicle lights.

As large arrow boards can be seen from 1 km away, they are especially effective in high volume or high speed areas and for moving operations either on work or shadow vehicles. For night use, arrow boards should be equipped with both an automatic and manual dimming device, capable of 50 percent dimming. FABs that are used at night should be checked to ensure that the devices are properly dimmed, otherwise motorists may be temporarily blinded. Circular hoods are recommended around each of the lenses to prevent side distraction at night.

Fibre optic boards may be substituted for bulbs, provided the minimum legibility distance and size of board is maintained.

It is recommended that FABs be displayed a minimum of 1.5 m above the roadway surface.

2.2.3.4 Overhead Flashing Beacons

Temporary overhead flashing yellow beacons may be used in work zones, both day and night, to warn drivers of such potential hazards as active truck entrances, and haul road intersections. In special circumstances, flashing red beacons may be required to emphasize an otherwise unexpected temporary stop requirement.

Flashing beacons may only be installed with the approval of the road authority. They have the same meaning as their permanently installed counterparts and are not to be used for channelization.

2.2.3.5 Floodlights

Floodlights may be used at night to illuminate work areas, TCP stations and other potentially hazardous locations when other roadway lighting is not considered adequate or does not exist. Floodlights should be shielded or positioned to prevent glare. Floodlighting of some areas may decrease relative visibility in other areas and it may be necessary to provide other devices, such as strings of Type C steady burn yellow lights to define intended vehicular paths.

Area floodlighting should not be considered as adequate illumination for signs or other devices which must be reflectorized or provided with individual light sources during hours of darkness.

Consideration may also be given to the temporary installation of luminaires at key locations in long duration work zones such as transitions and important intersections.

2.2.4 SHADOW VEHICLES

Shadow vehicles may be required by the road authority, as mobile advance warning devices, for continuously slow moving operations where a work vehicle blocks or encroaches into a travelled lane and that lane has not been closed to traffic. Such operations include pavement marking, hydroseeding, sweeping, flushing and possibly mowing, as shown in the Typical Traffic Control Layouts for short duration work.

Factors involved in determining the need for a shadow vehicle include exposure of workers to traffic, the speed of traffic relative to the speed of the work vehicle, traffic volumes, the type of roadway, shoulder width alignment, sight distance and weather conditions. Regardless, a shadow vehicle or TCP is required, on a higher speed rural road, if a work vehicle may block or encroach into a travelled lane and if the available sight distance is not equal to or greater than the following minimum safe stopping distances (SSDs):

Maximum Speed (km/h)	Reaction Distance (m)	Braking Distance (m)	SSD (m)
60	50	20	70
70	59	28	87
80	66	36	102
90	75	46	121
100	84	57	141
110	92	69	161

The above distances are based on a perception/reaction time of three seconds and a 0.7 coefficient of friction for dry, level pavement.

Unlike buffer vehicles, shadow vehicles are not used to block travelled lanes. As far as possible, they should be positioned on the shoulder and upstream of the work vehicle (or any vehicles held up behind the work vehicle) by a distance of at least 4* from Table A or B. For horizontal and vertical curves, the advance distance should be adjusted accordingly so that the shadow vehicle is clearly visible to traffic approaching the curves.

Shadow vehicles shall be equipped with an appropriate rear-facing sign such as C-45 SLOW VEHICLE AHEAD and either a FAB or a 360 degree flashing yellow light and 4-way flashers. If a FAB is used on a two lane two-way roadway, it shall only show a non-directional warning display. A FAB shall never display an arrow directing traffic into a lane which could be occupied by opposing traffic.

In a few situations, such as the reverse removal of cones from within a closed lane on multilane roadways, vehicles may serve as both buffer and shadow vehicles.

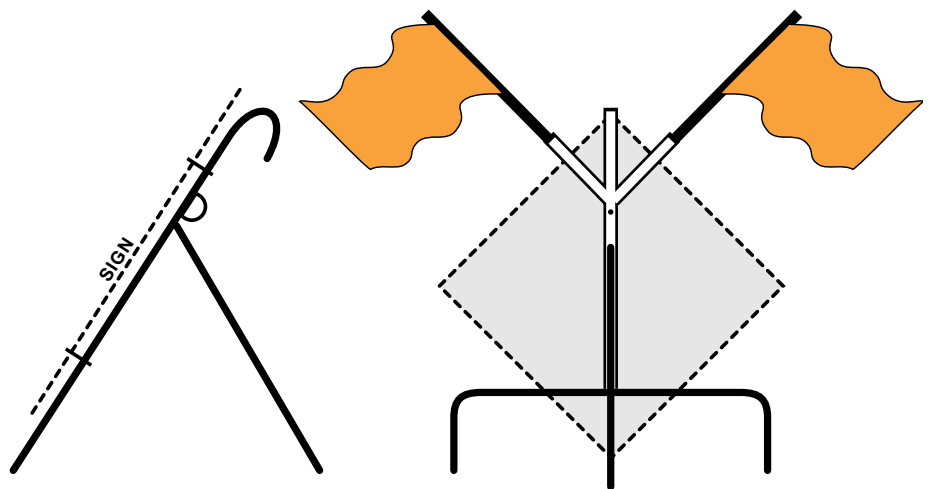
The operators of the shadow vehicle and work vehicle must be in radio contact.

2.2.5 BUFFER VEHICLES

Where necessary to protect workers from errant vehicles in a closed off active work area, a buffer vehicle may be parked in the work area and upstream of the workers.

Buffer vehicles shall be equipped with either a FAB or a 360 degree flashing yellow light and 4-way flashers. (The same restriction on FAB displays for two lane two-way roadways, as specified for shadow vehicles, applies.) Buffer vehicles may also be equipped with portable rear-mounted crash attenuators to reduce the effect of a collision.

2.2.6 TEMPORARY SIGN SUPPORTS

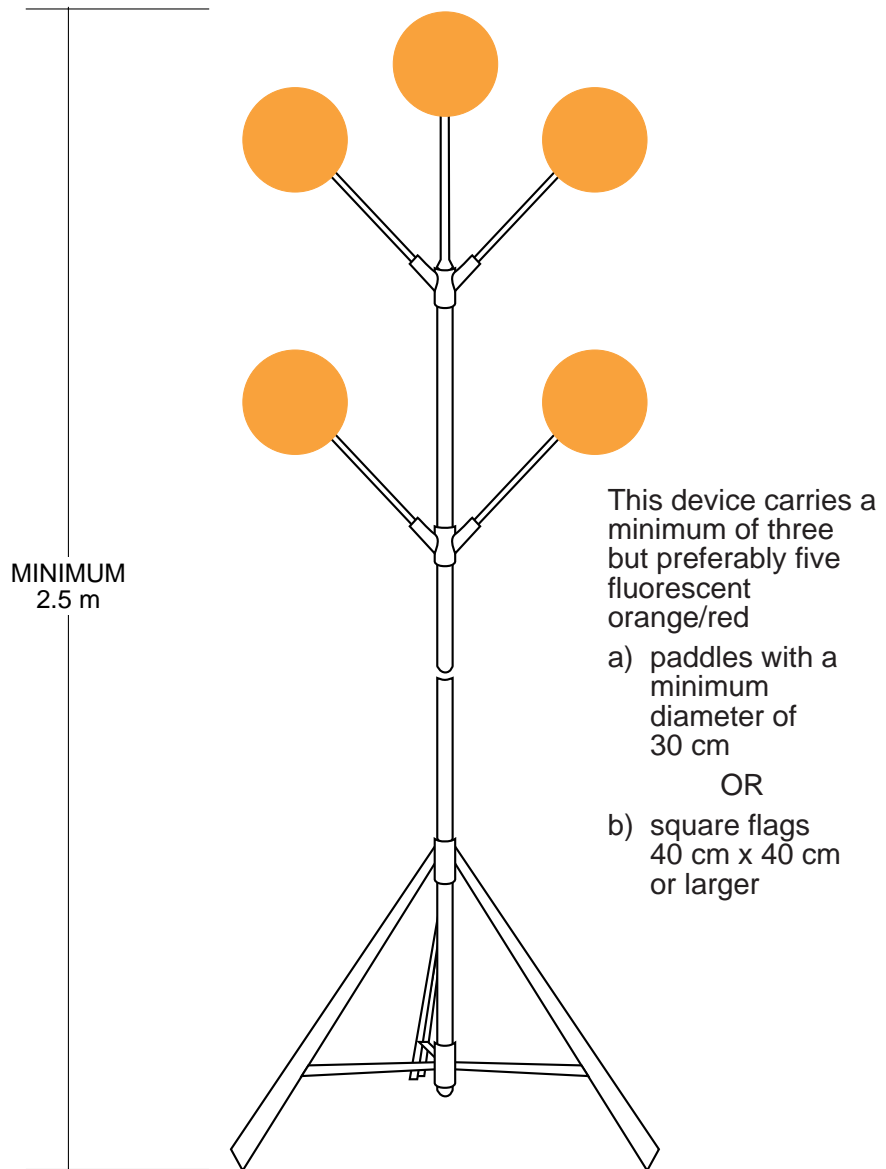


Only one of the many different types of temporary sign supports is illustrated here. The one shown has the advantages of reasonable stability (with the sign firmly attached) and a hook handle to allow hanging from a truck box. The handle, however, will deface other sign faces if mounted signs are stacked. The common features of temporary sign supports should be stability and portability. Stands which allow signs to be displayed with the bottom edges at least 30 cm above the roadway are preferred and stands with two flag holders must be available when required.

Temporary supports are used when signs are required only for short periods, intermittently or when they must be moved periodically. Signs which are required at static locations throughout long duration work shall be post mounted.

Whenever temporary signs and stands are not required, they must be removed completely from travelled roadways and shoulders available to public traffic. The practices of turning signs sideways or laying them down on the shoulder should be discouraged. In these positions, the unused signs and stands are hard to see and become unnecessary hazards for vehicles and pedestrians.

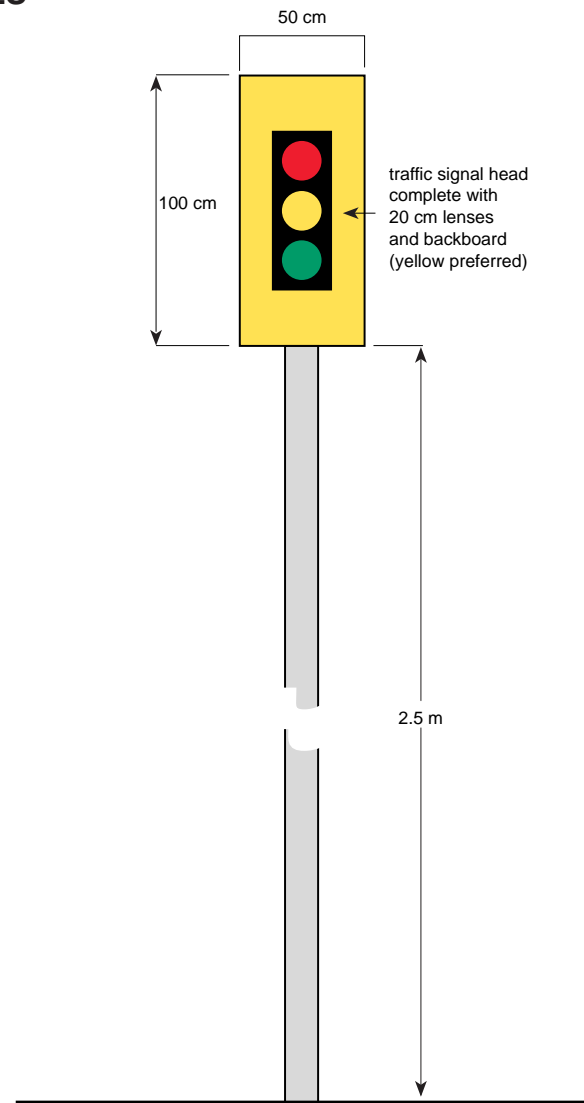
2.2.7 HIGH LEVEL WARNING DEVICES (HLWDs)



HLWDs are tall portable stands with fluorescent paddles or flags that are visible above traffic and parked cars. They are used only in daylight hours and most often in urban areas; especially where there is insufficient distance to erect all the usual warning signs in advance of work areas. HLWDs may also be used in rural areas to emphasize advance warning signs which could be quite remote from moving work areas and they may be used in work areas where no vehicles are present.

HLWDs may also have signs and Type B flashing yellow lights. Stability in wind and higher speed traffic can be a problem due to the height and the addition of other devices. It is therefore recommended that stability be increased by the use of sandbags on the bases.

2.2.8 TEMPORARY LANE CONTROL SIGNALS



2.2.8.1 General

Temporary lane control signal systems may be used in place of TCPs, in short duration work zones, to control sections of alternating one-way traffic on normally two-way roadways. Systems are generally radio controlled, battery-operated and consist of a “master” (transmitter) unit at one end and a “slave” (receiver only) unit at the other. Each unit should display at least one three colour signal head with backboard, as illustrated.

Temporary lane control signal systems must be equipped with a conflict monitor and shall have a manual override at the master unit. Due to problems which could occur through battery failure or lamp burnout in single heads, these devices should be attended at all times. It is emphasized that, except in emergency situations, use of these units on Ministry roadways is only authorized for short duration (daytime) operations.

Temporary lane control signals (and temporary traffic signals used for alternating one-way control) should be timed as shown in 2.2.8.2 following.

2.2.8.2 Timing for (Temporary) One-way Signals

Length of Single Lane (m)		15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360
“All Red” Interval One Way (s)		2	4	6	9	11	13	15	17	19	22	24	26	28	30	32	35	37	39	41	43	45	47	50	52
CYCLE LENGTHS (seconds)	150	810	785	760	725	700	675	650	625	605	570	545	520	495	470	450	415	390	370	345	325	300	275	245	220
	140	800	775	750	710	685	660	635	610	580	545	520	490	470	445	420	380	360	335	310	285	260	235	200	175
	130	795	765	735	695	670	640	610	585	560	520	490	465	440	410	385	345	320	290	270	240	215	195		
	120	785	755	725	680	650	620	590	560	535	490	460	430	405	375	345	305	275	250	220					
	110	775	740	710	660	630	595	565	530	500	460	425	395	360	330	300	255								
	100	760	725	690	640	600	570	535	500	465	415	380	345	315	285										
	90	745	710	670	615	575	540	500	460	420	365	330	295												
	85	740	700	660	600	560	520	480	440	395	340	305													
	80	730	690	645	585	545	500	455	410	370	315														
	75	725	680	630	565	520	475	430	385	340															
	70	715	670	620	545	500	450	405	360																
	65	705	650	600	520	470	420	370																	
	60	695	635	580	495	440																			
	55	675	610	555	470																				
	50	660	595	530																					
	45	640	570																						
	40	625																							

Vehicles / Hour
on Heaviest Approach

Vehicles / Hour
on Heaviest Approach

NOTES:

1. Assumed operating speed of 25 km/h.
2. Minimum green approximately 15 Seconds.
3. Yellow clearance of 3 seconds.
4. Based on 50% probability of queue clearance.

EXAMPLE:

GIVEN: Heaviest Approach Volume (One Way) = 365 V/Hr
Length of Single Lane Section = 150 m

FIND: Length of Green Interval (One Direction)
Length of All Red Interval

SOLUTION: By applying the given figures to the above table we find:

- a) Cycle Length = 90 seconds
- b) All Red Interval = 22 seconds

Since the Green Time for each approach is equal to the cycle length minus two All Red Intervals, minus two (3 second) clearance intervals divided by two, THEN

$$\text{Green Time for each approach} = \frac{90 - (2 \times 22) - (2 \times 3)}{2} = 20 \text{ seconds}$$

2.2.9 FLAGS ON HLWDs AND TEMPORARY SIGN SUPPORTS

Fluorescent red or orange flags may be used on HLWDs, as indicated in Section 2.2.7 and with signs temporarily mounted as shown in Section 2.2.6. They are square and a minimum size of 40 cm x 40 cm. Three or, preferably, five flags may be displayed on HLWDs and two flags on other temporary sign supports.

Flags may be used with any signs mounted on temporary supports. They are required, however, in speed zones of 70 km/h or higher for temporary signs which give warning of people working on or adjacent to a roadway. These signs include C-4 CREW WORKING AHEAD, C-28 TRAFFIC CONTROL PERSON AHEAD, C-36 SURVEY CREW AHEAD and C-58 ACCIDENT SCENE AHEAD.

Flags should be made of non-rigid material which will allow them to “flutter” in wind or in air disturbed by passing vehicles.

When mounted, flags should be positioned so that, moving or still, they do not interfere with sign messages.

Flags shall not be used by TCPs to direct the movement of traffic.

2.3 TRAFFIC CONTROL PERSONS (TCPs)

2.3.1 GENERAL

TCPs are used to regulate traffic to prevent conflicts between the movement of pedestrians, vehicles, workers and work zone equipment. They may also be used to slow traffic passing close to workers or equipment. TCPs are employed when all other methods of controlling traffic are considered inadequate to warn, direct, and regulate drivers.

Common applications for TCPs are control of alternating one-way traffic through sections of two-way road temporarily reduced to one lane, and for stopping public traffic to permit work zone equipment to enter or cross a road, etc.

One or both TCPs at a site may be omitted and self regulation of traffic allowed, under the conditions described in the notes for Figure 3.4.1, provided that the self regulated section does not extend through an intersection. A temporary lane control signal or temporary traffic signal may also be used in place of TCPs to control traffic on sections of one lane two-way roadway. See Section 2.2.8.

TCPs are not generally required as part of the traffic control for a reduction in the number of lanes on multilane roads.

2.3.2 RESPONSIBILITY

It is the responsibility of the traffic control person to effectively communicate with the travelling public by using traffic control motions and signals that are precise and deliberate so that the meaning of signals can be clearly understood.

2.3.3 QUALIFICATIONS

TCPs have a high level of contact with the public and should therefore be carefully selected and thoroughly trained. Training should consist of the successful completion of a recognized course. TCPs should possess the following characteristics:

- Intelligence and common sense.
- Alertness.
- A courteous but firm manner.
- A sense of responsibility for the safety of workers and the public.
- Good physical condition, especially sight and hearing.
- Neat appearance.
- Current certification of training to an approved standard.

2.3.4 TRAINING

The W.C.B. Occupational Health and Safety Regulations require that TCPs be given written instructions on the performance of their duties. The instructions should include but not be limited to the Regulations and Section 2.3 of this Manual. A TCP desirably should have working knowledge of this Manual.

The following points should be emphasized in the training of TCPs:

- Importance of their job.
- Need for a courteous but firm manner.
- Personal protective equipment which conforms to Occupational Health and Safety Regulations (Part 8) for high visibility apparel and safety headgear
- Signals made by TCPs to control traffic must conform to the W.C.B. Occupational Health and Safety Regulations.
- Proper positioning in relation to the work area in order to be effective and ensure the safety of the public, workers, equipment and the TCP.
- Alertness.
- Discipline to prevent others from loitering near the TCP position and not to leave the position until relieved or the conflict being controlled no longer exists.
- Requirement to remove C-28 Traffic Control Person Ahead signs whenever TCPs are not in position.

2.3.5 EQUIPMENT

A C-28 TCP Ahead sign must be in place in advance of any TCP. The C-27 Traffic Control (stop and slow) Paddle, used by TCPs, must have retroreflectorized sheeting. No substitutes will be permitted. TCPs must be provided with equipment if necessary for effective communication between partner TCPs when TCPs are not visible to each other (see also 2.3.6 Positioning). C-27 paddles may be comfortably displayed by use of a 1.3 m handle extension described in sec 2.1.5, C-27. When it is only necessary to slow traffic in one direction the STOP side of the control paddle should be hidden by the TCPs body.

If TCPs are required after dark their positions should, if possible, be illuminated. TCPs should also be supplied with flashlights equipped with red signalling batons and spare batteries

Each TCP must use personal protective equipment consisting of high visibility apparel and safety headgear meeting Occupational Health and Safety Regulations (Part 8). Their personal protective equipment must be kept clean and in working condition.

2.3.6 POSITIONING

If a TCP can not be positioned so there will be no interference with other traffic control devices such as stop signs or a traffic signal it may be necessary to place covers over stop signs or to flash signals in order to avoid contradictory instructions to drivers.

TCPs should be positioned in accordance with the following:

- Stand outside the lane carrying moving traffic.
- Unless otherwise specified stand 25 - 75 m from the work area in order to provide some manoeuvring room for lane changing or for an out of control vehicle.
- Always face moving traffic but be aware of what is happening in the stopped lane.
- Where work is in progress adjacent to an intersection, it may be necessary to stand in the middle of the intersection in which case it may not be possible to conform to one or more of the three points above.
- Stand where the TCP can see and be seen by approaching drivers. To the extent practical, stand where the background will make the TCP as conspicuous as possible.
- Notwithstanding the above points, the TCP should stand at the most appropriate location to direct traffic through a work area, consistent with the Industrial Health and Safety Regulations.
- Plan an escape route.
- If there is no line of sight between two TCPs, and they do not have radio communication, it will be necessary to position a third TCP between the two to relay visual signals.

2.3.7 TCP SIGNALS TO STOP AND SLOW TRAFFIC*

*Complete TCP Signals are described and illustrated in the W.C.B. Occupational Health and Safety Regulations.

HOW TO STOP TRAFFIC

1. Stand on roadway shoulder and hold paddle in right hand to stop first vehicle. The paddle should always be displayed in a static manner. Then move to centreline and hold paddle in left hand.
2. Stand where TCP can see and be seen by approaching traffic from a sufficient distance (at least 150 m) to enable it to stop safely.
3. Stand some distance (preferably between 25 m and 75 m) from the work area so as to protect personnel or equipment.



HOW TO SLOW TRAFFIC

1. Extend traffic control paddle towards lane of oncoming traffic.
2. To avoid traffic coming to a full stop, wave traffic forward with other hand.

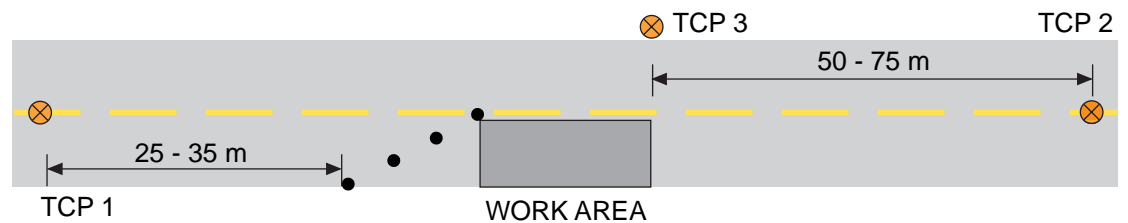
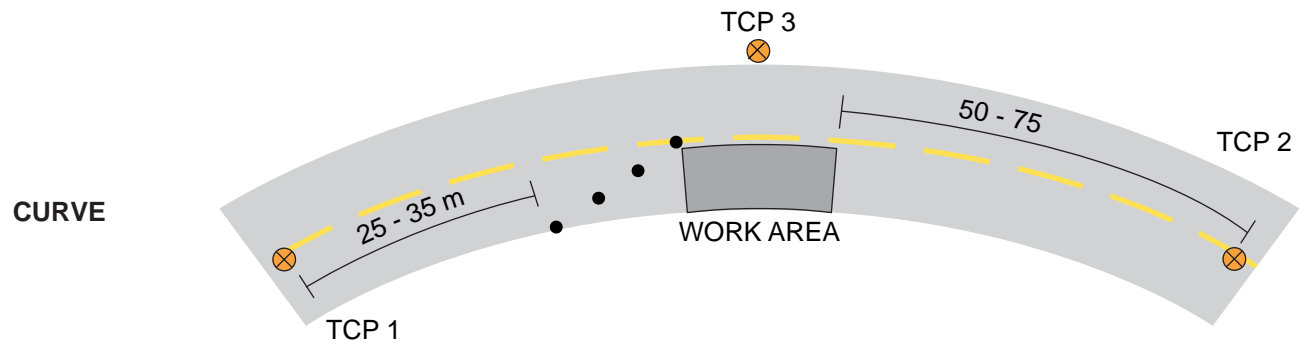
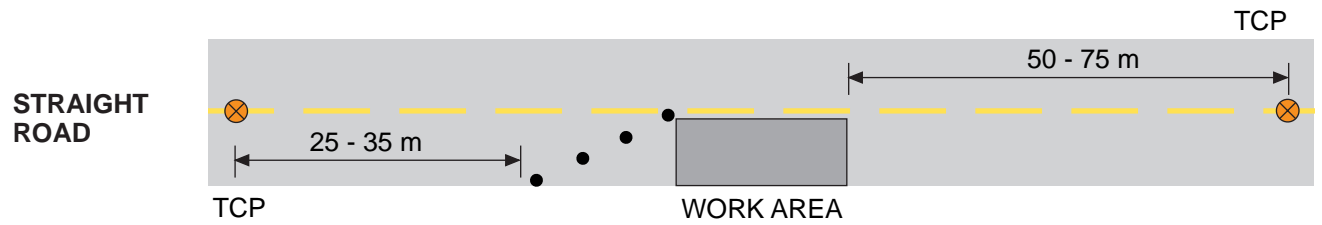
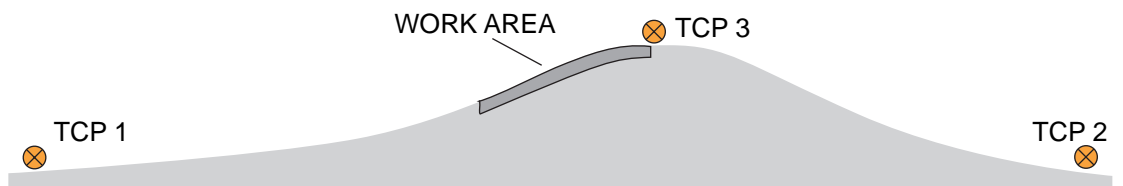


WHAT TO WEAR

High visibility apparel, safety headgear and protective footwear are mandatory for all TCPs.

