

**To: Work Area Traffic Control Manual Holder**

The Work Area Traffic Control Manual (WATCM) provides a uniform set of traffic control guidelines for all work carried out on New Brunswick provincial roads. Any work that occurs within the right-of-way of a provincial road must conform to the guidelines prescribed by this manual.

The 2009 version of the WATCM has been revised. The revisions are effective as of September 23, 2015. If you have any questions in regards to the content of the Manual, please contact the New Brunswick Department of Transportation's Maintenance and Traffic Branch at 506-453-3939.



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## Summary of Revisions

The following is a summary of revisions completed for the WATCM for 2015.

Section	Section Title	Page / Figure	Reason for Revision
All			Update to Department of Transportation and Infrastructure.
	Table of Contents	i	Change to title of Chapter 5 from "Work Area Personnel" to "WATCM Traffic Personnel"
	Definitions	ii	<b>Partial Lane Closure</b> is changed from 2.5 m to 3.0 m. This brings the definition in line with other jurisdictions and in practice, less than 3.0 m is too narrow for a usable lane width.
	Definitions	iii	<b>Traffic Control Device</b> : added "or any other Traffic Control Device as prescribed by this manual" to make the definition inclusive of all possible devices used in the manual.
1.3	Planning and Preparation	2	Under <b>Public Advisory Notices</b> added "Utility Agencies shall be responsible to issue public advisory notices related to their work".
2.3	Work Area Components	6	Under <b>Advance Warning Area</b> added "including the appropriate distance advisory tab" to the Construction Ahead sign, as this tab is required.
2.7	Urban Area Work	9	Under Lower Speeds change from 50 km/hr to "50 – 70 km/hr", to account for the various speed limits found in urban areas.
3	Traffic Control Devices	19	"Road Closed to Thru Traffic" format change.
3	Traffic Control Devices	22, 23	Added <b>Hazard Marker</b> to page 23, as it is a frequently used traffic control device. Format change to page 22 and 23 to allow the insertion of the Hazard Marker without adding an additional page.
3.7	Delineation Devices	27	Updated the Construction Marker to remove post, as it can be used in multiple methods, with post or attached to barriers.
3.7	Delineation Devices	28	Removed "However, traffic cones may be used in tapers provided they are spaced at half the distance shown in Table 3-3."
3.8	Temporary Pavement Markings	28	Added "greater than 150 m in length" to Work Areas description.
3.8	Temporary Pavement Markings	29	Removed "shall only be used on milled surfaces", as this conflicts with the Item 576 Standard Specification.
3.12	Pilot Vehicles	31	Removed "long or complex" from the Work Area description. Added "Minimize the length of road affected by the work" to procedures to be followed when Pilot Vehicles are used. This is to help ensure users know that they need to keep the Work Area as short as possible to minimize road user delay and frustration.
4.1	Sign Installation	32	Added "Alternate mounting devices shall be approved by the Department of Transportation and Infrastructure's Maintenance and Traffic Branch." This will assist users in knowing that any alternate device can and must be approved by DTI.
4.1	Sign Installation	34	Under <b>Flags</b> "shall only" was changed to "must". This will allow users to use flags on other size human activity signs.
4	Figure 4-7, 4-8, 4-9, 4-10	40-43	White line and Yellow line were detailed incorrectly, this has been fixed.
5	WATCM Traffic Personnel	48	Change of title from "Work Area Personnel" to "WATCM Traffic Personnel".
5.1	Traffic Control Agents	48/49	Added Traffic Control Agents "shall keep up to date with revisions available on the DTI site."
5.2	Traffic Control Persons	50	Changed "entertainment devices" to "personnel electronic devices". This reflects the recent change in electronics.