Personal protective clothing and equipment must conform to the W.C.B.'s current "Occupational Health and Safety Regulations." Clothing must meet specifications detailed in the "Personal Protective Equipment Standard 2-1997. Safety headgear and safety protective footwear must conform to Part 8 of these Regulations. Additionally, safety headgear must be orange with V.E. trim around the crown.

2.3.8 LOCATION OF TRAFFIC CONTROL PERSONS











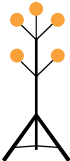
**HILL****NOTE:**

On curves or hills, TCP locations 1 and 2 may not be intervisible. If radio communication is not available in such cases, a third TCP will be required as shown to relay signals between TCPs 1 and 2.

TRAFFIC CONTROL PERSONS (TCPs)

CHAPTER 3

TYPICAL TRAFFIC CONTROL LAYOUTS FOR SHORT DURATION WORK ZONES

LEGEND	
	TUBULAR MARKER – TYPE D
	CONE – TYPE A, B or C
	SIGN
	TRAFFIC CONTROL PERSON (TCP)
	SHADOW, BUFFER or WORK VEHICLE
	(360°) FLASHING YELLOW LIGHT
	WORK AREA
	PORTABLE LANE CONTROL SIGNAL
	BARRICADES and FENCING
	FLASHING ARROW BOARD (FAB)
	HIGH LEVEL WARNING DEVICE (HLWD)

Exception for Emergency and Brief Duration Work

If the work being carried out is of an emergency or brief duration nature, as defined, and is within a speed limit of 60 km/h or less, it may not be practicable to provide the TCPs or advance signing called for in Chapters 3 and 4 of the Traffic Control Manual.

TABLE A**Positioning of devices on conventional roadways for various speed limits.**

*	Regulatory speed limit	50 km/h	60 km/h	70 km/h	80 km/h	90-100 km/h
1a	Taper length for lane closure	35 (1:10)	55 (1:15)	75 (1:20)	90 (1:25)	110 (1:30)
1b	Taper length for shoulder work or where TCPs used (min. 3 cones)	5	8	10	12	15
2	Maximum distance between cones or tubular markers for 1a	10	10	10	10	10
3	Minimum tangent distance between tapers	30	60	90	120	150
4	Distance between construction signs	40	60	80	100	150

Dimensions shown are in metres and are minimums except for 2*.

Cones and tubular markers are generally used in daylight but if used at night must be reflectorized. Barricades, flexible drums or temporary delineator posts are generally used during hours of darkness and must be reflectorized.

Dimensions 1b* apply to downstream tapers, shoulder tapers, and to two-way traffic tapers on travelled lanes where traffic is controlled by TCPs, portable lane control signals or temporary traffic signals.

Dimensions 4* represent the minimum advance placement distances for initial signs as well as distances between subsequent signs in multi-sign series.

Figure 3.1.1 Work on Shoulder (Less Than 30 Minutes)

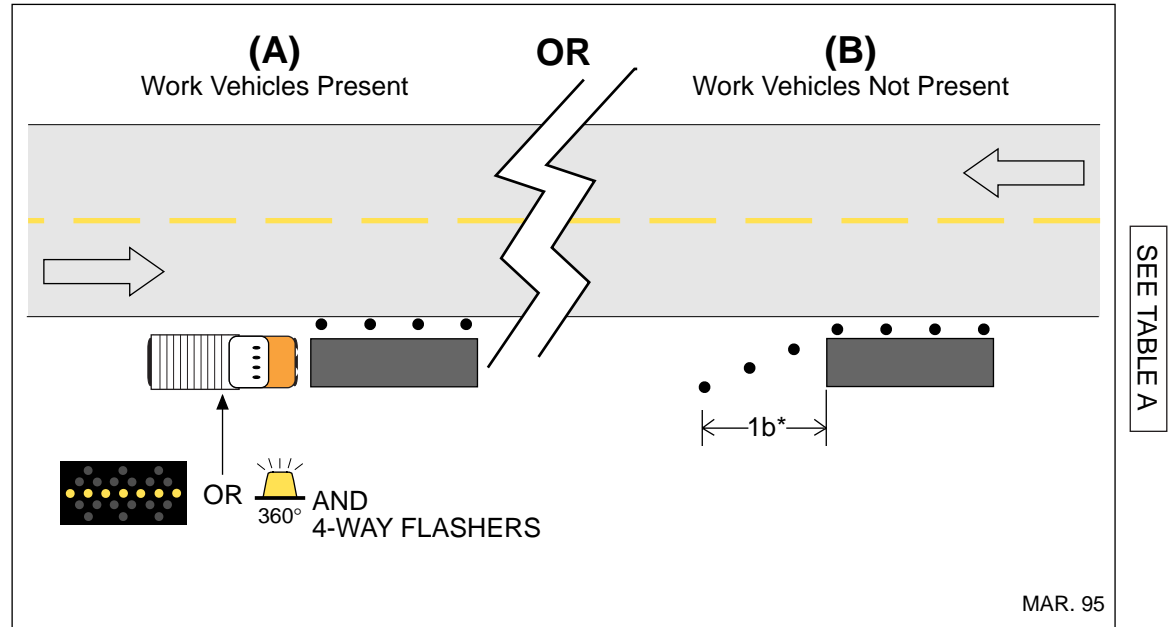
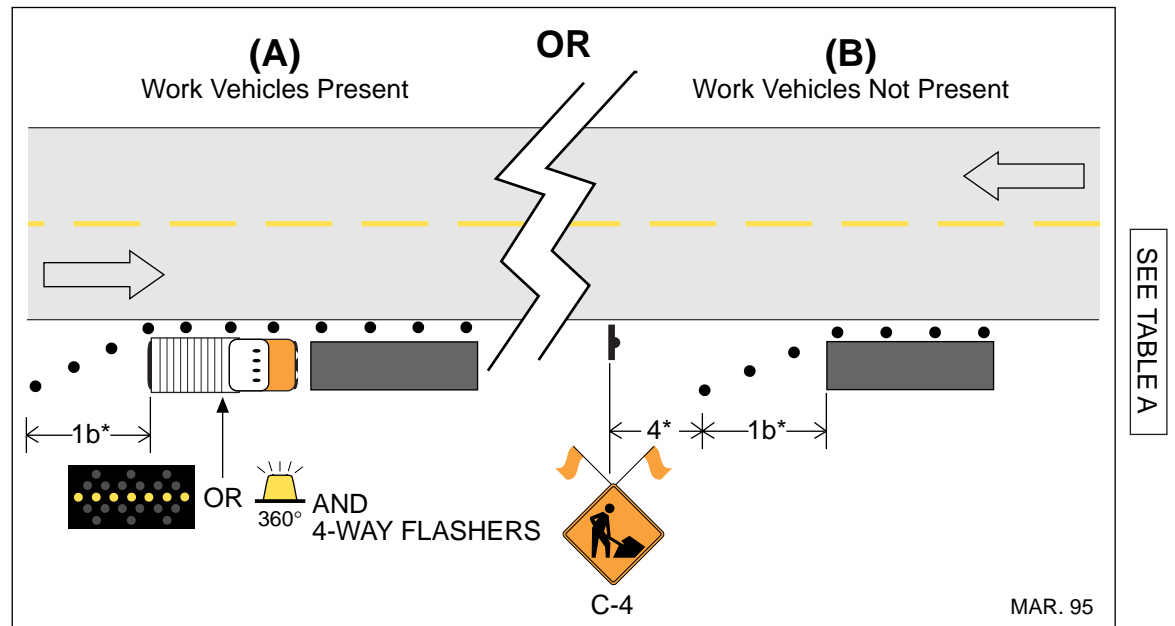
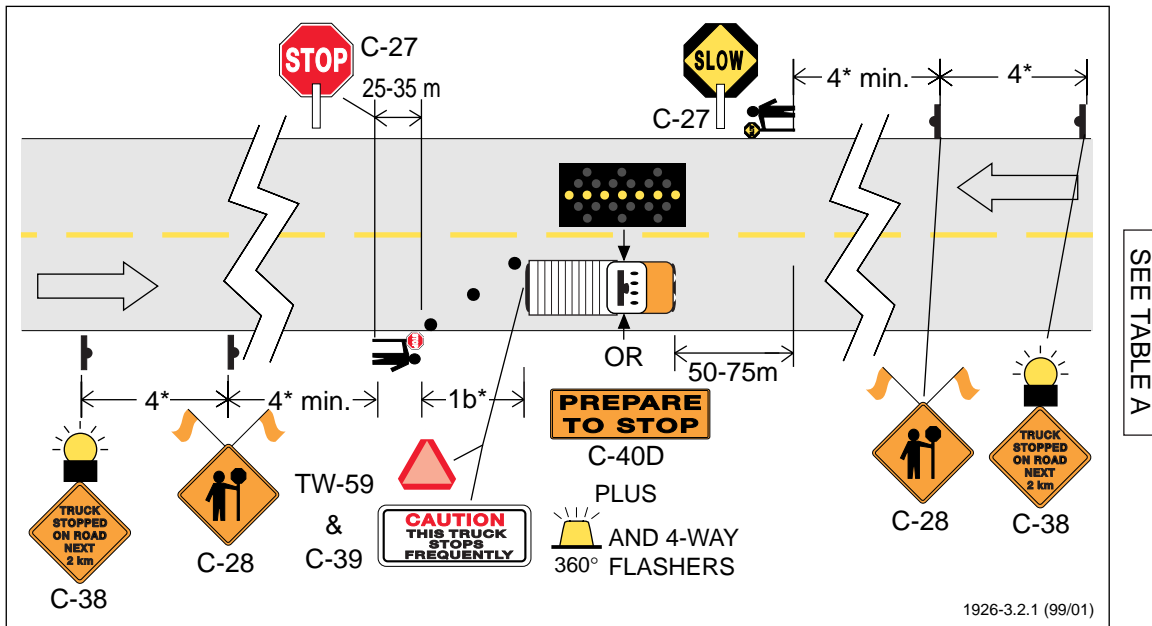


Figure 3.1.2 Work on Shoulder (30 Minutes or Greater)

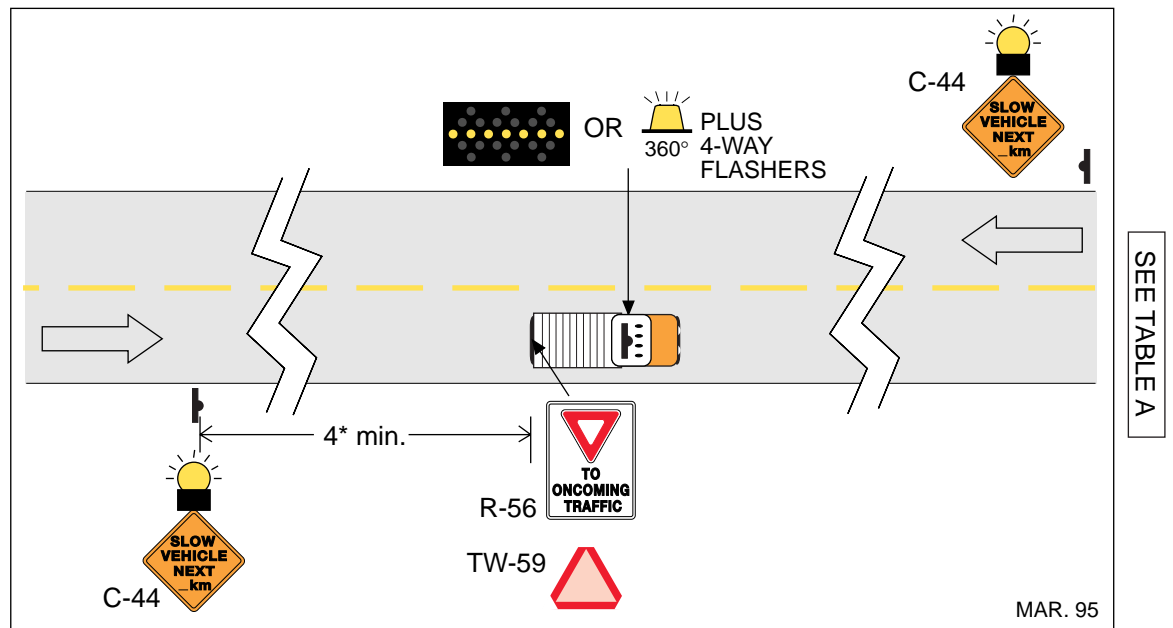


**Figure 3.2.1 Intermittent Moving Work
– Two Lane Two-way Roadway**



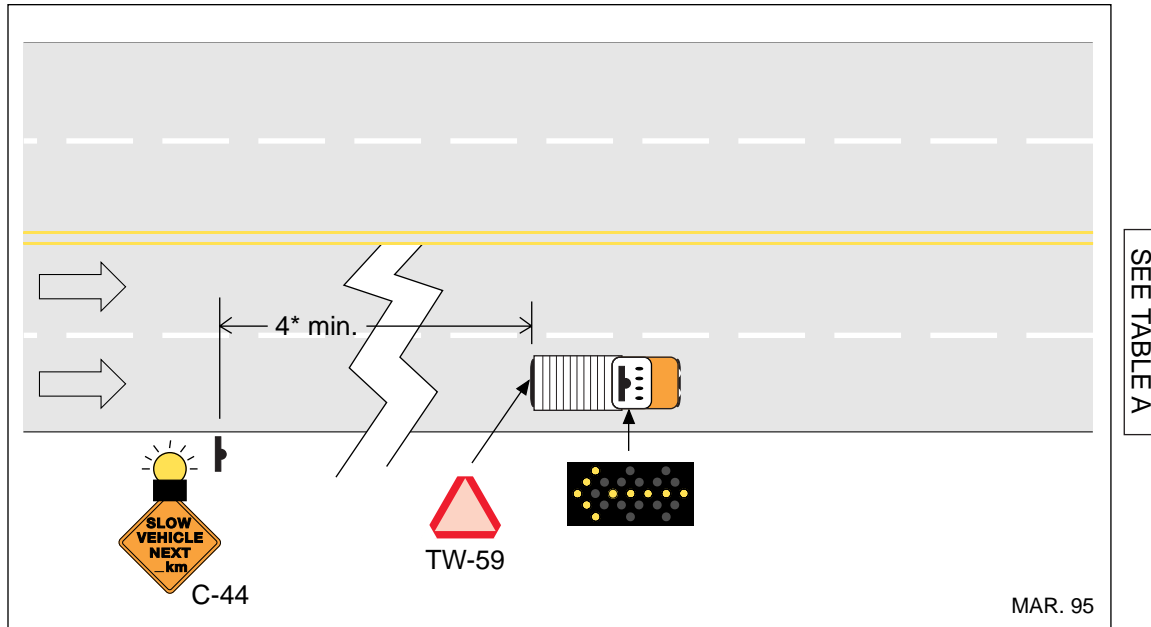
- Typical applications are Benkleman beam testing, reflective road stud installation, temporary patching, crack sealing, etc.
- Distance on C-38 signs should not exceed 2 km.
- A Type B flashing yellow light or flags shall be used with C-38 signs. Addition of a HLWD is optional.
- If speed limit is 60 km/h or less the C-38 sign and its accessories may be omitted.
- A shadow vehicle with a C-45 or other appropriate sign on the rear may be required by the road authority.
- C-39 and TW-59 signs should be removed or covered and the C-40D sign lowered when work vehicles travel at posted speeds.
- C-40D may be omitted from large line-type utility vehicles if it is impractical to mount the sign.

**Figure 3.2.2 Continuously Slow Moving Work
– Two Lane Two-way Roadway**

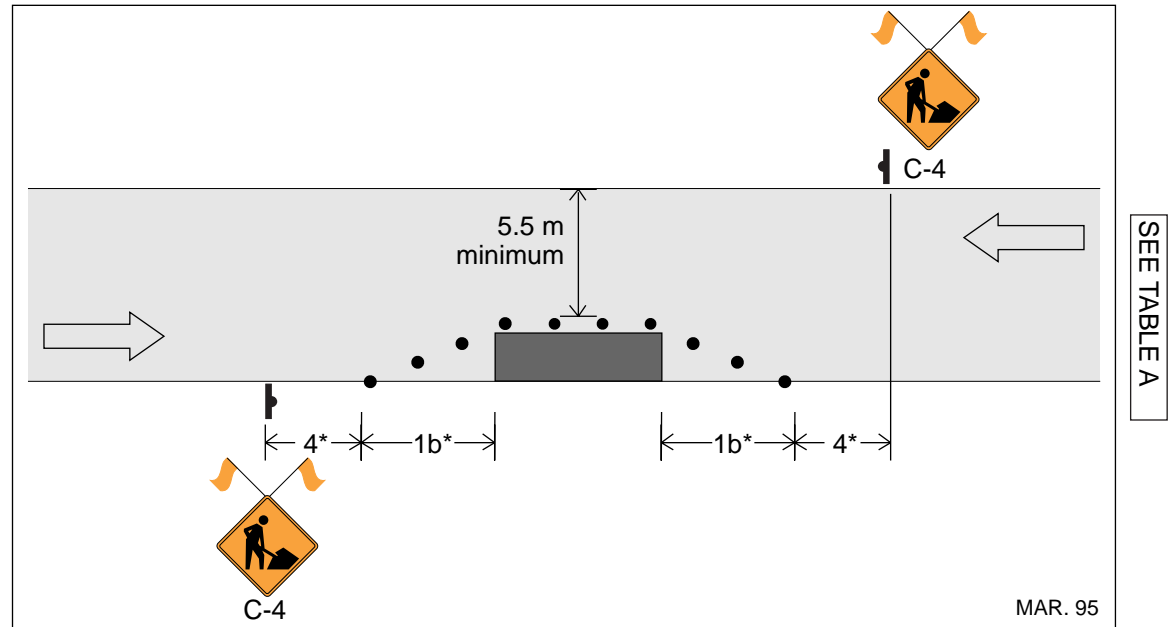


- For pavement striping see Appendix B of the Traffic Control Manual.
- Typical applications are hydroseeding, grading, sweeping and flushing, etc.
- Maximum distance on C-44 signs should not exceed 8 km.
- A Type B flashing yellow light or flags shall be used with C-44 signs. Addition of a HLWD is optional.
- If speed limit is 60 km or less, the C-44 sign and its accessories may be omitted.
- All signs should be removed or covered when work is not underway and work vehicles can travel at posted speeds.
- A shadow vehicle with a C-45 or other appropriate sign on the rear may be required by the road authority.
- R-56 may be omitted from large line-type utility vehicles if it is impractical to mount the sign.

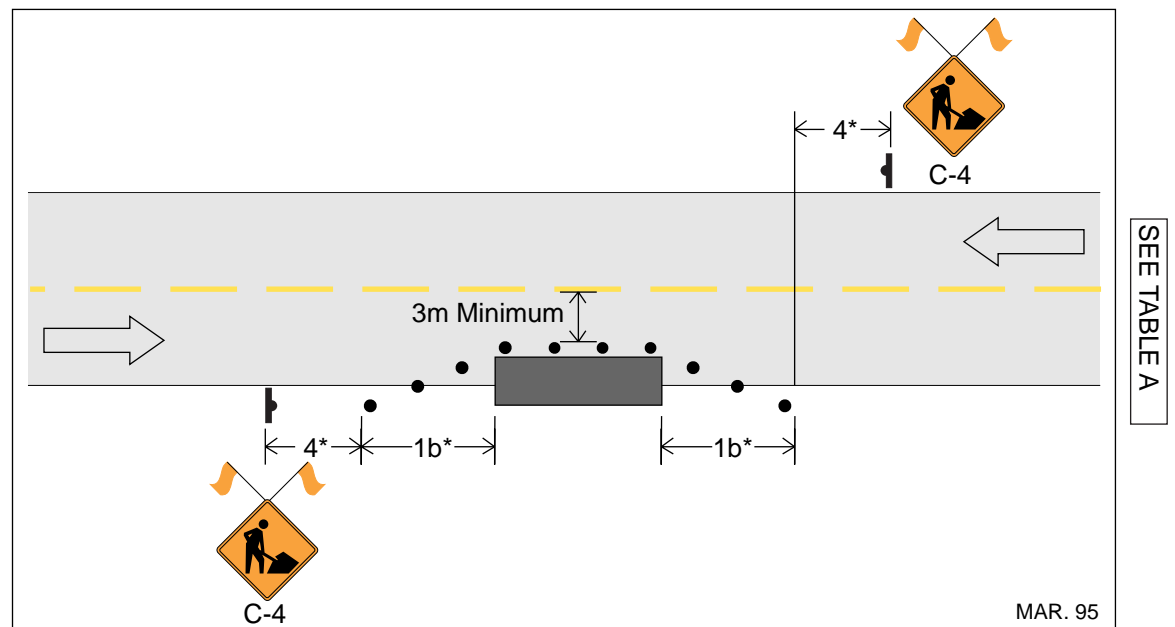
Figure 3.2.3 Continuously Slow Moving Work – Multilane Roadway



- For pavement striping, see Appendix B of the Traffic Control Manual.
- Typical applications are hydroseeding, grading, flushing and sweeping etc.
- Maximum distance on C-44 sign should not exceed 8 km.
- A Type B flashing yellow light or flags shall be used with the C-44 sign. Addition of a HLWD is optional.
- If speed limit is 60 km or less, the C-44 sign and its accessories may be omitted .
- If speed limit is 60 km/h or less, the FAB can be replaced by a 360° plus 4-way flashers.
- All signs should be covered or removed when work vehicles can proceed at posted speeds.
- A shadow vehicle with a C-45 or other appropriate sign on the rear may be required by the road authority.

Figure 3.3.1 Work on Low Volume Roadway – No Centreline

- FAB (bar mode) or 360° plus 4-way flashers are optional.
- Use lane closure if speed limit is 70 km/h or greater, if sight distance is restricted (ie., dust, curves, etc.) or if there is less than approximately 5.5 m of road width remaining.

Figure 3.3.2 Roadside Work – Encroachment into Travelled Lane

- FAB (bar mode) or 360° plus 4-way flashers are optional.
- Where speeds are 70 km/h or greater a temporary speed zone of 50 km/h may be used in direction of obstructed lane.

Figure 3.3.3 Work in Parking Lane – Urban Area

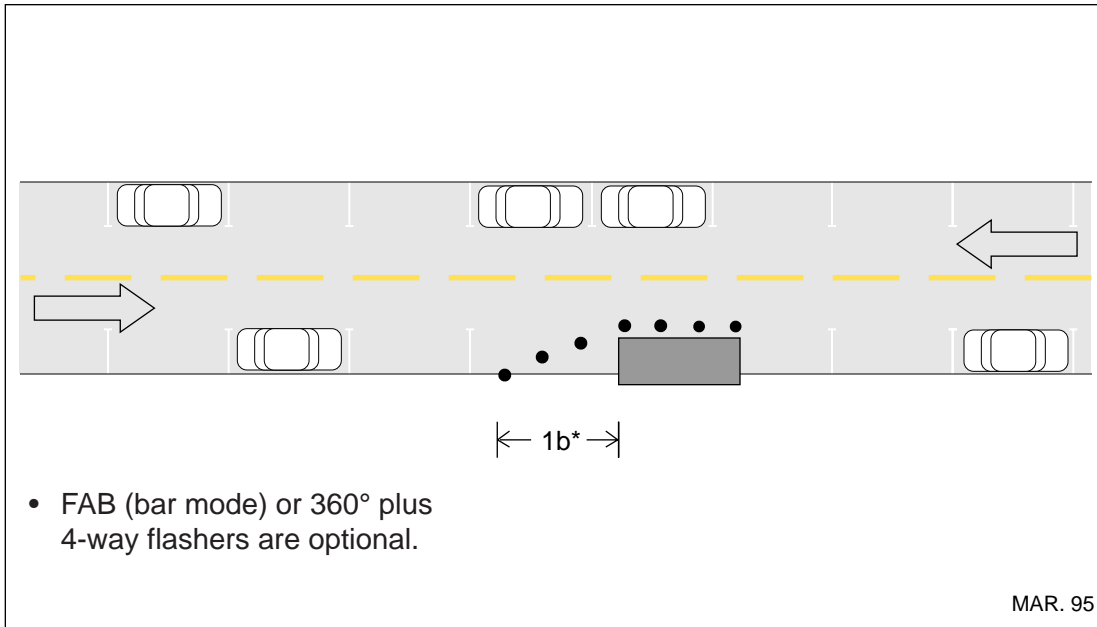
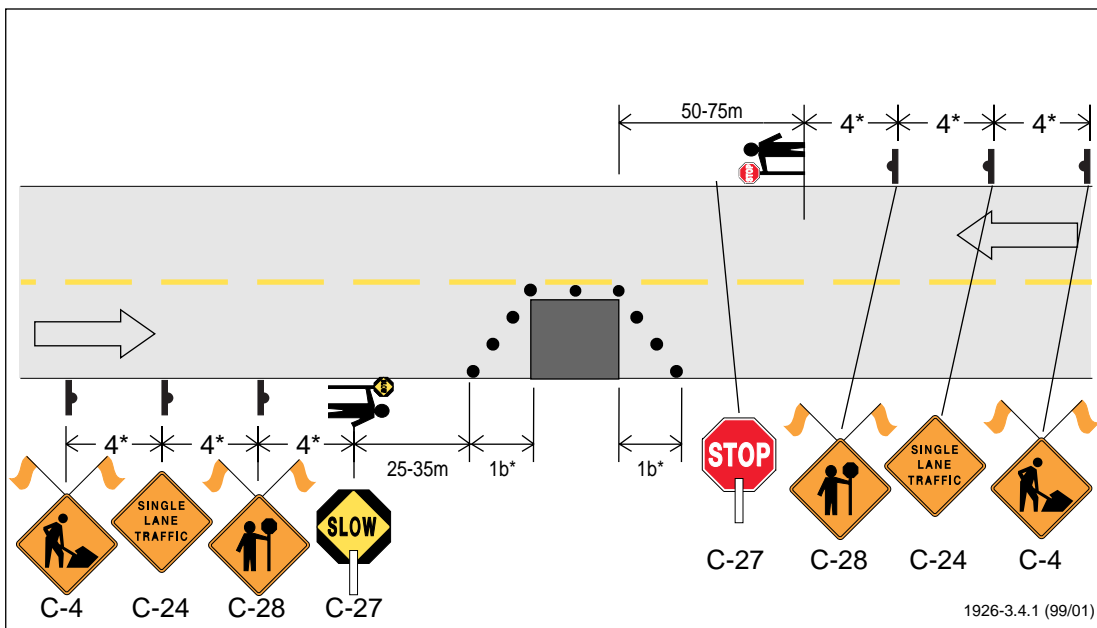


Figure 3.4.1 Lane Closure with TCPs – Two Lane Two-way Roadway



- For a temporary speed zone, place C-1 signs at positions shown for C-24s. Move both C-24 and C-4 signs a further 4* upstream. Place C-23 signs downstream of each TCP.
- If the one lane section is sufficiently short (e.g., a spot obstruction), sight distance is adequate, and traffic volumes are light, it may be possible to omit the TCP for the open lane or possibly even both TCPs, and let traffic flow be self regulating. If the TCP for the open lane is omitted, the corresponding C-28 sign must be omitted. If the TCP for the closed lane is also omitted, the C-28 for that direction must be replaced with an R-56 Yield to Oncoming Traffic. If both TCPs are omitted, a Class 1 barricade must be added on each side of the work zone.

**Figure 3.4.2 Lane Closure With Temporary Lane Control Signals
– Two Lane Two-way Roadway**

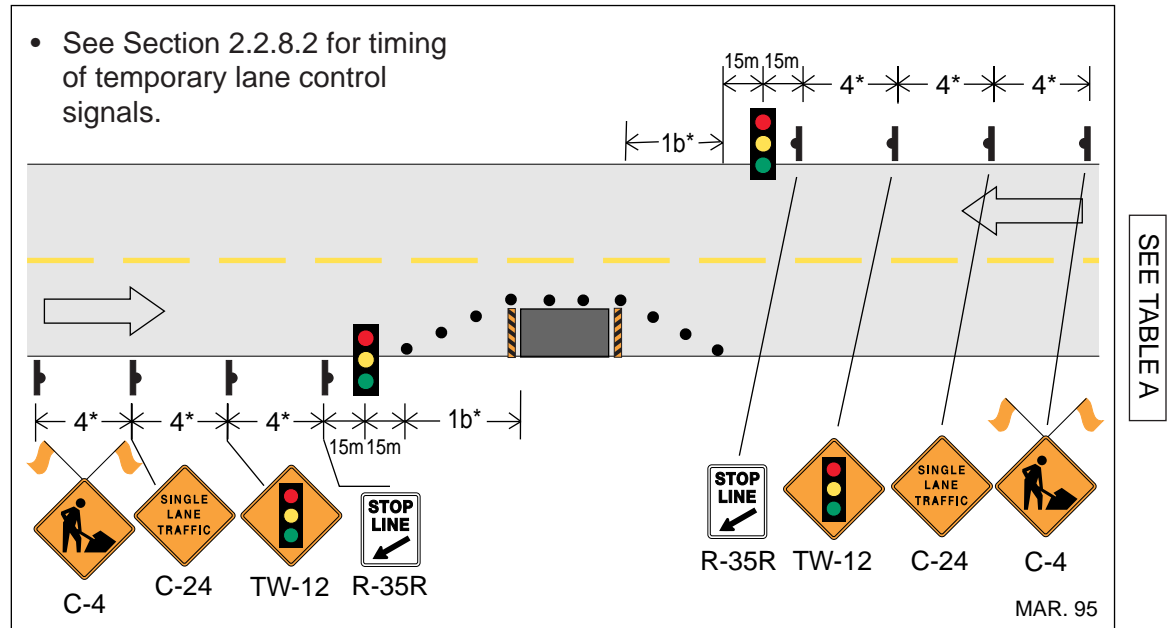
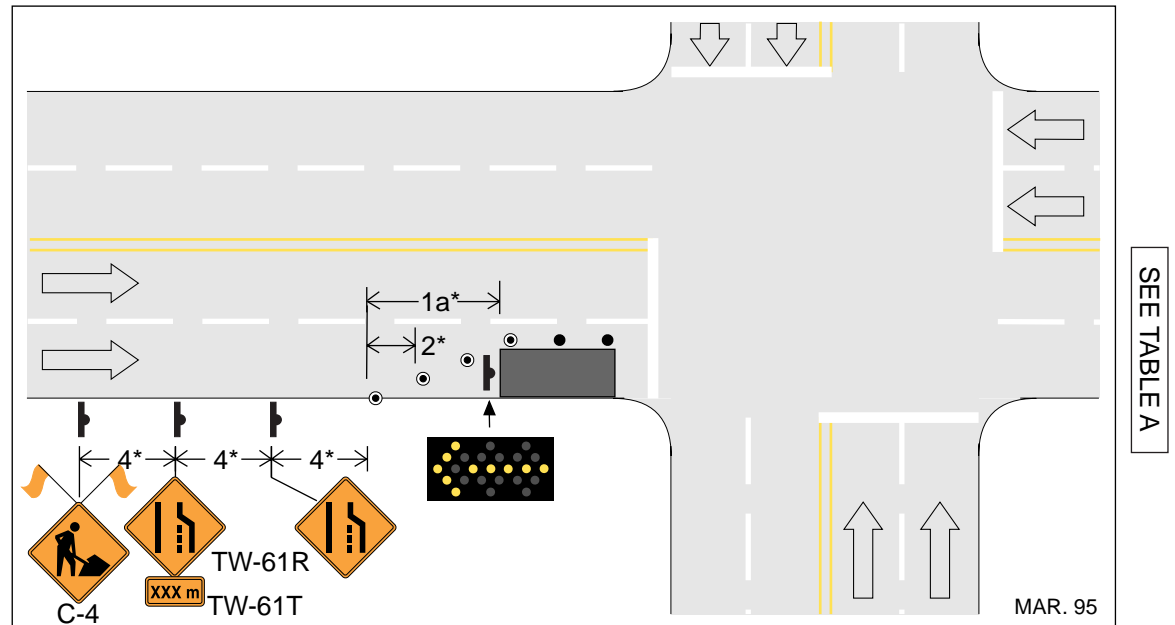


Figure 3.4.3 Right Lane Closed – Multilane Roadway



- If the speed limit is 60 km/h or less the upstream TW-61R may be omitted and the C-4 moved downstream by 4*.
- Substitution for the Fab sign may be made as indicated in the following table:

Speed Limit	Workers or Work Vehicle Present	No Workers or Vehicles Present
≤60	C-53 plus 360° & 4 way flashers or C-53 plus HLWD	C-53 plus HLWD
≥ 70	No Substitution	C-53 plus HLWD

Figure 3.4.4 Left Lane Closed – Multilane Roadway

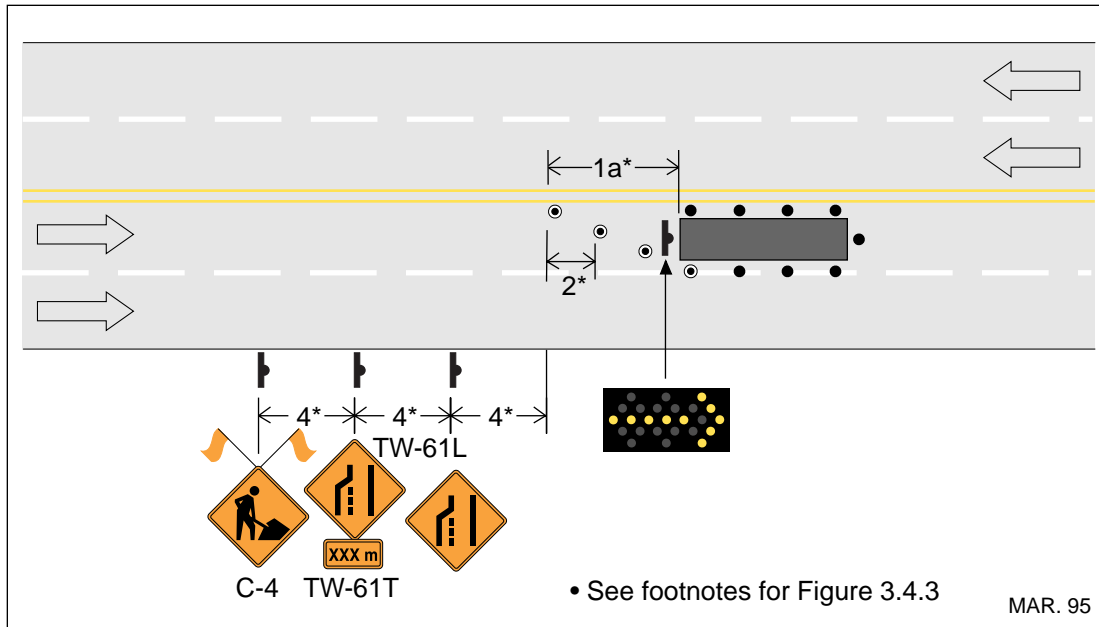


Figure 3.4.5 Centre Lane Closed – Multilane Roadway

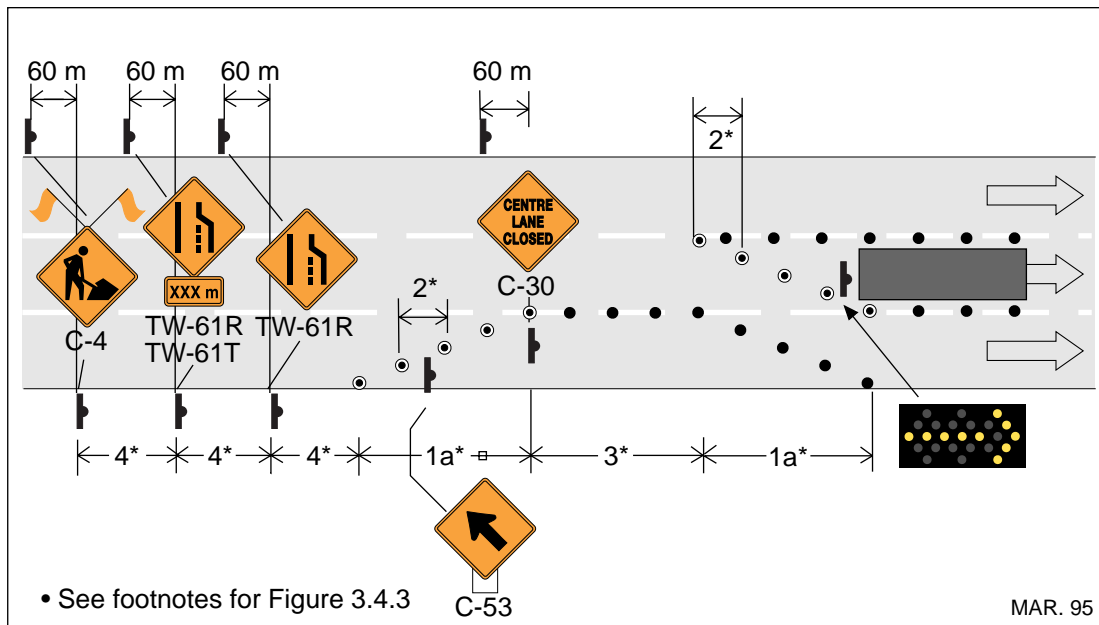
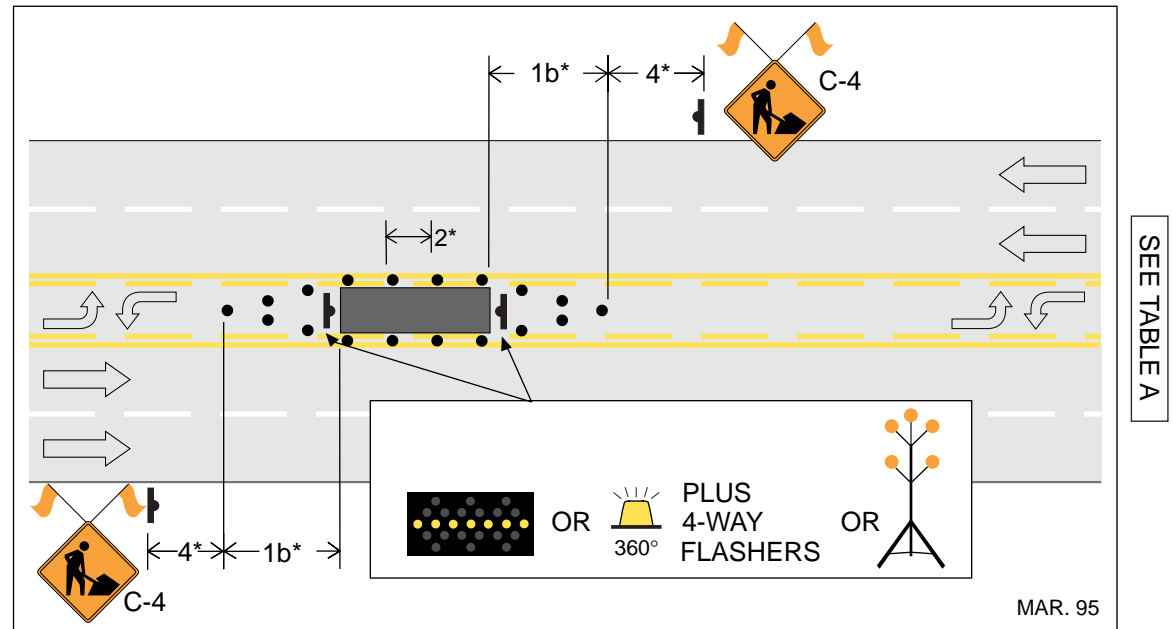
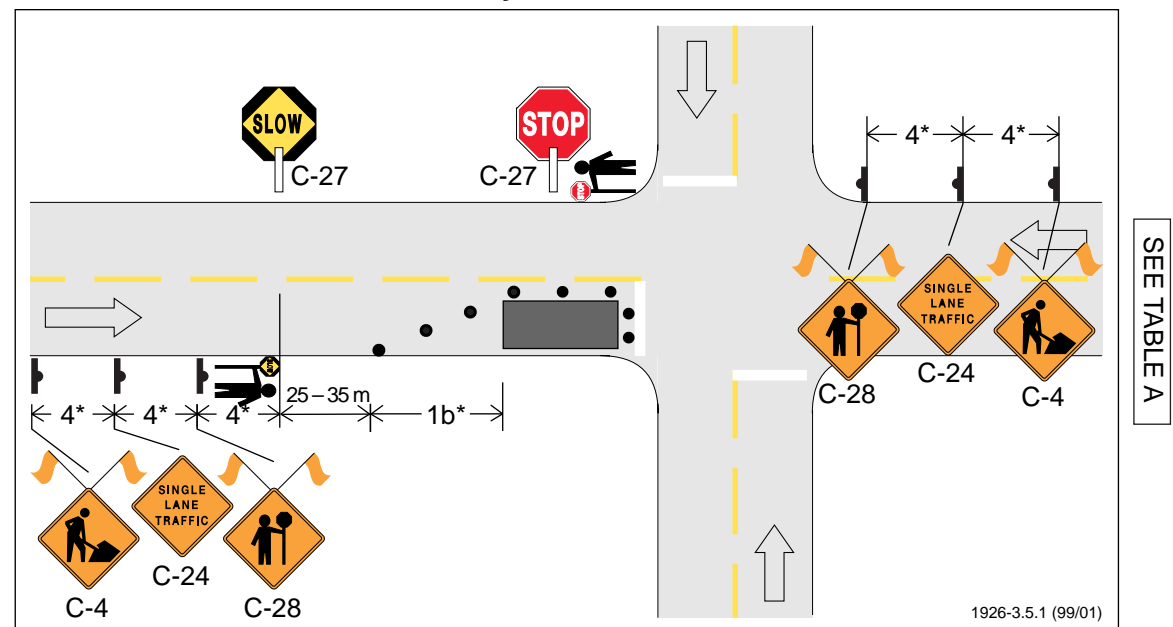


Figure 3.4.6 Two-way Left Turn Lane Closed

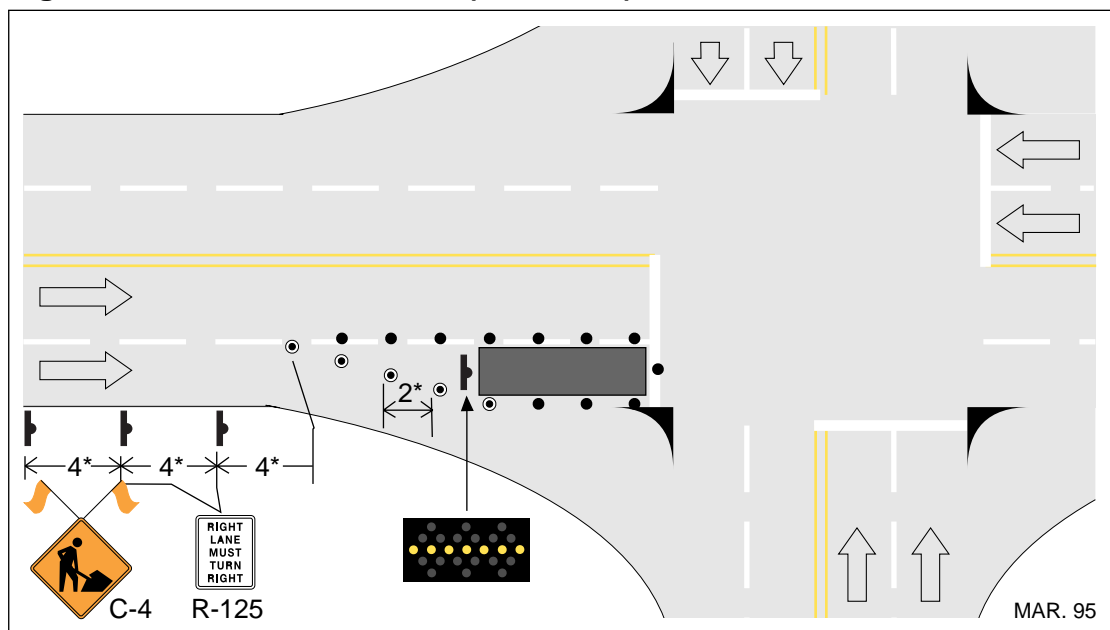
- Depending on the nature of the work, one or both adjacent lanes may also need to be closed; as per Figure 3.4.4.

**Figure 3.5.1 One Lane Closed (Near Side)
– Two Lane Two-way Intersection**

- When traffic volumes are high or the intersection is signalized, consult the road authority to determine whether police assistance is required.
- Traffic signals should be placed in flashing operation.

Diagram illustrating the placement of traffic signs for a single-lane traffic reduction. The diagram shows a two-lane road narrowing to a single lane. Signs C-4 (Single Lane Traffic), C-24 (Single Lane Traffic), and C-28 (Single Lane Traffic) are placed along the road. A 'SLOW' sign (C-27) and a 'STOP' sign (C-27) are also shown. Dimensions are provided for the spacing between signs and the width of the single-lane section.

- ### Figure 3.5.3 One Lane Closed (Near Side) – Multilane Intersection



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Figure 3.5.4 One Lane Closed (Far Side) – Multilane Intersection

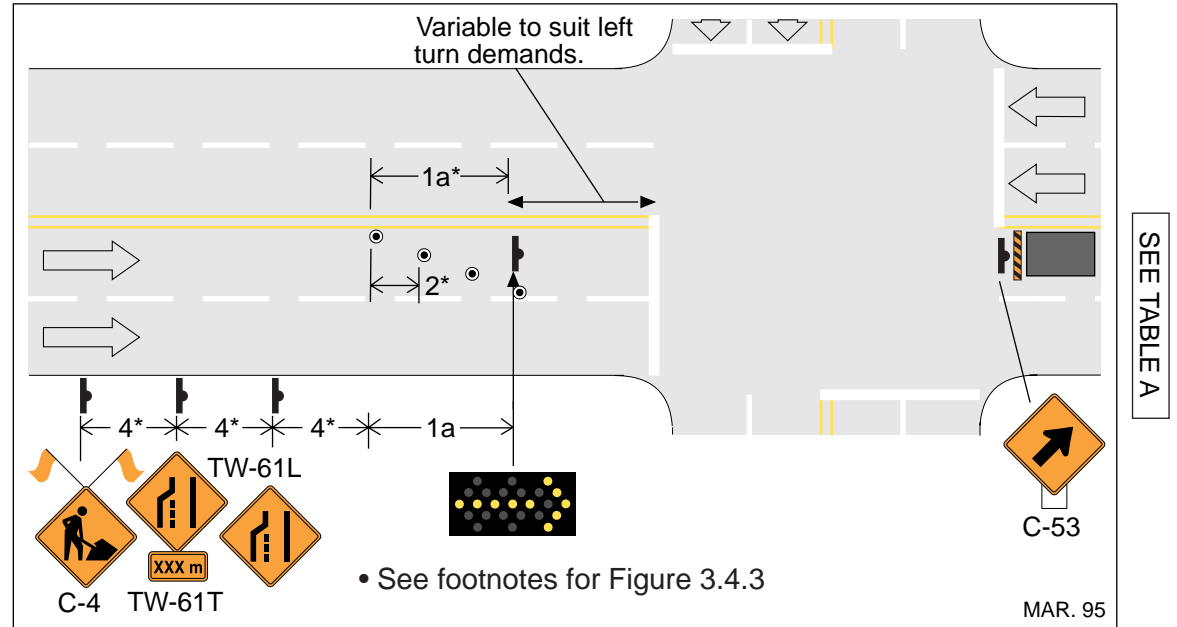
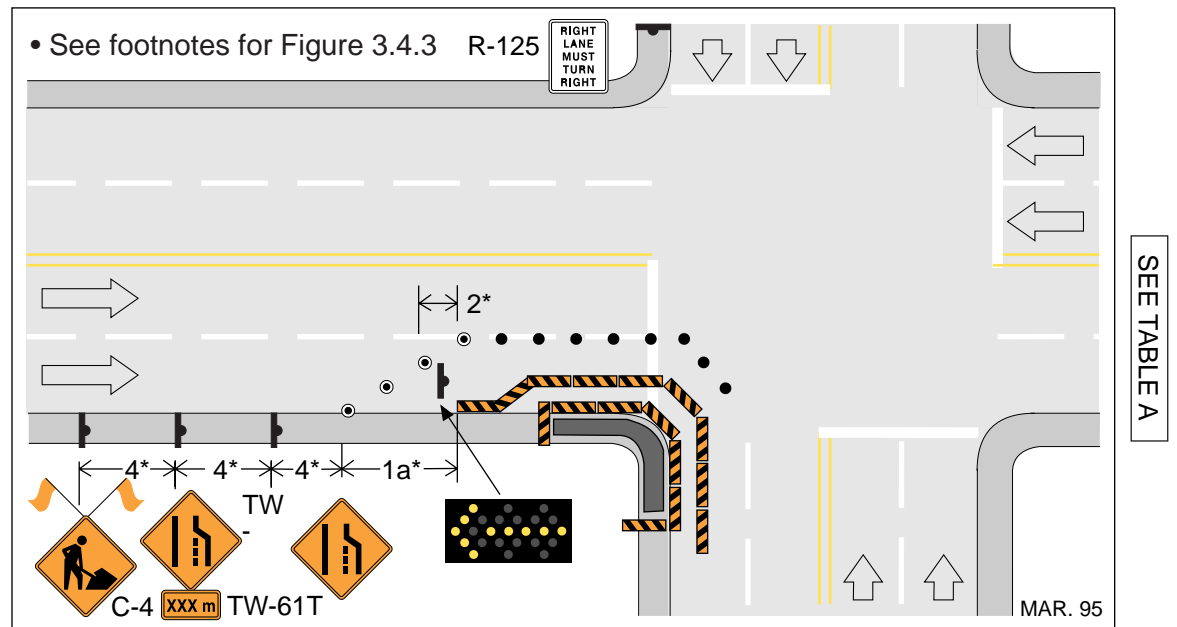


Figure 3.6.1 Sidewalk Detour onto Roadway



GENERAL

See Part C, Appendix B.

See Part C, Appendix B.

Figures 3.7.1 to 3.7.3 inclusive indicate traffic control required for installation of pavement arrows, stopline and crosswalk markings.

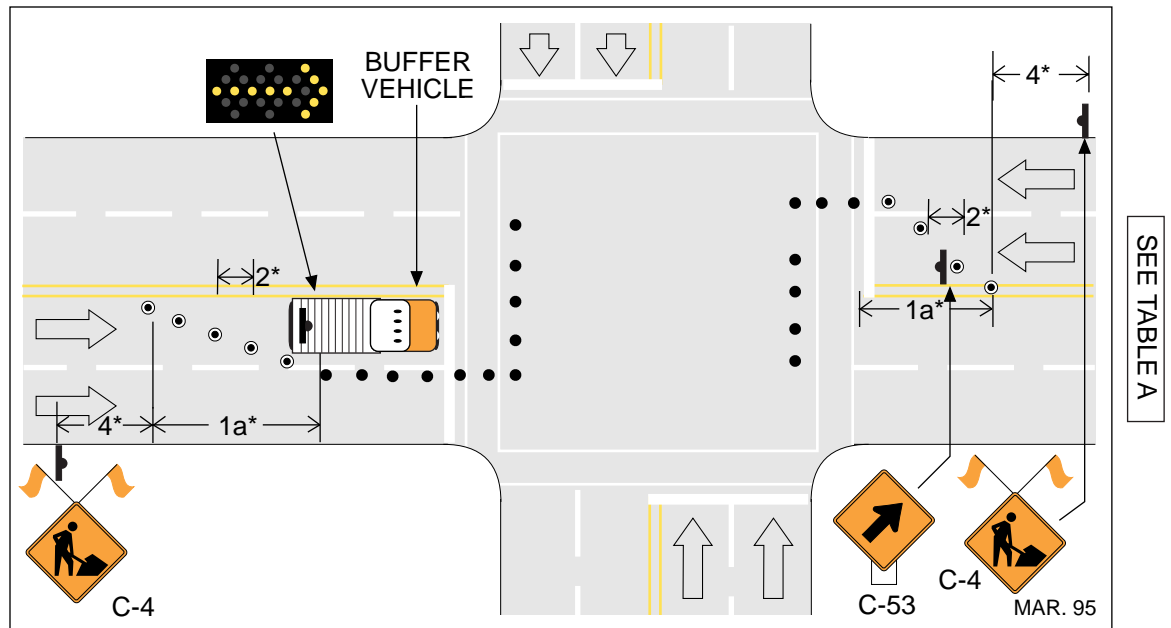
SEE TABLE A

C-4

MAR. 95

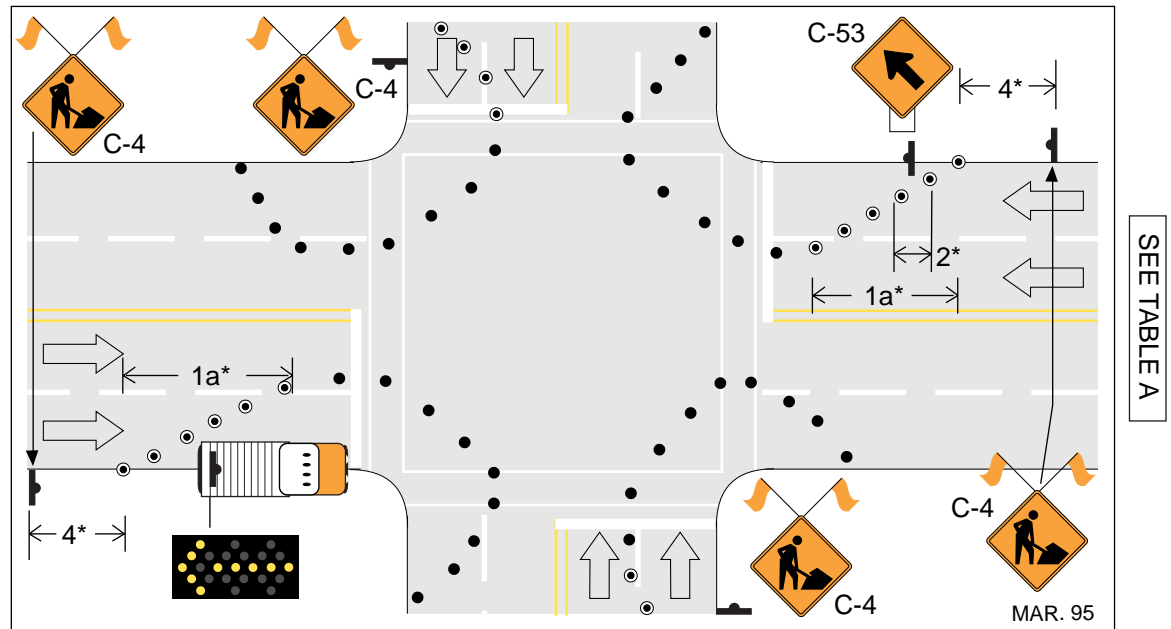
- The C-4 sign may be removed when the painting operation is complete and no workers are present. The Type A cones remain until the paint has dried.
- A vehicle with a FAB or a 360° plus 4-way flashers shall be stationed within the upstream island when the speed limit is 70 km/h or higher and workers are present.

**Figure 3.7.2 Stop Lines and Crosswalks (Left Lanes)
– Multilane Roadway**



- Buffer vehicle is used when workers are on the roadway, regardless of speed.
- See Table for Figure 3.4.3.

**Figure 3.7.3 Marking – Stop Lines and Crosswalks (Right Lanes)
– Multilane Roadway**



- Buffer vehicle is used when workers are on the roadway, regardless of speed.
- See Table for Figure 3.4.3.

3.8 SURVEYING

GENERAL

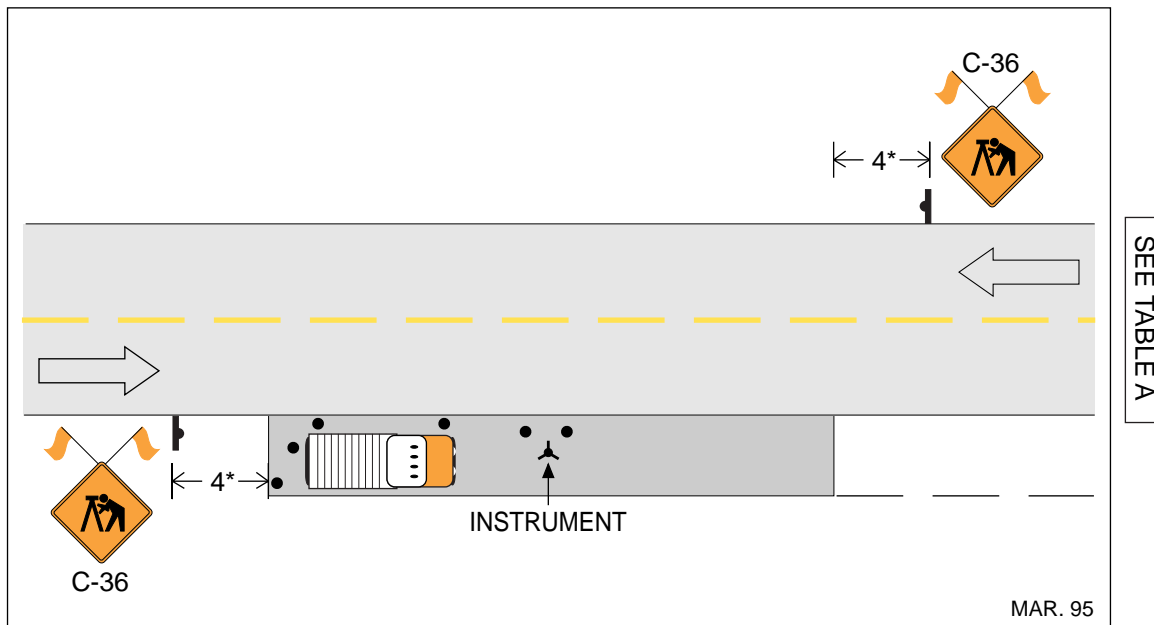
Survey work areas may not have the attention getting vehicles and equipment typically present at construction and maintenance work sites. Extra caution is therefore required by survey crews.

It is advantageous to have members of the survey crew qualified as TCPs (Section 2.3) so they can control traffic when required or supplement personnel working solely as TCPs.

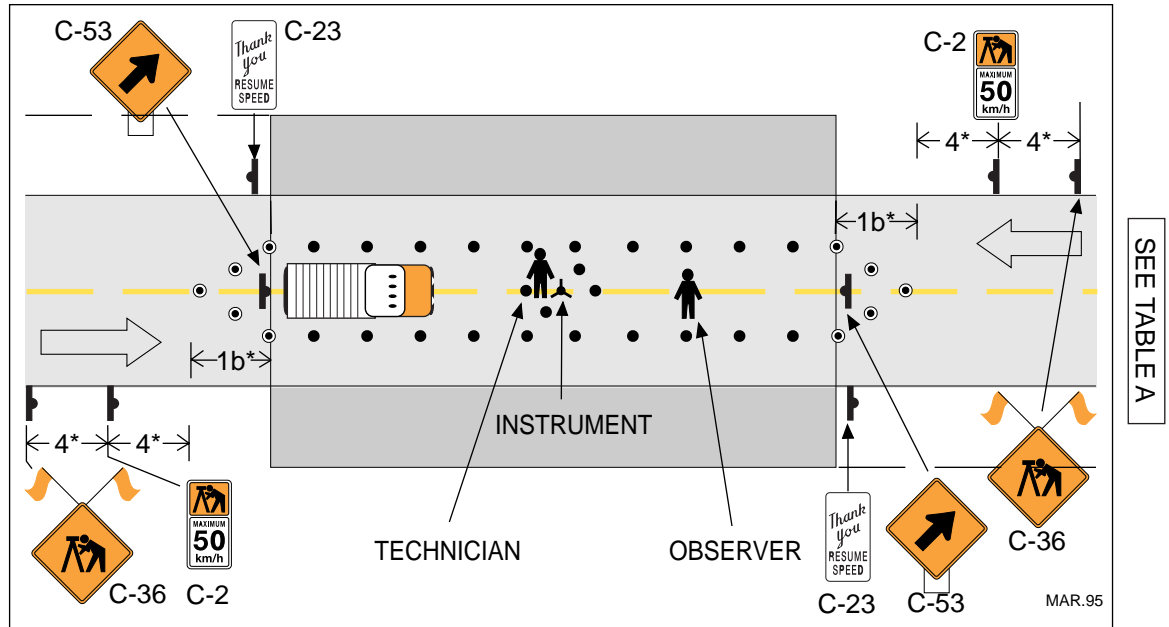
All signs must be removed or covered when no member of the crew is working on or adjacent to the roadway.

The following figures illustrate traffic control for various surveying situations.

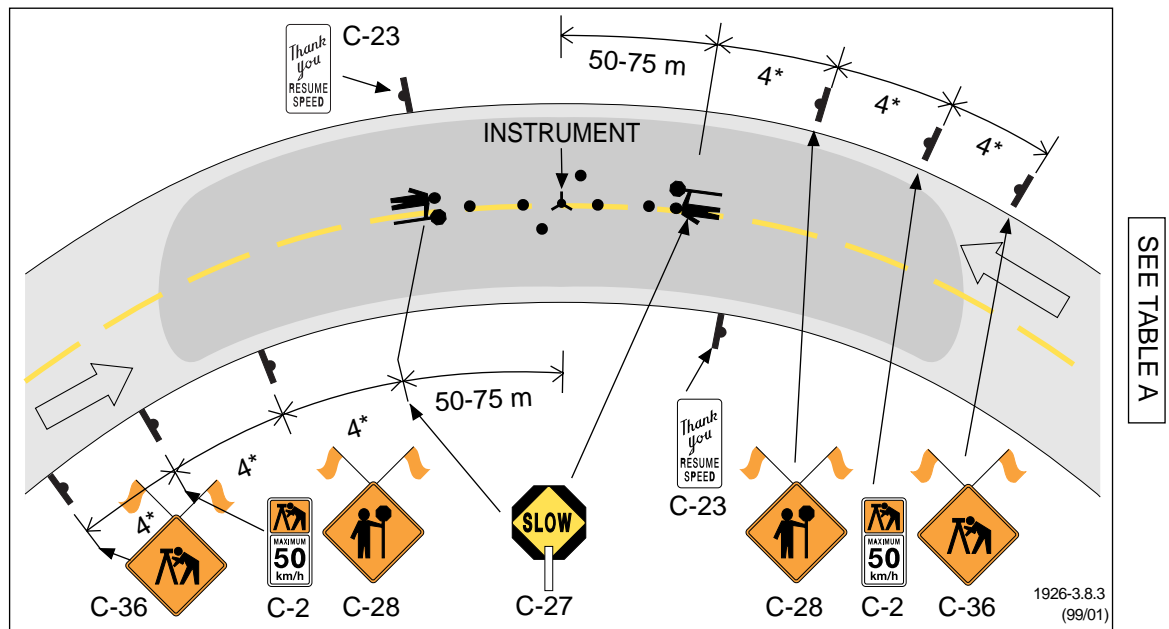
Figure 3.8.1 Surveying – Work on Shoulder



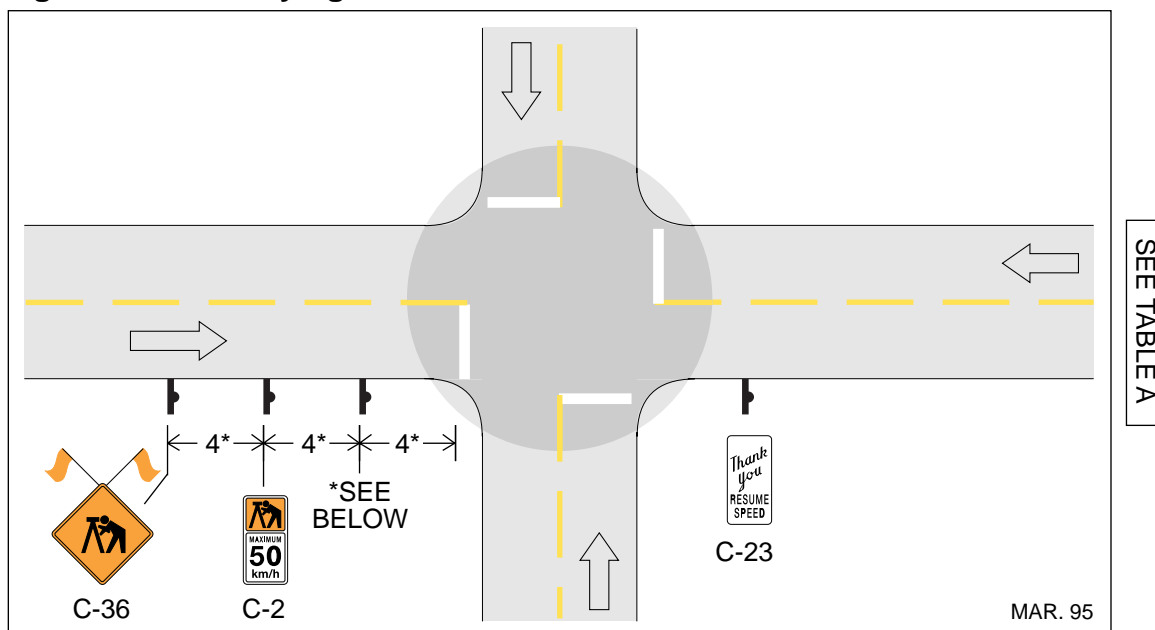
- Buffer vehicle with 360° and 4-way flashers is required for speed limits of 70 km/h or greater and on high volume roads.

Figure 3.8.2 Surveying – Work on Centreline (Tangent)

- An observer may be required to assist the instrument person by watching traffic.
- Buffer vehicle with 360° and 4-way flashers is required when the speed limit is 70 km/h or greater.
- C-2 and C-23 signs (Temporary Speed Zone) should be used only where conditions warrant. If they are not required the C-36 signs can be moved downstream by a distance 4*.

Figure 3.8.3 Surveying – Work on Centreline (Curve or Hill)

- Buffer vehicle with 360° and 4-way flashers may be used where the speed limit is 70 km/h or greater.
- C-2 and C-23 signs (Temporary Speed Zone) should be used only where conditions warrant. If not required the C-36 signs can be moved downstream by a distance 4*.

Figure 3.8.4 Surveying – Work in Intersections

- The same signing is required on all approaches to the intersection.
- * The use of C-28 signs and one or more TCPs are optional depending on specific circumstances.
- C-2 and C-23 signs (Temporary Speed Zone) should be used only when conditions warrant. If they are not required the C-36 signs can be moved downstream by a

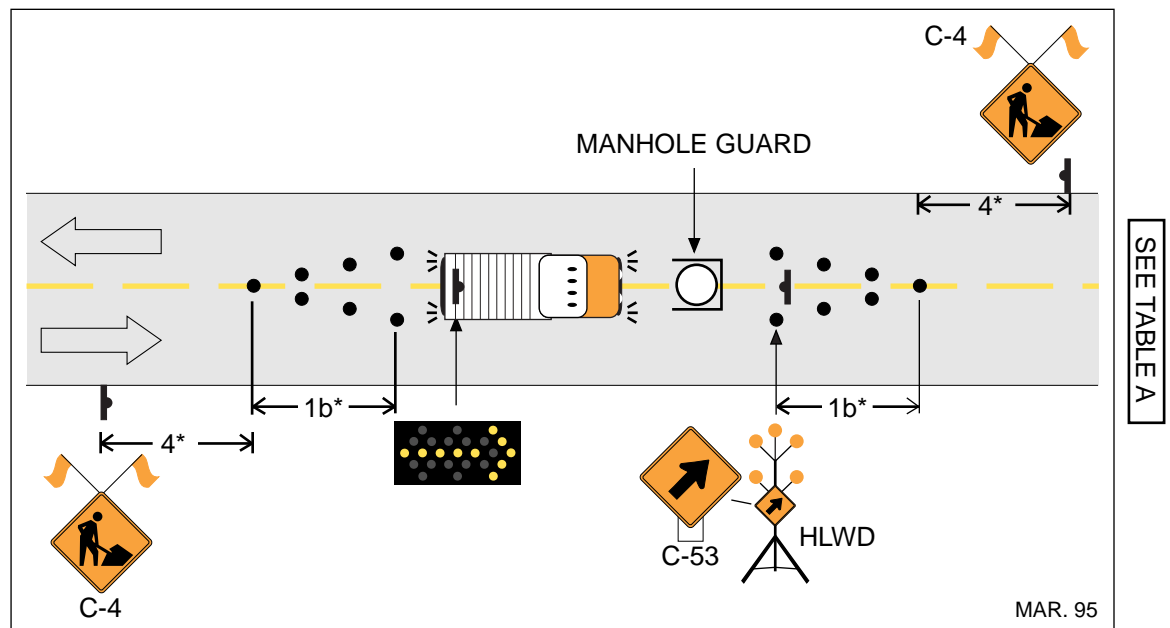
3.9 UTILITY WORK

GENERAL

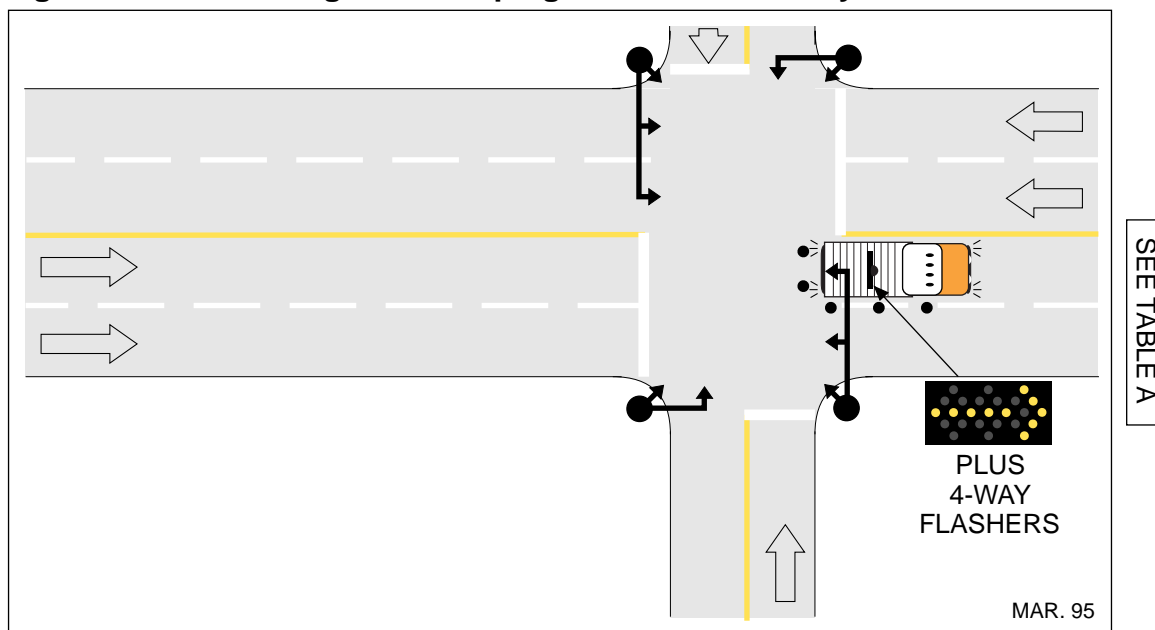
In most circumstances, traffic control required for utility work is no different than that required for road construction or maintenance.

The following figures, however, illustrate traffic control for situations peculiar to utility work.

Figure 3.9.1 Utility Work on Centreline – Urban Area













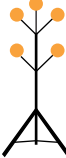
- Additional advanced warning may be used if required.
- C-1 and C-23 signs (Temporary Speed Zone) may be used when conditions warrant.
- See Table for Figure 3.4.3.

Figure 3.9.2 Traffic Signal Relamping or Overhead Utility Work

- Work vehicle with 4-way flashers operating and FAB directing traffic into the right lane is stopped under a signal head where lamps are to be replaced.
- If the speed is 70 km/h or higher, the signal may be placed in flashing operation.

CHAPTER 4

TYPICAL TRAFFIC CONTROL LAYOUTS FOR LONG DURATION WORK ZONES

LEGEND	
	TUBULAR MARKER – TYPE D
	CONE – TYPE A, B or C
	SIGN
	TRAFFIC CONTROL PERSON (TCP)
	SHADOW, BUFFER or WORK VEHICLE
	(360°) FLASHING YELLOW LIGHT
	WORK AREA
	PORTABLE LANE CONTROL SIGNAL
	BARRICADES and FENCING
	FLASHING ARROW BOARD (FAB)
	HIGH LEVEL WARNING DEVICE (HLWD)

Exception for Emergency and Brief Duration Work

If the work being carried out is of an emergency or brief duration nature, as defined, and is within a speed limit of 60 km/h or less, it may not be practicable to provide the TCPs or advance signing called for in Chapters 3 and 4 of the Traffic Control Manual.

TABLE A

Positioning of devices on conventional roadways for various speed limits.

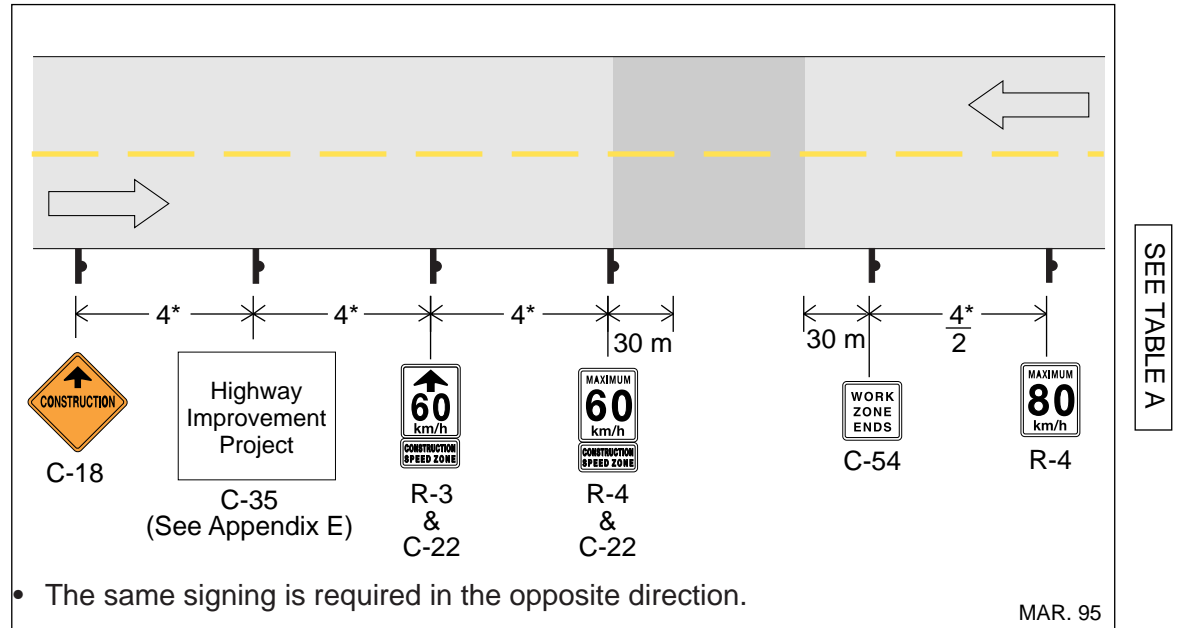
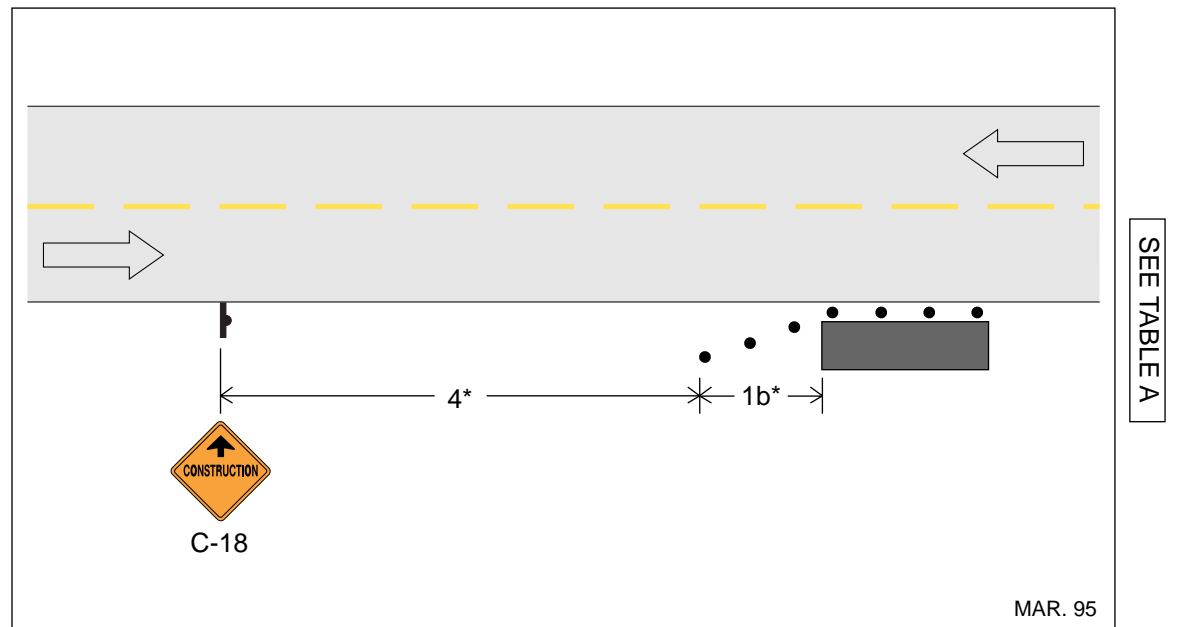
*	Regulatory speed limit	50 km/h	60 km/h	70 km/h	80 km/h	90-100 km/h
1a	Taper length for lane closure	35 (1:10)	55 (1:15)	75 (1:20)	90 (1:25)	110 (1:30)
1b	Taper length for shoulder work or where TCPs used (min. 3 cones)	5	8	10	12	15
2	Maximum distance between cones or tubular markers for 1a	10	10	10	10	10
3	Minimum tangent distance between tapers	30	60	90	120	150
4	Distance between construction signs	40	60	80	100	150

Dimensions shown are in metres and are minimums except for 2*.

Cones and tubular markers are generally used only in daylight but if used at night must be reflectorized. Barricades, flexible drums or temporary delineator posts are generally used during hours of darkness and must be reflectorized.

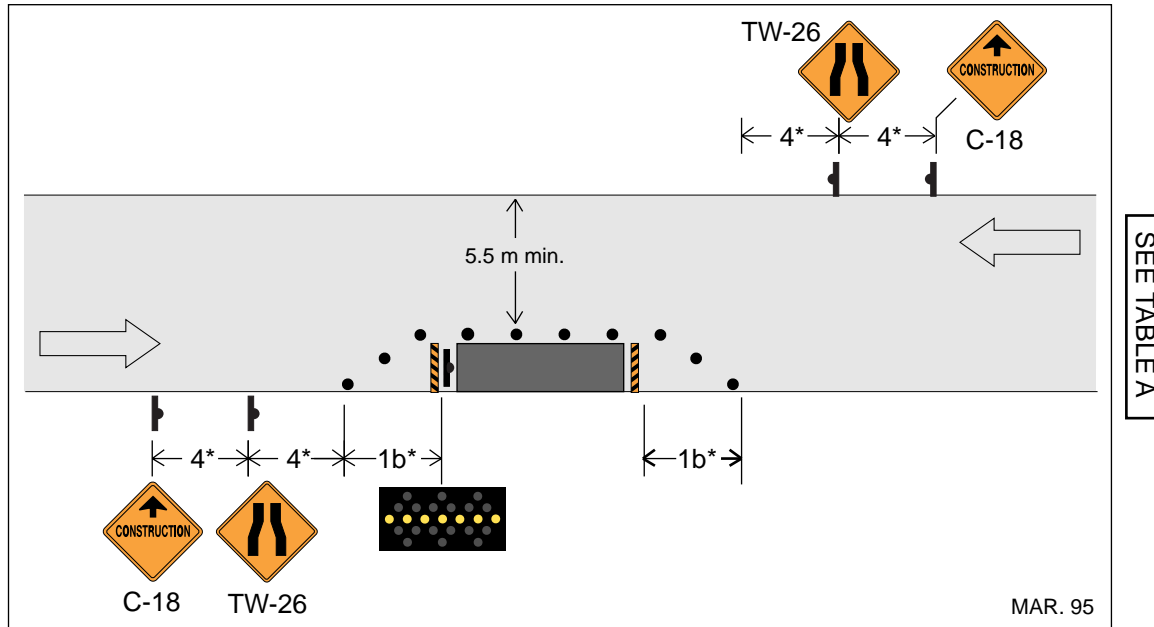
Dimensions 1b* apply to downstream tapers, shoulder tapers, and to two-way traffic tapers on travelled lanes where traffic is controlled by TCPs, portable lane control signals or temporary traffic signals.

Dimensions 4* represent the minimum advance placement distances for initial signs as well as distances between subsequent signs in multi-sign series.

Figure 4.1.1 Typical Construction Speed Zone Signing**Figure 4.2.1 Work on Shoulder**

- When work is not in progress but the work area has not been cleared, care should be taken to isolate it from the travelled roadway with delineation devices and Type A flashers.

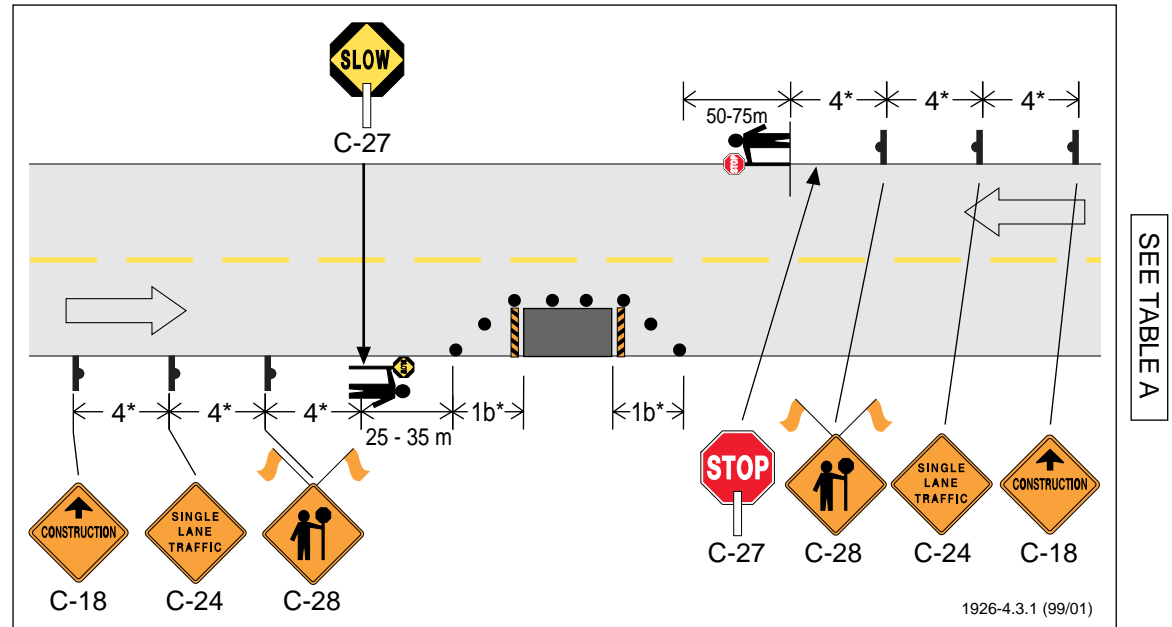
Figure 4.2.2 Work on Low Volume Roadway – No Centreline



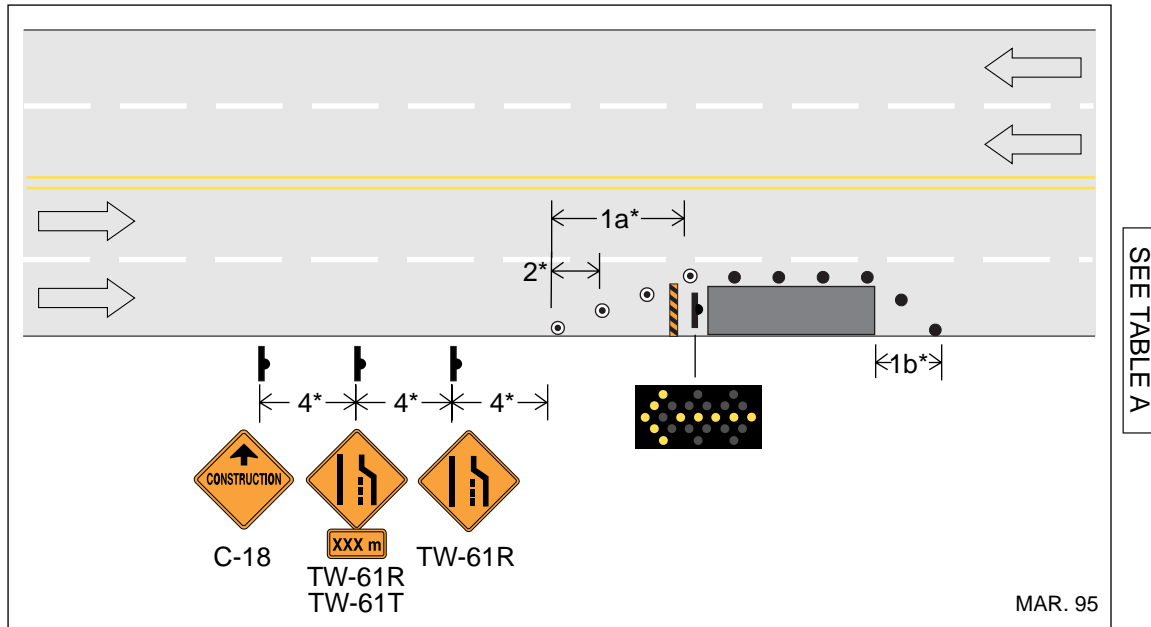
- FAB is required if workers are present.
- Use a lane closure if the speed limit is 70 km/h or greater, if sight distance is restricted (i.e., dust, curves etc.) or if there is less than approximately 5.5 m of road width remaining.
- Substitution for the FAB sign may be made as follows:

	Workers or Work Vehicle Present	No Workers or Vehicles Present
Day	360° & 4 way flashers or HLWD	HLWD
Night	360° & 4 way flashers	Type A flashers

Figure 4.3.1 Lane Closure With TCPs – Two Lane Two-way Roadway



- If the one lane section is sufficiently short (eg., a spot obstruction), sight distance is adequate, and traffic volumes are light, it may be possible to omit the TCP for the open lane or possibly even both TCPs, and let traffic flow be self regulating. If the TCP for the open lane is omitted, the corresponding C-28 sign must be omitted. If the TCP for the closed lane is also omitted, the C-28 for that direction must be replaced with an R-56 Yield to Oncoming Traffic.

Figure 4.3.2 Right Lane Closed – Multilane Roadway

- If the speed limit is 60 km/h or less the upstream TW-61R may be omitted and the C-18 moved downstream by 4*.
- Substitution for the Fab sign may be made as indicated in the following table:

Speed Limit	Light Condition	Workers or Work Vehicle Present	No Workers or Vehicles Present
≥ 60	Day	C-53 plus 360° & 4 way flashers or C-53 plus HLWD	C-53 plus HLWD
	Night	C-53 plus 360° & 4 way flashers	C-53 plus Type A flashers
≥ 70	Day	No Substitution	C-53 plus HLWD
	Night	No Substitution	C-53 plus Type A flashers

Figure 4.3.3 Left Lane Closed – Multilane Roadway

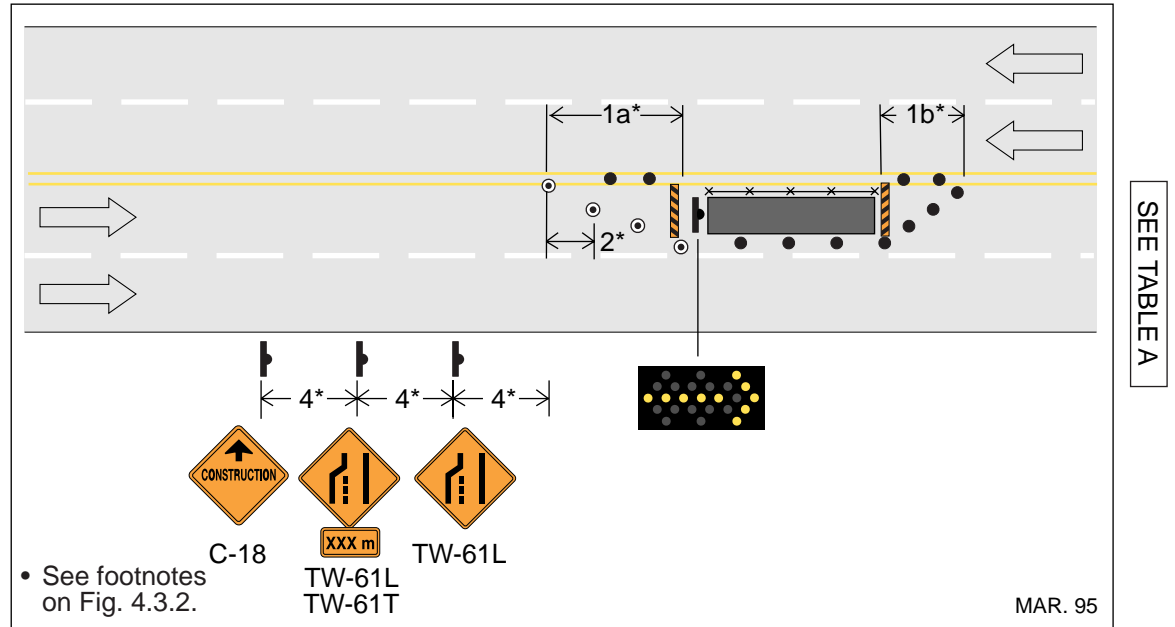
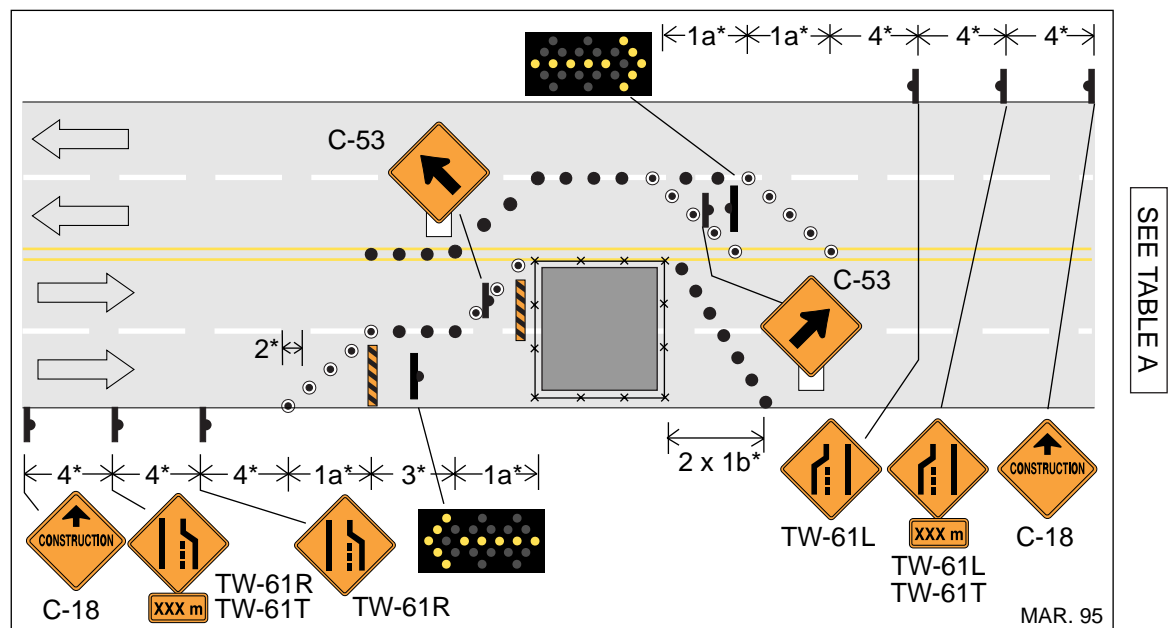
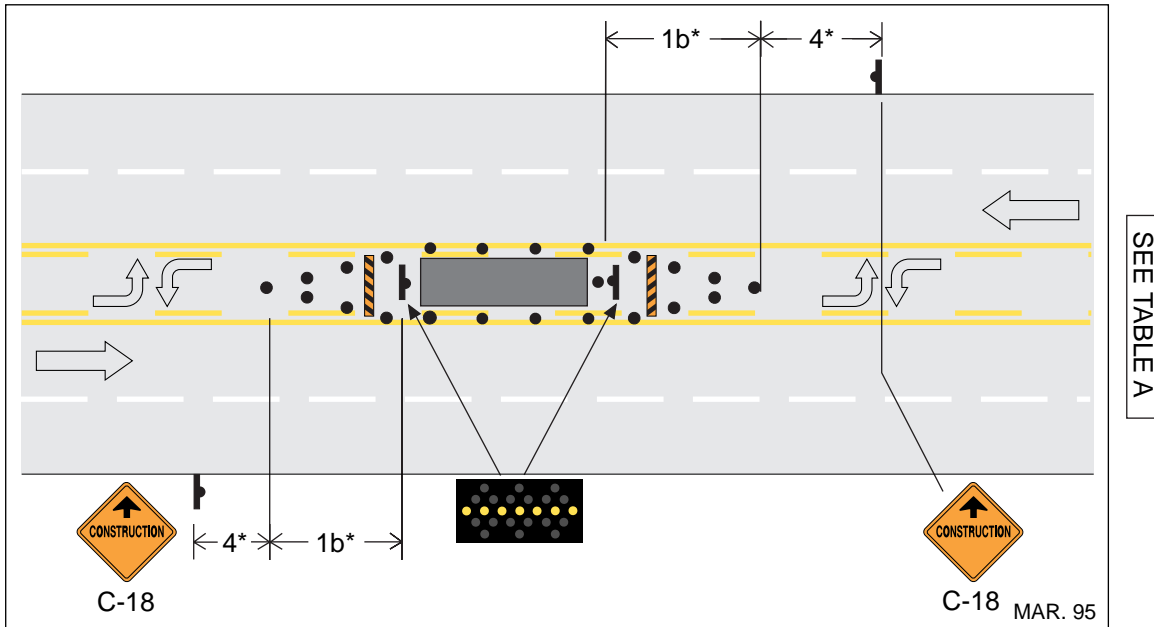


Figure 4.3.4 Median Crossover – Multilane Roadway



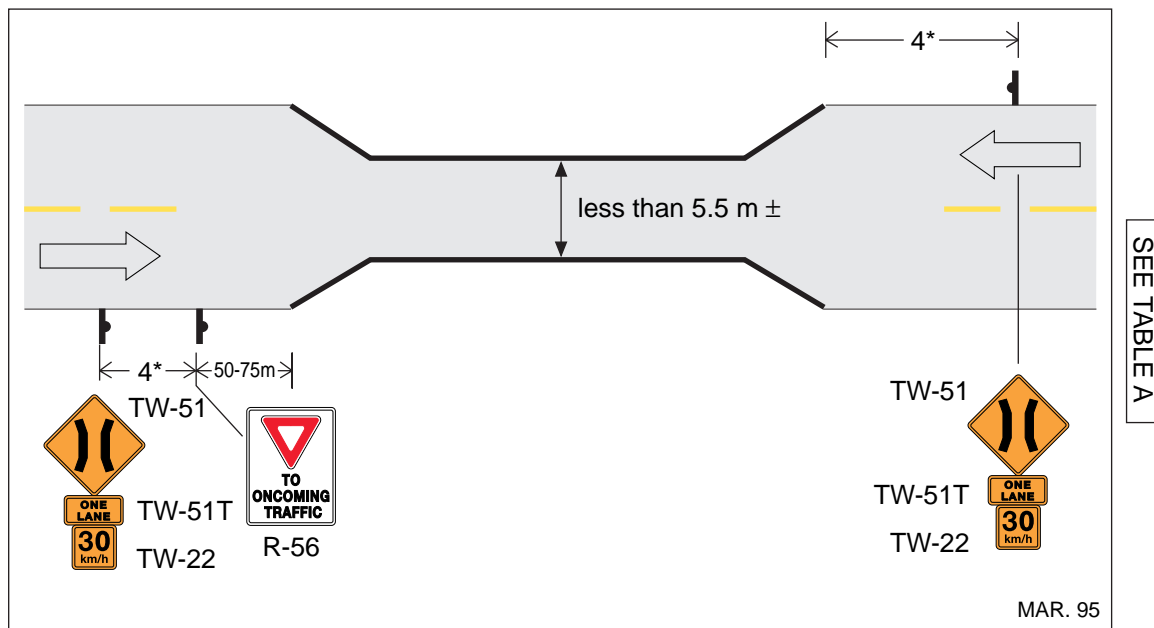
- For high volume roads, concrete barriers may be considered to separate opposing traffic.
- See footnotes on Fig. 4.3.2.

Figure 4.3.5 Two-way Left Turn Lane Closed

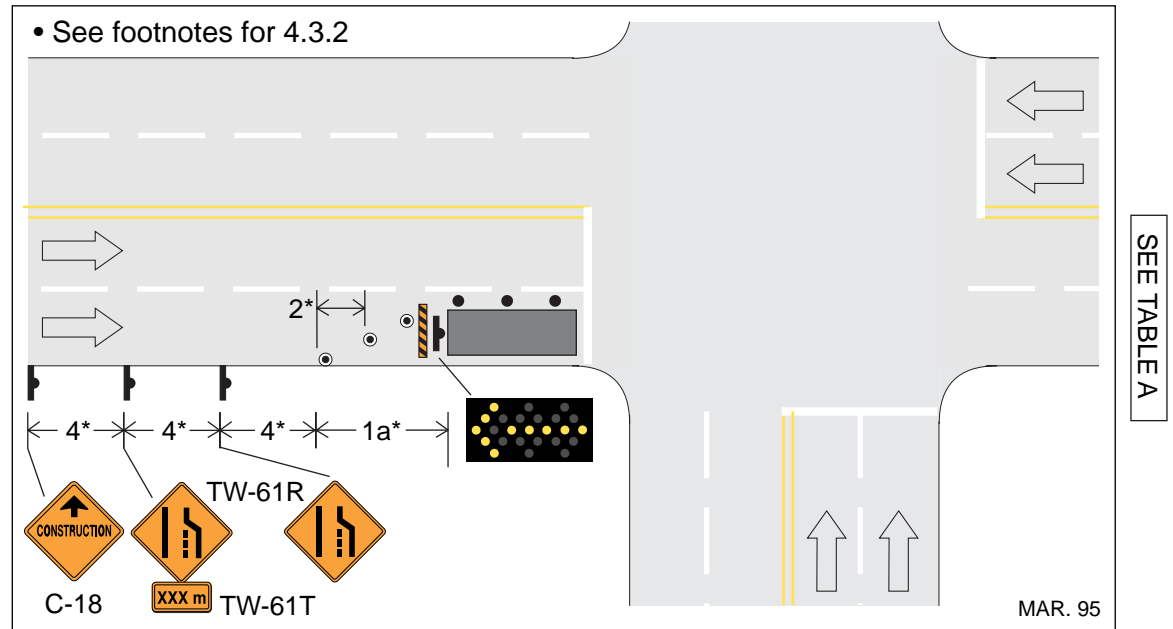
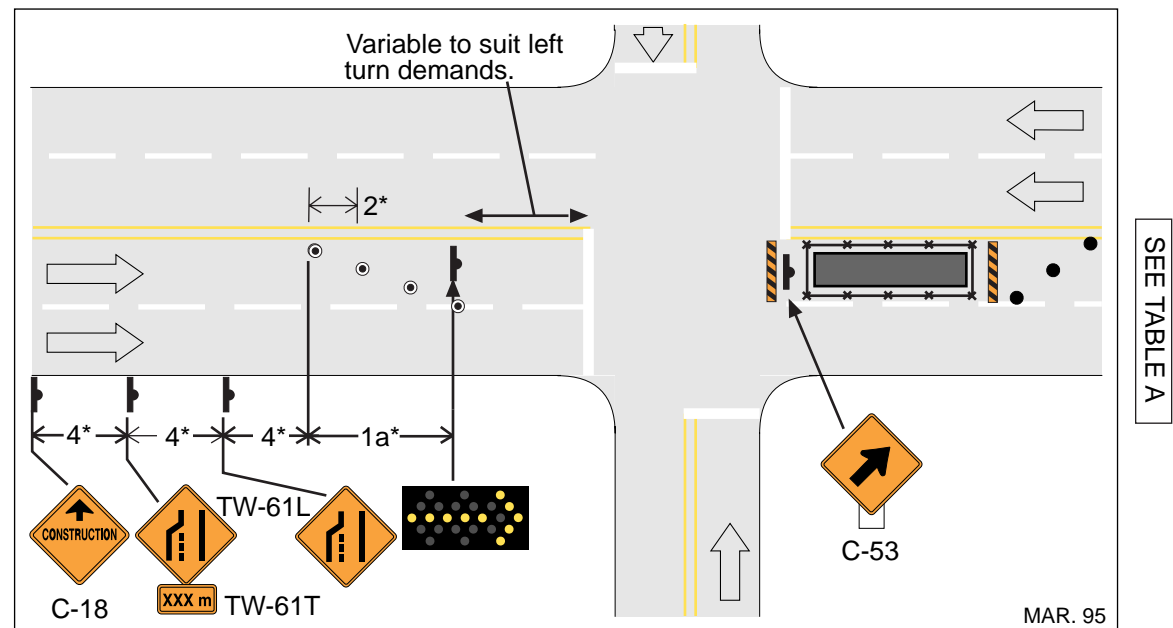


- Two-way Left Turn Lanes are generally used where the speed limit is 60 km/h or less. Under this condition, other devices may be substituted for the FAB as indicated in the table in the footnotes for Fig. 4.3.2 but omitting the C-53.

Figure 4.3.6 One Lane Bridge or Roadway

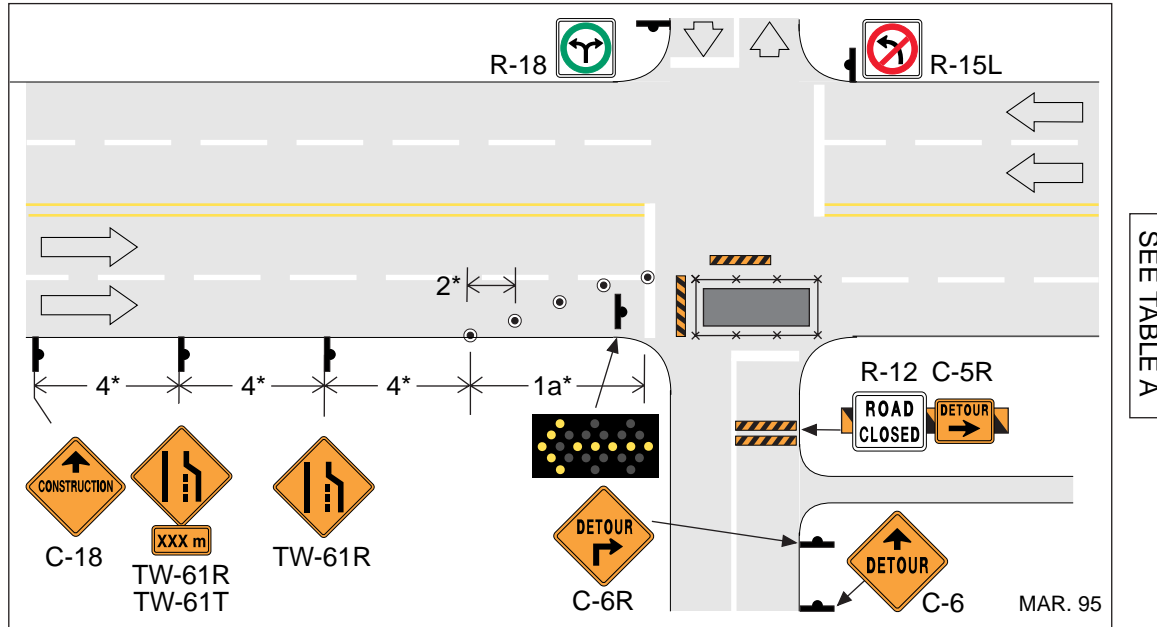


- Traffic from one approach always yields (The side with the best sight distance).
- Advisory speed tabs used when required.
- For one lane roadway, substitute C-24 for TW-51 and TW-51T signs.

Figure 4.4.1 One Lane Closed (Near Side) – Multilane Intersection**Figure 4.4.2 One Lane Closed (Far Side) – Multilane Intersection**

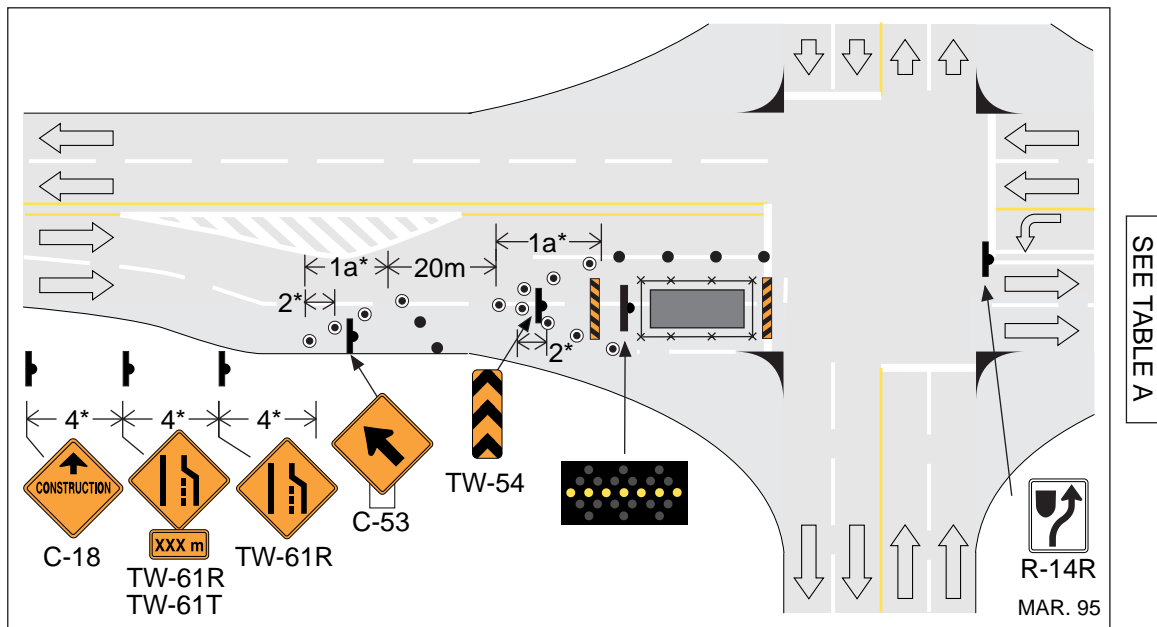
- Curb parking should be prohibited next to the work area and the taper.
- See footnotes for figure 4.3.2.

Figure 4.4.3 One Lane Closed – Multilane Intersection

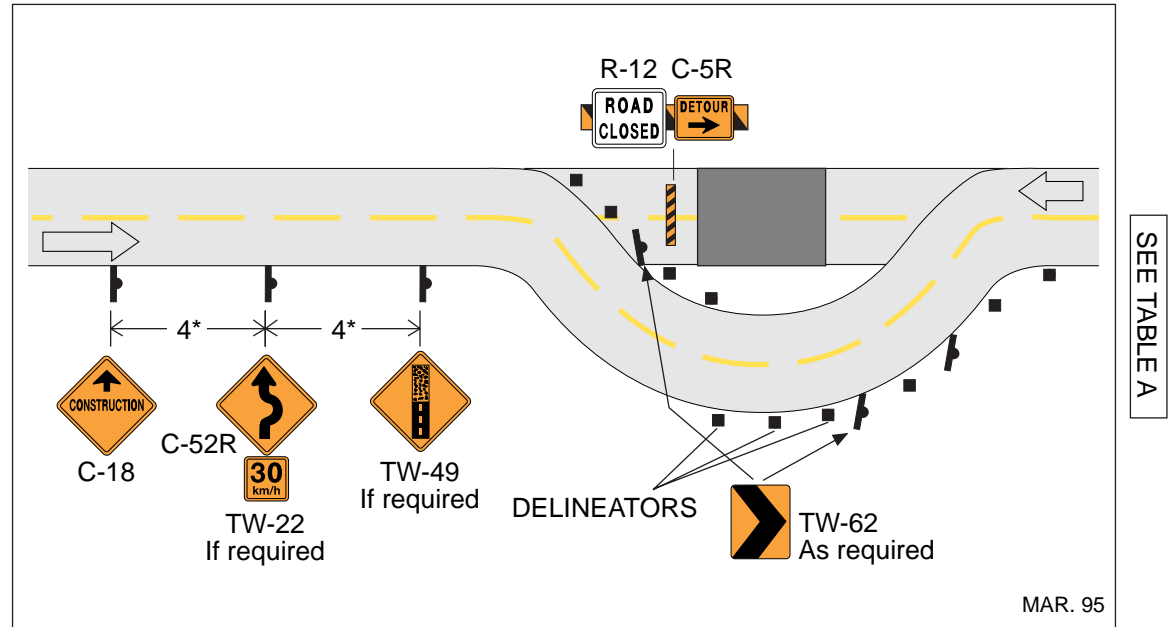


- Detour signing is also required on the intersection leg opposite the closure.
- See footnotes on Fig. 4.3.2.

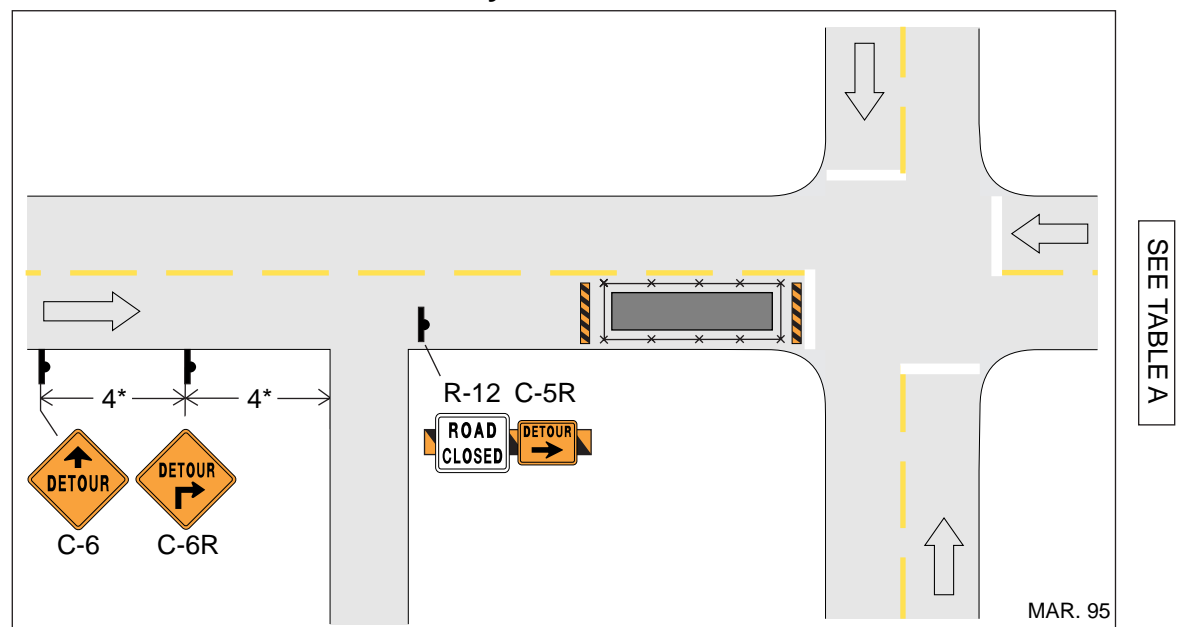
Figure 4.4.4 Two Lanes Closed (Near Side) – Multilane Intersection



- It may be necessary to prohibit certain turning movements.
- Other devices may be substituted for the FAB as indicated in the Table in the footnotes for Figure 4.3.2, but omitting the C-53.

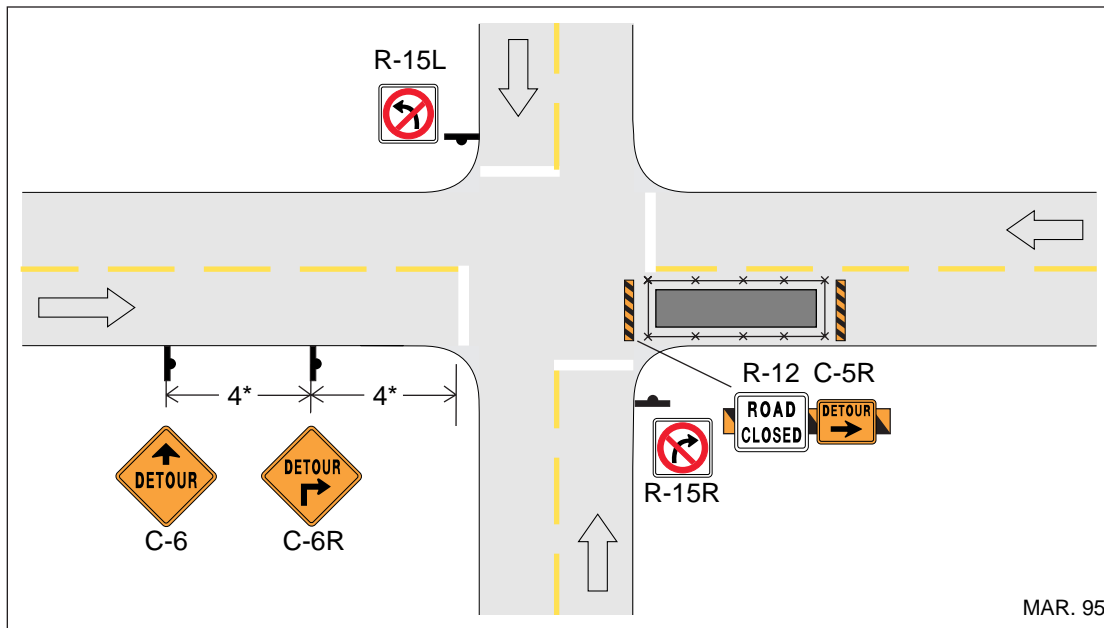
Figure 4.5.1 Roadside Diversion – Two Lane Two-way Roadway

- If the diversion is paved, temporary pavement markings are required.
- Similar signing is required for opposing traffic.

Figure 4.5.2 One Lane Closed (Near Side) – Two Lane Two-way Intersection

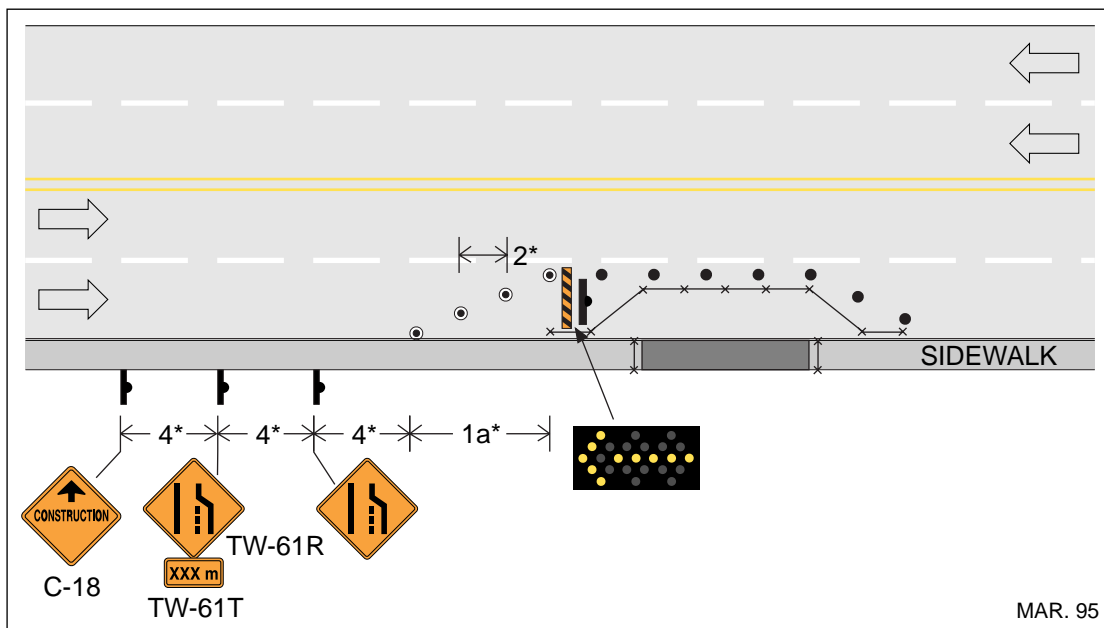
- This layout is to be used if an alternate route detour is available; if not, TCPs are required and the layout shown in Figure 4.3.1 should be used.

**Figure 4.5.3 Detour for One Lane Closed (Far Side)
– Two Lane Two-way Intersection**

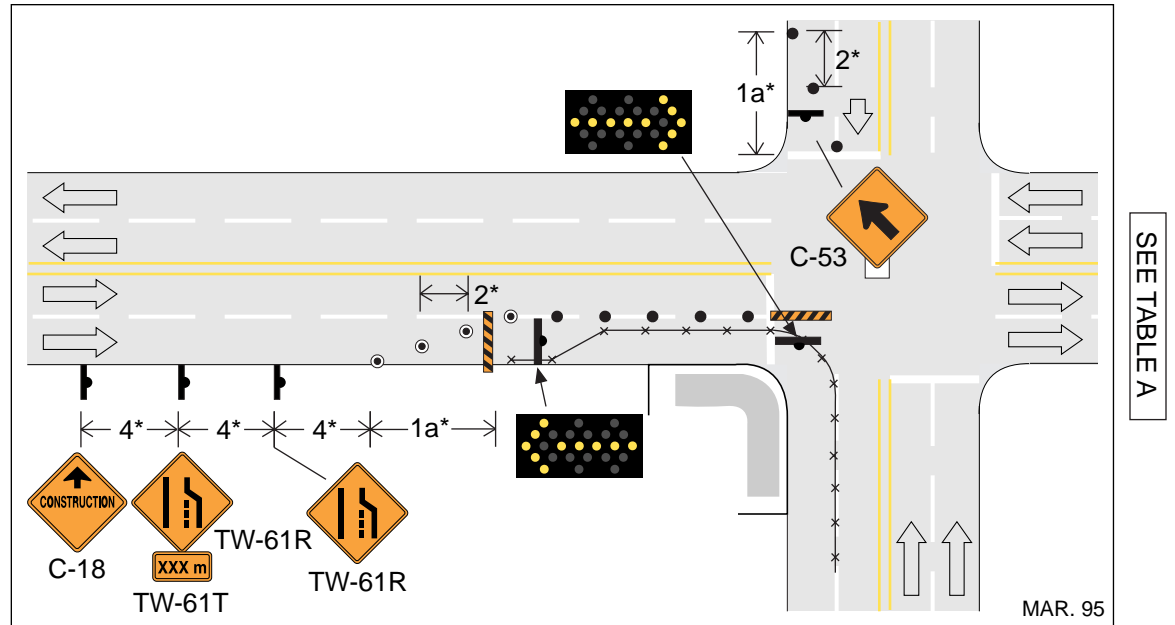


- This layout is to be used if an alternate route detour is available; if not, TCPs are required and the layout shown in Figure 4.3.1 should be used.

Figure 4.6.1 Sidewalk Detour – Multilane Roadway



- For sidewalk closures of long duration, a boardwalk and railing should be provided.
- See footnotes on Fig. 4.3.2.

Figure 4.6.2 Sidewalk Detour – Multilane Intersection

- The same advance signing is required on the cross street approach opposite the sidewalk detour.
- See footnotes on Fig. 4.3.2.

CHAPTER 5

TYPICAL TRAFFIC CONTROL LAYOUTS FOR FREEWAY WORK ZONES





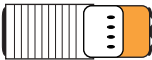

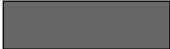



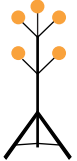
LEGEND	
	TUBULAR MARKER – TYPE D
	CONE – TYPE A, B or C
	SIGN
	TRAFFIC CONTROL PERSON (TCP)
	SHADOW, BUFFER or WORK VEHICLE
	(360°) FLASHING YELLOW LIGHT
	WORK AREA
	PORTABLE LANE CONTROL SIGNAL
	BARRICADES and FENCING
	FLASHING ARROW BOARD (FAB)
	HIGH LEVEL WARNING DEVICE (HLWD)

TABLE B

Positioning of devices on freeways.

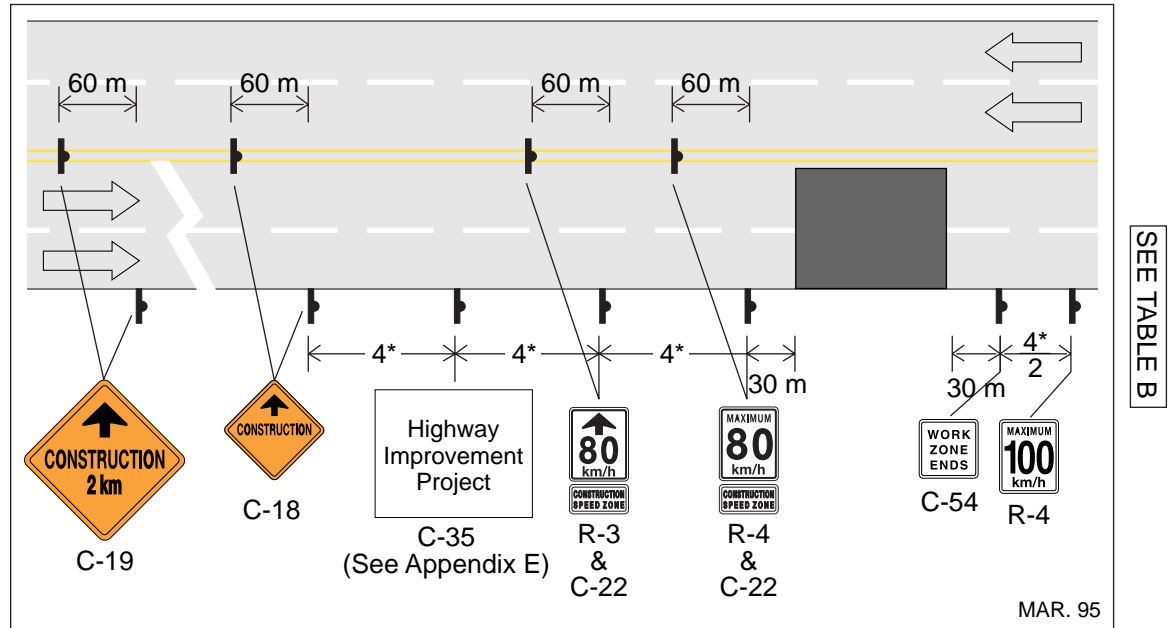
*	Regulatory speed limit	80-110 km/h
1	Taper length for lane closure	165 (1:45)
2	Maximum distance between tubular markers for (1)	10
3	Minimum tangent distance between tapers	200
4	Distance between construction signs	200

Dimensions shown are in metres and are minimums, except for 2*.

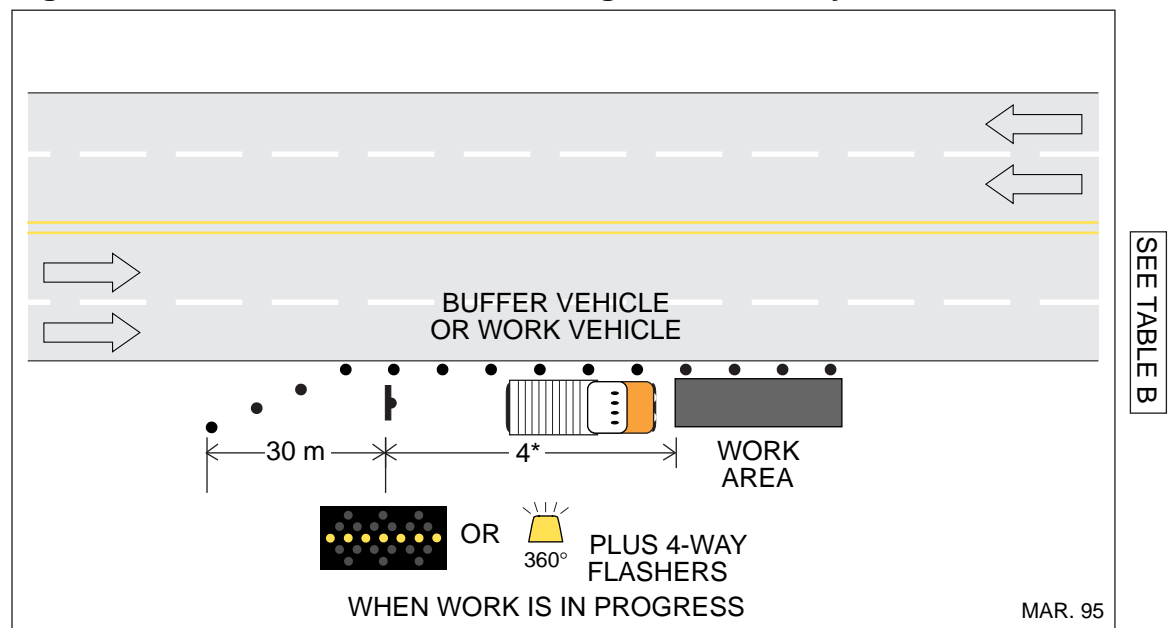
Cones and tubular markers will generally be used only in daylight but if used at night must be reflectorized. Barricades, flexible drums or temporary delineator posts are generally used during hours of darkness and must be reflectorized.

Dimensions 4* represent the minimum advance placement distance for initial signs as well as distances between subsequent signs in multi-sign series.

Downstream tapers should have a minimum length of 15 m per lane.

Figure 5.1.1 Advance Warning Area – Longer Term Work

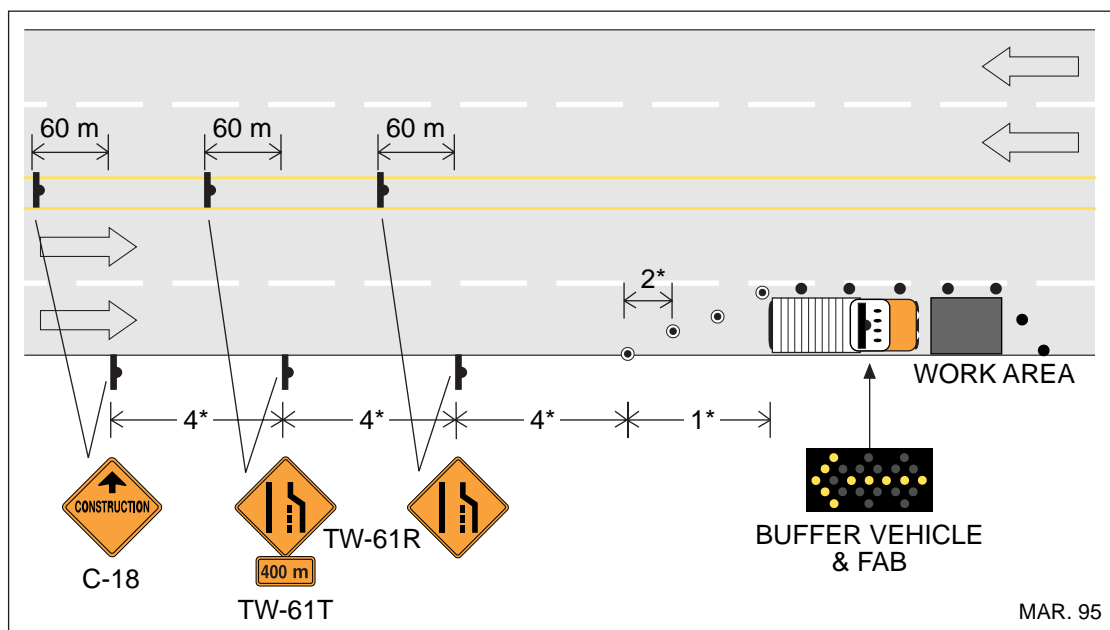
- The same signing is required in the opposite direction only if work operations affect traffic in the opposite direction.
- Construction speed zone is shown as a typical example of legal speed reduction which should only be imposed if warranted. Any existing speed limit signs within the zone must be covered or removed.

Figure 5.3.1 Work on Shoulder – Moving and Stationary Work

- For moving operations cones may be omitted.
- When work is not in progress but the work area has not been cleared, care should be taken to isolate it from the travelled roadway with delineation devices and Type A flashing yellow lights (nighttime) or Type B flashing yellow lights (daytime).

The diagram illustrates a two-lane road layout for a shadow vehicle and a work vehicle. The road is divided into two lanes by a dashed center line. A yellow line marks the edge of the work area. A 'SHADOW VEHICLE' is positioned in the left lane, and a 'WORK VEHICLE' is positioned in the right lane. A 'TW-59' sign is placed between the vehicles. A 'SLOW VEHICLE NEXT km' sign is placed in the left lane. A distance of 60m is indicated between the shadow vehicle and the TW-59 sign. A distance of 4* is indicated between the shadow vehicle and the work vehicle. The diagram is labeled 'C-44' and 'MAR. 95'.

- ### Figure 5.5.1 Stationary and Intermittent Moving Work With Lane Closure



See 5.6.1(b) for balance of figure

60m 60m 60m 60m 60m

4* 4* 4* 4* 4* 4* 1* 3* 1*

1* 1* 4*

2*

3*

30 m

CONSTRUCTION

TW-61R

800 m

60 km/h

MAXIMUM 60 km/h

CONSTRUCTION (SPEED ZONE)

CONSTRUCTION (SPEED ZONE)

R-3

R-4

R-4

MAXIMUM 90 km/h

R-4

C-18

TW-61R

TW-61T

R-3

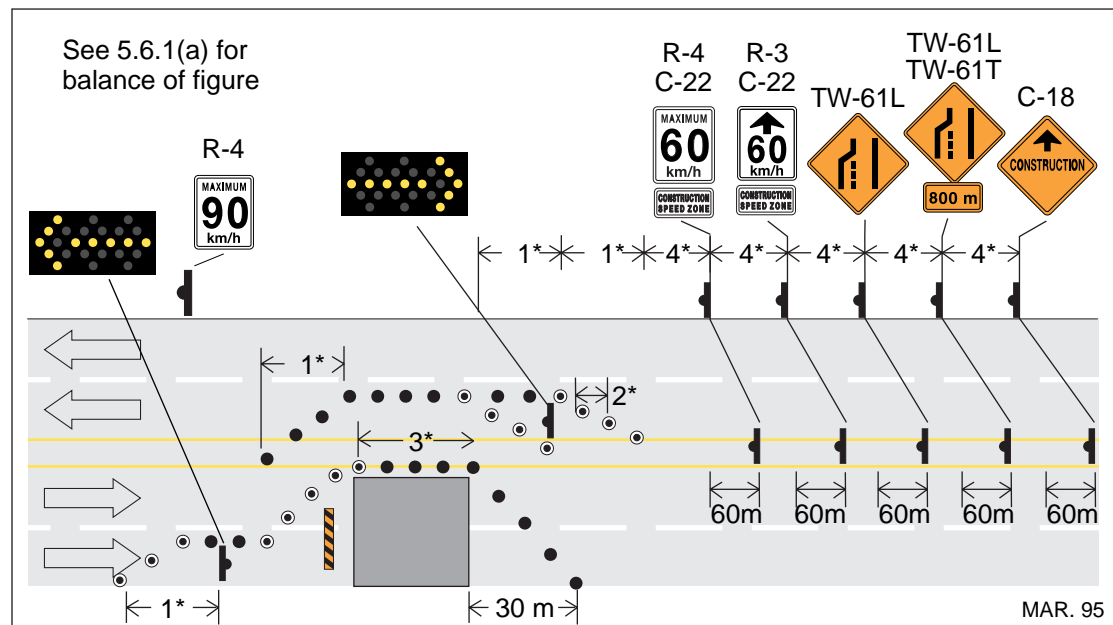
C-22

R-4

C-22

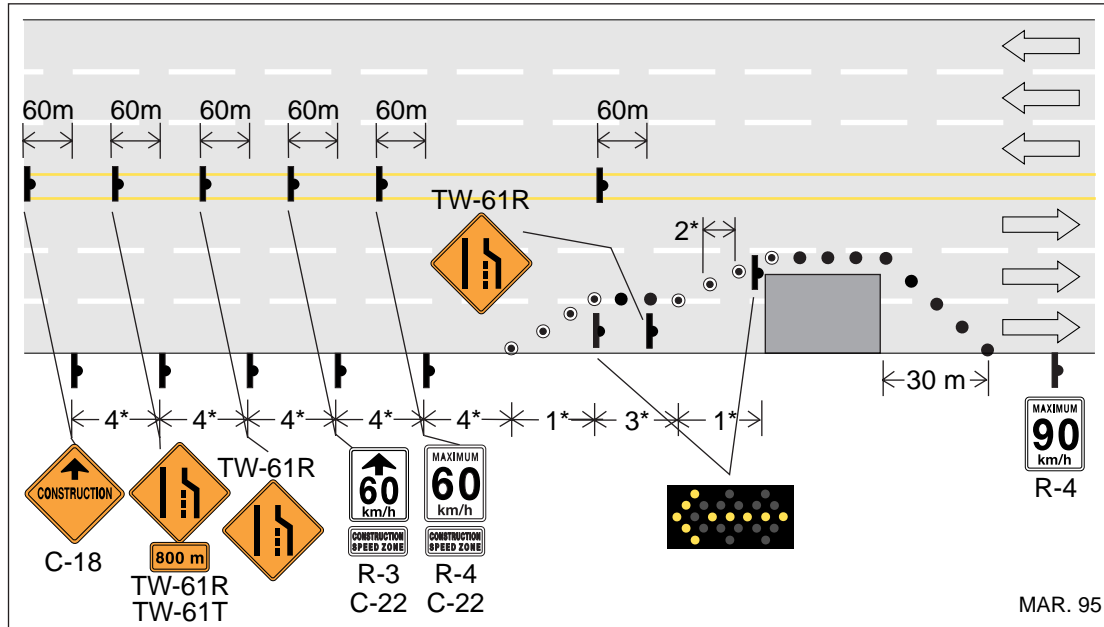
MAR. 95

- ### Figure 5.6.1(b) Median Cross Over (Far Side Signing)



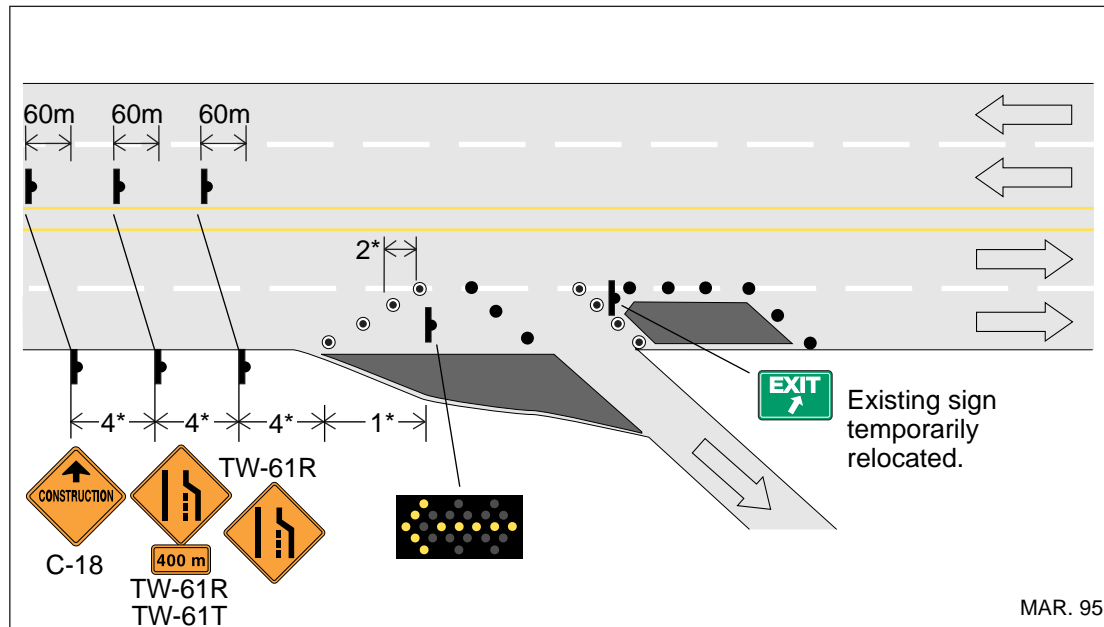
- Signing as shown in Figure 5.6.1(a) Median Cross Over (Near Side Signing) is also required.
- Construction speed zone is shown as a typical example of speed zone reduction.
- For high volume locations concrete median barriers may be considered to separate opposing traffic.

Figure 5.7.1 Two Lanes Closed On Three Lane Roadway



- Construction speed zone is shown as a typical example of speed zone reduction.

Figure 5.8.1 Lane Closure at Open Exit Ramp



[illegible]

- SEE TABLE B

Diagram illustrating a road closure setup for a two-lane road. The diagram shows a two-lane road with a dashed center line and solid edge lines. A yellow line indicates the start of the closure. A series of black dots represents the closure area. A 'ROAD CLOSED' sign (R-12) is placed at the end of the closure. Two orange diamond signs are placed before the closure: 'CONSTRUCTION' (C-18) and 'EXIT CLOSED AHEAD' (Special). The distance between the signs is marked as 4*.

APPENDICES

TRAFFIC CONTROL FOR SPECIALIZED MINISTRY WORKS ON HIGH SPEED RURAL HIGHWAYS

Notice

Traffic control as called for in these Appendices is generally required for high speed rural highways only. It is not intended as a requirement for low speed urban streets.





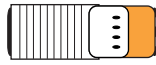





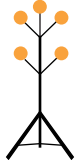
LEGEND	
	TUBULAR MARKER – TYPE D
	CONE – TYPE A, B or C
	SIGN
	TRAFFIC CONTROL PERSON (TCP)
	SHADOW, BUFFER or WORK VEHICLE
	(360°) FLASHING YELLOW LIGHT
	WORK AREA
	PORTABLE LANE CONTROL SIGNAL
	BARRICADES and FENCING
	FLASHING ARROW BOARD (FAB)
	HIGH LEVEL WARNING DEVICE (HLWD)

TABLE A

Positioning of devices on conventional roadways for various speed limits.
(For positioning of devices on rural freeways, see Table B in Chapter 5.)

*	Regulatory speed limit	50 km/h	60 km/h	70 km/h	80 km/h	90-100 km/h
1a	Taper length for lane closure	35 (1:10)	55 (1:15)	75 (1:20)	90 (1:25)	110 (1:30)
1b	Taper length for shoulder work or where TCPs used (min. 3 cones)	5	8	10	12	15
2	Maximum distance between cones or tubular markers for 1a	10	10	10	10	10
3	Minimum tangent distance between tapers	30	60	90	120	150
4	Distance between construction signs	40	60	80	100	150

Dimensions shown are in metres and are minimums except for 2*.

Cones and tubular markers are generally used in daylight but if used at night must be reflectorized. Barricades, flexible drums or temporary delineator posts are generally used during hours of darkness and must be reflectorized.

Dimensions 1b* apply to downstream tapers, shoulder tapers, and to two-way traffic tapers on travelled lanes where traffic is controlled by TCPs, portable lane control signals or temporary traffic signals.

Dimensions 4* represent the minimum advance placement distances for initial signs as well as distances between subsequent signs in multi-sign series.

APPENDIX A

ROAD CLOSURES FOR SNOW AVALANCHE CONTROL

Where snow avalanche conditions warrant, a highway may be closed at locations with gates, at designated locations without gates, or at other locations approved by the Avalanche Technician. Closure locations should be on relatively level grade, be free of avalanche hazard and have turning room for large vehicles.

Traffic control for snow avalanche closures is as illustrated in one of the following:

Figure A1 Gates and no TCPs

Figure A2 Gates and TCPs

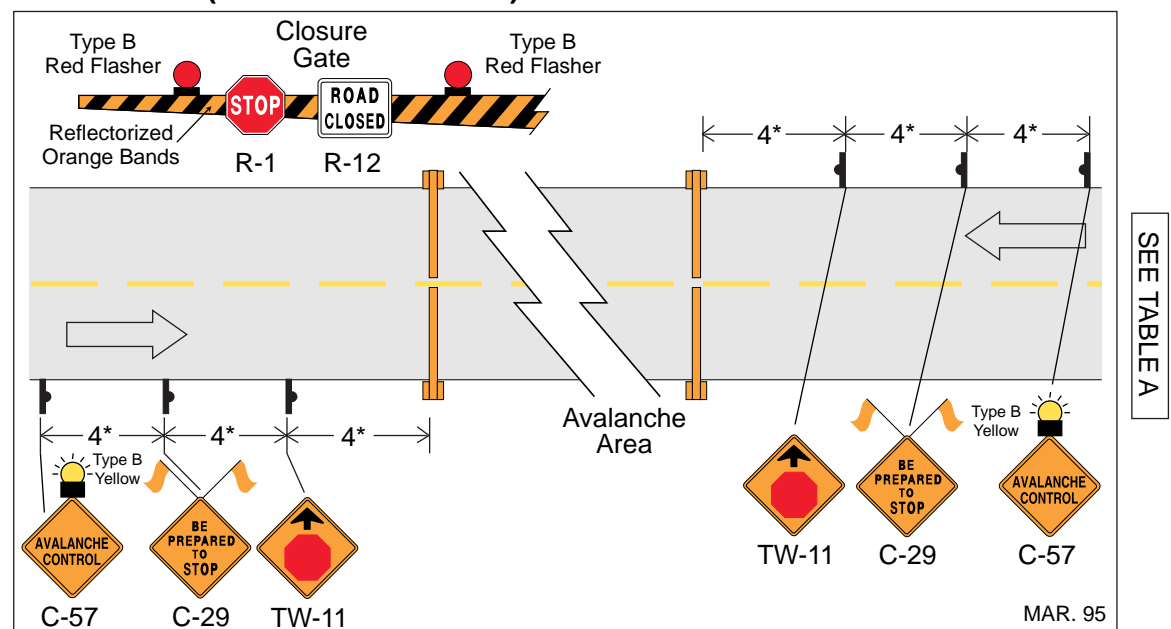
Figure A3 Barricades and TCPs

When not required, signs, including those on gates, must be removed, folded or covered, and flags removed.

Bases for gates shall be marked with W-54 black and yellow HAZARD markers.

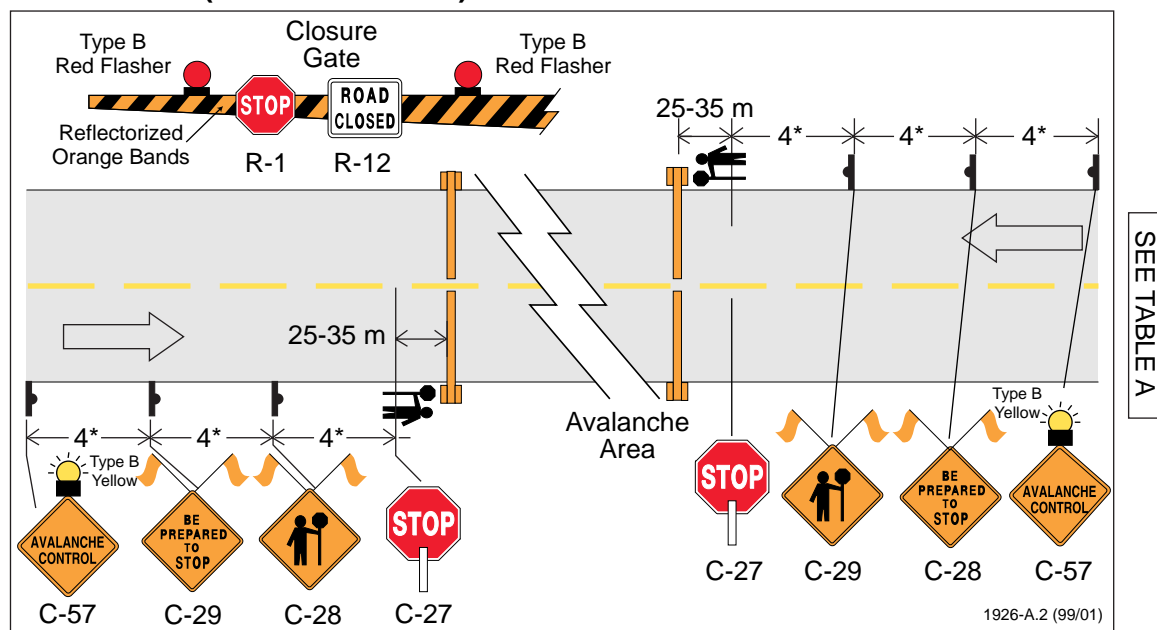
On multilane divided roadways the indicated signing should be repeated in the median if space permits. A sign mounted in the median should be approximately 60 m upstream from the same sign on the shoulder.

**Figure A.1 – Road Closure for Snow Avalanche Control
(Gates and no TCPs)**



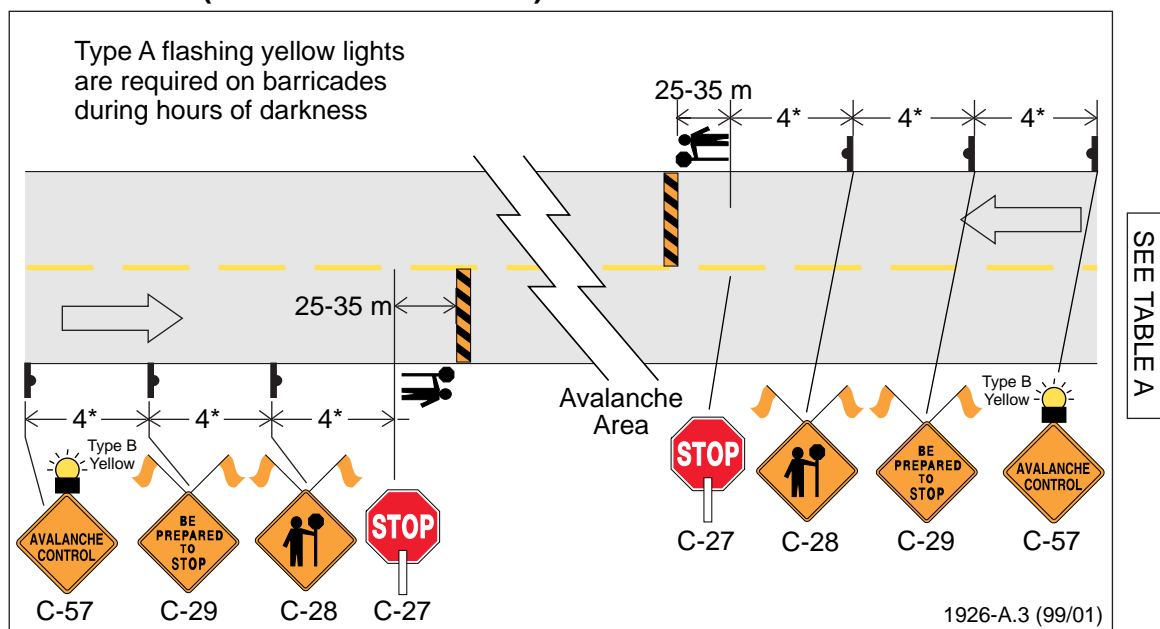
- If avalanche barrier gates are not manned during the closure, they should be locked as authorized by the Ministry Snow Avalanche Technician.
- Type B flashing yellow lights may be replaced with flags.

**Figure A.2 – Road Closure for Snow Avalanche Control
(Gates and TCPs)**



- Type B flashing yellow lights may be replaced with flags.

**Figure A.3 – Road Closure for Snow Avalanche Control
(Barricades and TCPs)**



- Roads may be closed for snow avalanche control (with barricades and TCPs) at ungated locations approved by the Avalanche Technician.
- Type B flashing yellow lights may be replaced with flags.

APPENDIX B

PAVEMENT MARKING

A document titled “Roadmarking Procedures” dated March 31, 1981 and subsequent revisions describes procedures and equipment required when marking is carried out on roads under the jurisdiction of the Ministry of Transportation and Highways. In addition, the following figures show recommended traffic control for the most common rural marking procedures.

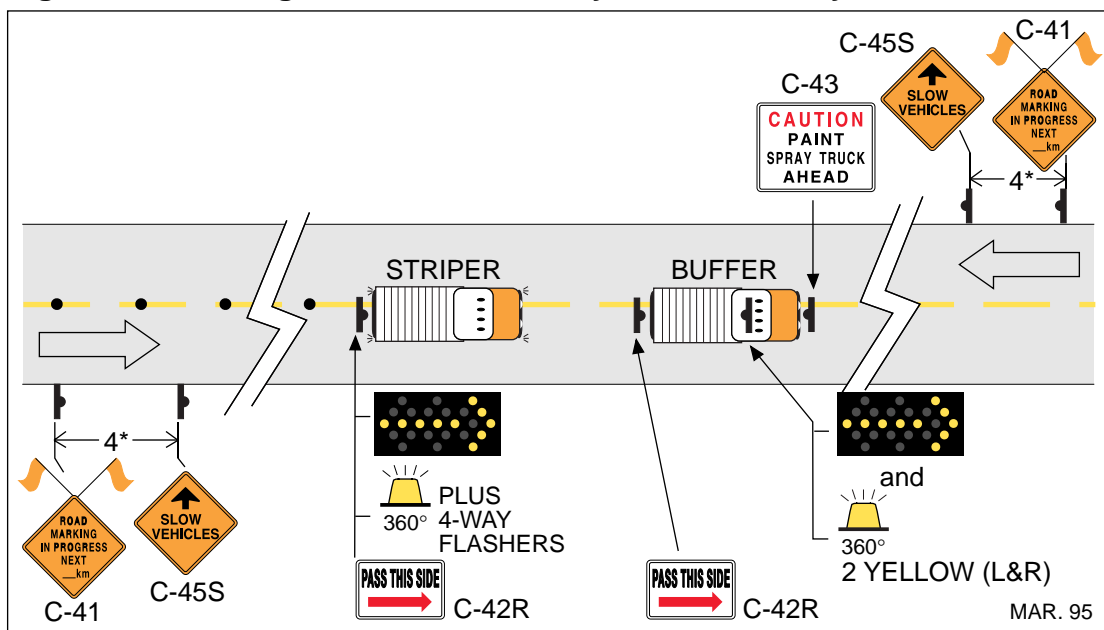
Two Lane Two-way Rural Roadway

Figure B.1 indicates traffic control for painting centreline on a two lane two-way rural road.

Multilane Rural Roadway

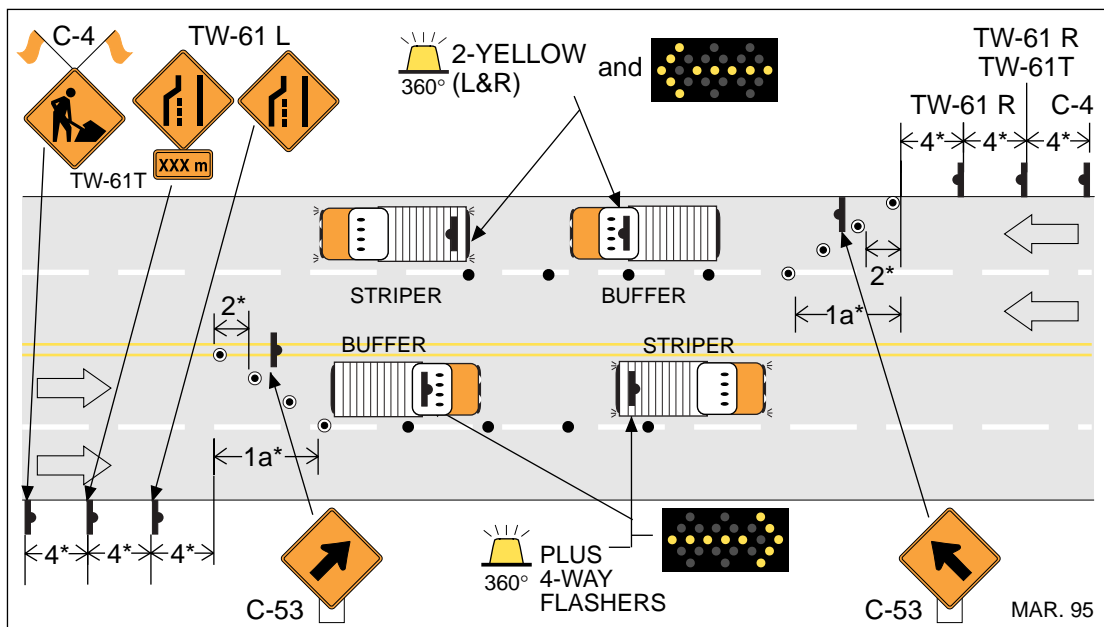
Figure B.2 indicates traffic control for painting pavement markings on a multilane rural road.

Figure B.1 Marking – Two Lane Two-way Rural Roadway



- Distance on C-41 chalk board must not exceed 10 km.
- C-41S sign may be used in place of or to supplement C-41 or C-45S signs.

Figure B.2 Marking – Multilane Rural Roadway



APPENDIX C

FALLING WEIGHT DEFLECTOMETER

This pavement testing device is mounted on a small trailer towed by a van. The test unit typically stops for a maximum of 45 seconds per test and does not require personnel to leave the vehicle. Test are usually taken at intervals of between 20 m and 100 m.

On two lane tow-way roadways with light traffic volumes and good visibility, traffic control as illustrated in Figure 3.2.2 (with C-38 sign in place of a C-44) may be used. If traffic volumes are high or visibility poor, traffic control as illustrated in Figure 3.2.1 should be used.

On multilane roadways traffic control as illustrated in Figure 3.2.3 (with a C-38 sign in place of a C-44) may be used provided that the speed limit is 70 km/h or higher, a shadow vehicle must be used, and if considered necessary a buffer vehicle as well.

C-38 signs when used for Falling Weight Deflectometer operations on rural highways may indicate a distance not exceeding 8 km.

APPENDIX D

PAVING AND SEALCOATING

GENERAL

Paving and sealcoating operations present a variety of traffic control situations which are frequently changing and constantly moving. It is, therefore, not practical to provide detailed traffic control proposals for all situations. Figures D.1 (a) and (b) and D.2 (a) and (b) illustrate minimum signing required for two typical situations.

If work is not in progress, and the roadway and shoulders are clear of machinery and obstructions, and the condition of the unfinished roadway is such that traffic can proceed safely without the aid of TCPs or a pilot car, all non applicable signs should be removed or covered. If there are potential dangers such as loose gravel, dust, low shoulders, bumps, fresh oil, uneven lifts of pavement, grooved pavement, no pavement markings, etc., then each should be signed accordingly and the construction speed zone should be left in effect.

Particular attention should be given to signing for low shoulders and uneven lifts of pavement as they are not easily detected in darkness or poor weather. On long sections, warning signs should be repeated as necessary.

Construction speed zones should be altered as necessary to keep them as short as possible and to not require drivers to proceed at unreasonably low speeds. Long zones will require that R-4/C-22 assemblies be repeated as necessary. The ends of construction speed zones are marked with R-4 signs showing normal speed limits.

Figure D.2(a) and (b) illustrates typical signing for a pilot car operation. This signing can be incorporated into that shown in Figure D.1(a) and (b).

Care must be taken to ensure that signs are moved to keep up with moving paving and sealcoating operation.

If TCPs must be employed during hours of darkness and difficulty is experienced getting traffic to stop, an oversized (75 cm x 75 cm) R-1 STOP sign may be placed on a barricade across the closed lane where the TCP is located.

Figure D.1(a) Paving – Work Not In Progress

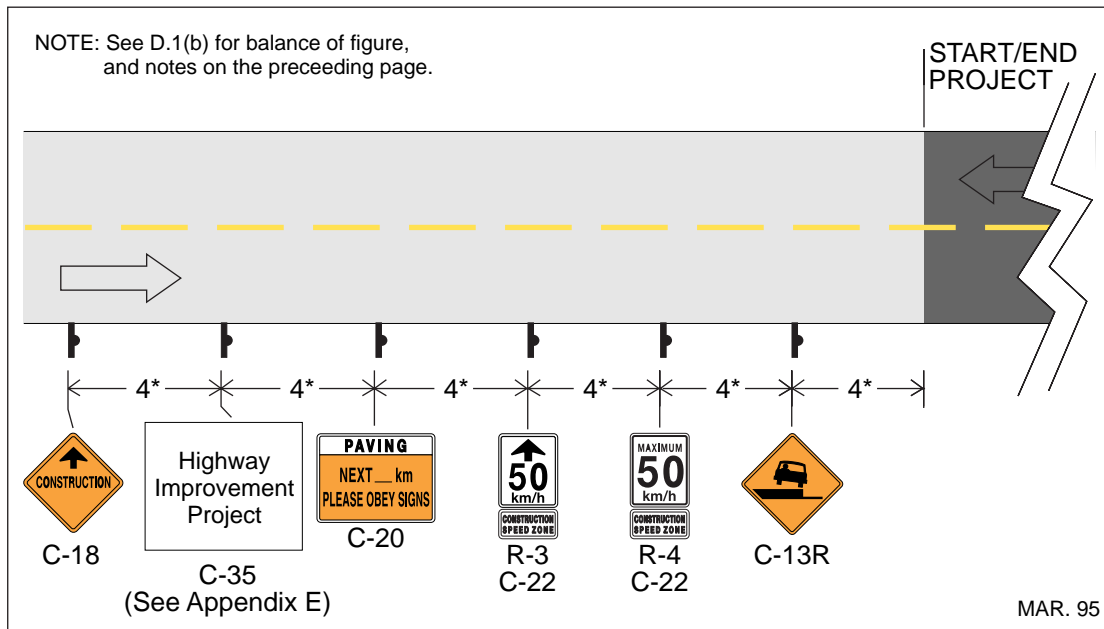
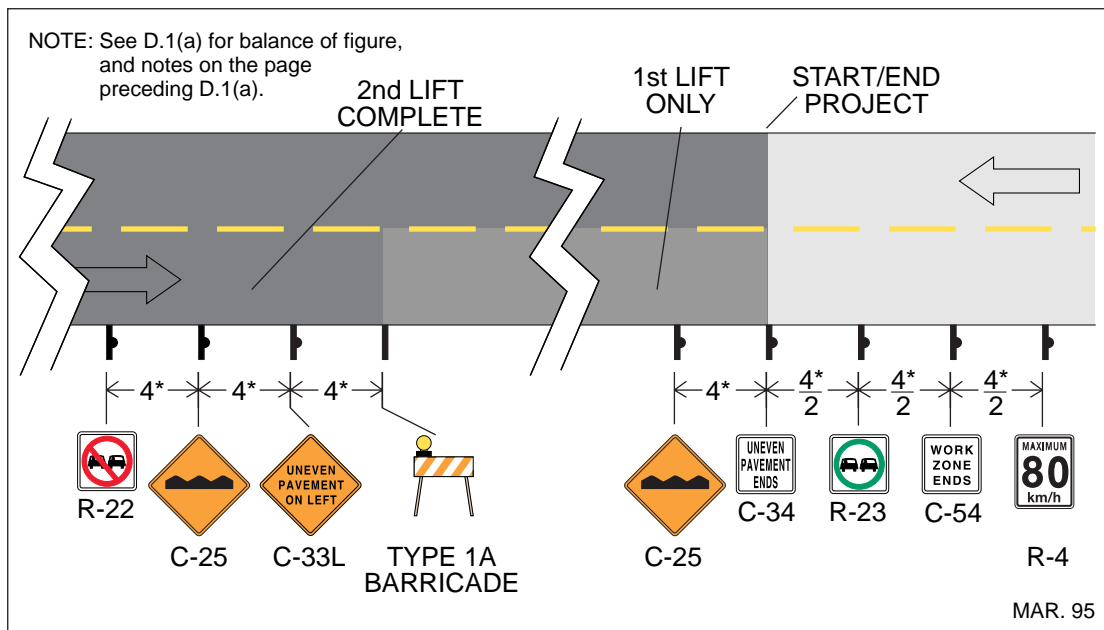


Figure D.1(b)



- Repeat applicable signs for other direction.
- At night:
 - Add Type 1A Barricades with Type A Flashing Yellow Lights to all sign locations in Advance Warning Area.
- As required throughout the work area, repeat signs such as:
 - R-4/C-22, C-8, C-12, C-14, C-24, C-37, C-46, C-49, TW-27, TW-36, TW-49, TW-50/TW-24 etc.

Figure D.2(a) Sealcoating in Progress

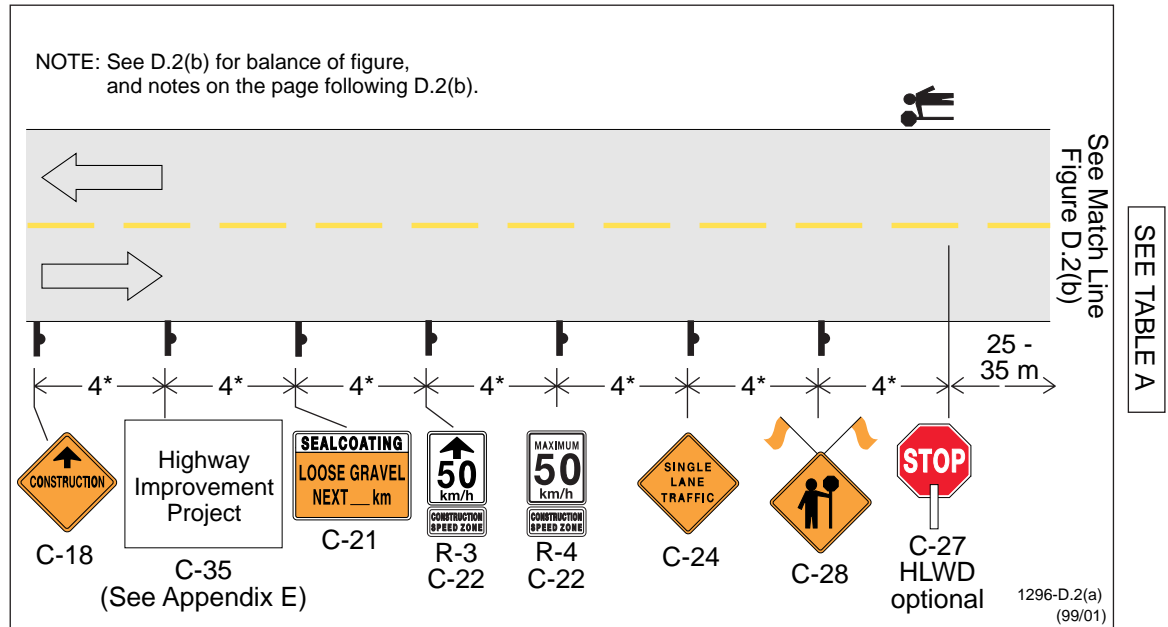
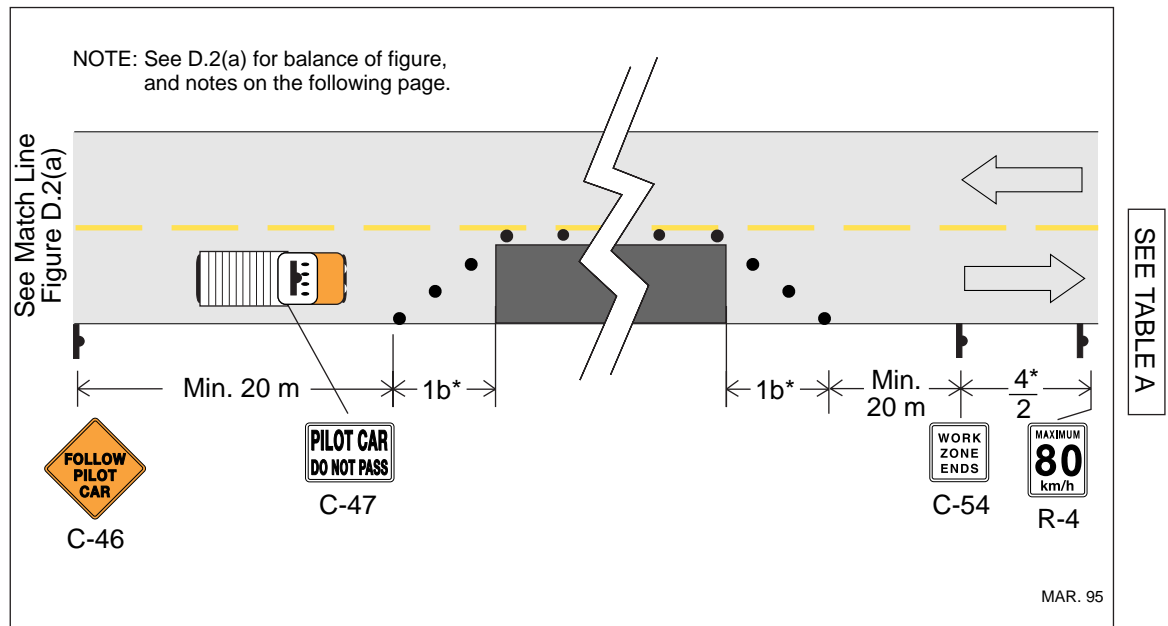
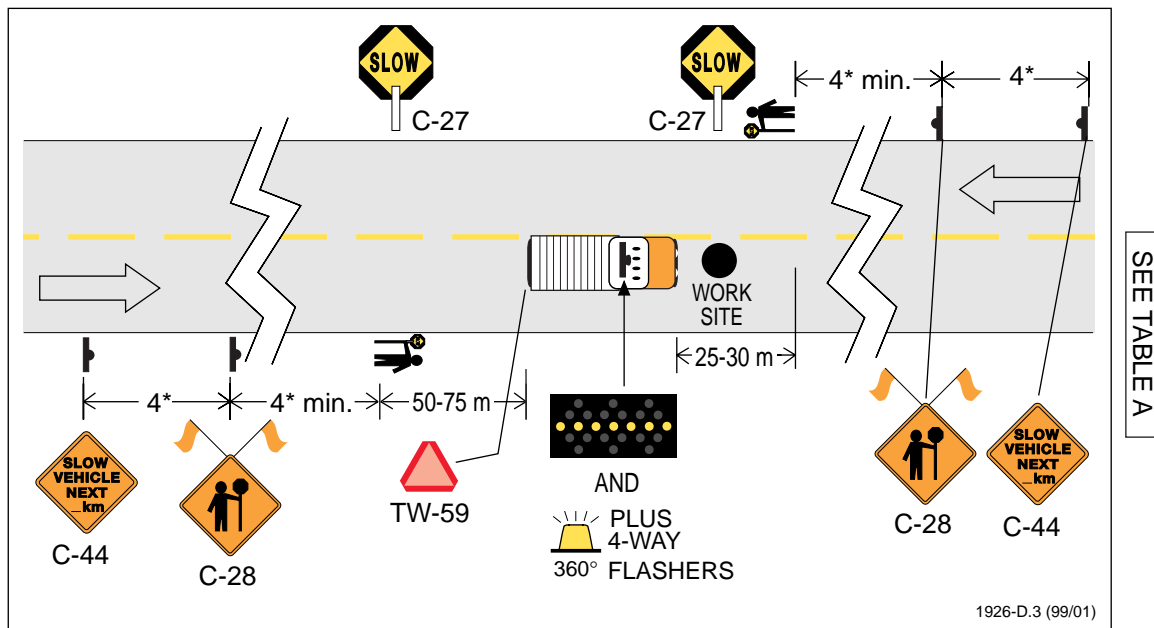


Figure D.2(b) Sealcoating in Progress



- Repeat applicable signs for opposite direction.
- At night:
 - Add Type 1A Barricades with Type A Flashing Yellow Lights to all sign locations in Advance Warning Area.
 - Add floodlights to illuminate TCPs station.
- As required throughout the work area:
 - Repeat signs such as R-4/C-22, C-4, C-14, C-37, C-46, C-49, TW-27, TW-36 etc.
- Every 5 km repeat C-21 sign showing decreasing distances.
- The pilot car operator and TCPs should be in radio contact.

**Figure D.3 Removing Temporary Reflectors from Sealcoat
– Two Lane Two-way Roadway**



- Distance on C-44 signs should not exceed 8 km.
- A Type B flashing yellow light or flags shall be used with C-44 signs. Addition of a HLWD is optional.
- all signs should be removed or covered when work is not underway and work vehicles can travel at posted speeds.
- A shadow vehicle with a C-45 or other appropriate sign on the rear may be required by the road authority.
- A C-42R PASS THIS SIDE (Right Arrow) sign may be displayed on the rear of the work vehicle only if there is consistently sufficient through lane and shoulder width for following traffic to pass safely on the work vehicle's right side.

APPENDIX E

MINISTRY HIGHWAY IMPROVEMENT PROJECT (HIP) SIGNS

(Various colours, not refl.)

An appropriate HIP sign is required in the Advance Warning Area of all major Ministry capital highway construction and rehabilitation projects and cost-shared municipal road projects that are in public view. A locational example is shown in Figure 4.1.1.

For those HIP signs with two sizes, the larger are for multilane highways with maximum speed limits of 80 km/h and higher. The smaller signs are used on all other highways.

The type of HIP sign required depends on the program(s) through which project funds are provided. The three categories are listed below.

- Federal Government funded
- Major Project
- Rehabilitation Project

The C-35 SHIP and C-35 INFA signs are used when projects are jointly funded by Federal Government programs.

C-35 MP signs are used for designated major and other capital-funded highway construction projects. The middle (green) panel shows the name of the project. If the project is not named, the panel shows HIGHWAY/IMPROVEMENT PROJECT. The bottom (yellow) tab shows the project segment on the first line and the type of improvement on the second.

C-35 RP signs are used on highway rehabilitation projects. The project boundaries or feature name are placed on the green portion of the sign.

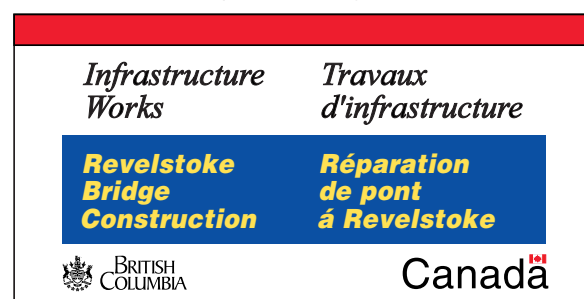
C-35 SHIP

(240 x 120) (300 x 150)



C-35 INFA

(240 x 120)



C-35 MP

(240 x 170) (300 x 210)



C-35 RP

(240 x 170) (300 x 210)