5.3	Dedicated Traffic Observers	52	Added example of “very brief period” to section to better clarify what it means. (Same example as in section 2.1).
6.1	Work Location	53	<b>Partial Lane Closure</b> is changed from 2.5 m to 3.0 m. <b>Lane Closure</b> is changed from 2.5 m to 3.0 m. This brings the definition in line with other jurisdictions and in practice, less than 3.0 m is too narrow for a usable lane width.
7	Typical Layouts for Two Lane Roads	Figure 7-5	Added to Note 5 “or $\leq 50\text{km/hr}$ ”.
7	Typical Layouts for Two Lane Roads	Figure 7-6	Buffer is 20 m only. Removed reference to “B” in table. 20 m fixed buffer added to both sides.
7	Typical Layouts for Two Lane Roads	Figure 7-7	Buffer is 20 m only. Removed reference to “B” in table. 20 m fixed buffer added to both sides. Notes 2 replaced and Notes 7 and 8 were added. Centerline in lane closure area removed. Reduction in Speed Signs added.
7	Typical Layouts for Two Lane Roads	Figure 7-8a	Buffer is 20 m only. Removed reference to “B” in table. 20 m fixed buffer added to both sides. Centerline in lane closure area removed.
7	Typical Layouts for Two Lane Roads	Figure 7-8b	Buffer is 20 m only. Removed reference to “B” in table. 20 m fixed buffer added to both sides. Centerline in lane closure area removed.
7	Typical Layouts for Two Lane Roads	Figure 7-22	Diagram table – now indicates All Durations. Notes updated to reflect this change. Road Work Sign with km tab added. After Milling/Paving Signs removed. Moved Traffic Control Persons Ahead sign to outside of Activity Area. Changed location of Construction Zone Ends and Max Speed signs.
7	Typical Layouts for Two Lane Roads	Figure 7-23	Changed delineation device picture to cone. Added Bump sign and Note 8. Added pave to gravel sign.
7	Typical Layouts for Two Lane Roads	Figure 7-28	Changed delineation device picture to cone.
7	Typical Layouts for Two Lane Roads	Figure 7-29	Diagram word changed to “Unexpected hazard”
7	Typical Layouts for Two Lane Roads	Figure 7-31	Updated signs to reflect current use and requirements.
8	Typical Layout for Multilane Roads	Figure 8-8a	Added arrowboard and enhanced striping detail.
8	Typical Layout for Multilane Roads	Figure 8-8b	Added enhanced striping detail.
8	Typical Layout for Multilane Roads	Figure 8-10	Added missing temporary Exit Sign. Correction – changed S to B.
8	Typical Layout for Multilane Roads	Figure 8-18	Changed delineation device picture to cone.
8	Typical Layout for Multilane Roads	Figure 8-21	Added Note 4. Updated signs to reflect current use and requirements.



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## Definitions

**AADT:** Average Annual Daily Traffic expressed in terms of vehicles per day.

**Active:** a term used to describe the Activity Area when work is being carried out at the present time.

**Activity Area:** the component of a Work Area where the actual construction, maintenance, or utility work occurs.

**Advance Warning Area:** the component of a Work Area where road users are first alerted about upcoming road work.

**Approach Area:** the component of a Work Area where road users are given final warning about road work, and are informed of what action(s) to take.

**ASTM:** designation of the American Society for Testing and Materials.

**Barricade:** a device which provides a visual indicator of a lane or road closure.

**Barrier:** a device or series of devices through which a vehicle would not normally pass, intended to prevent Errant Vehicles from entering the Activity Area.

**Buffer Area:** the component of a Work Area that provides recovery space for Errant Vehicles.

**Buffer Vehicle:** a truck equipped with a Truck Mounted Attenuator (TMA) positioned in advance of workers to provide protection from Errant Vehicles.

**Construction Zone:** a portion of the Work Area where double fines are enforceable.

**Dedicated Traffic Observer:** an individual whose sole responsibility is to monitor approaching traffic and warn workers of potential hazards.

**Delineation Devices:** devices used to clearly highlight the traffic's path through a Work Area.

**Detour:** where traffic must depart completely from the original road and follow another road to bypass a Work Area.

**Device Installer:** any individual directly involved with the setup and removal of Traffic Control Devices in a Work Area.

**Diversion:** where traffic must deviate from its normal path to bypass an Activity Area.

**Double Posting:** the practice of placing signs on both sides of the road.

**Errant Vehicles:** a vehicle that strays from its designated path and travels in an uncontrollable or unpredictable manner.

**Flashing Arrow Board (FAB):** an electronic sign with a group of lights capable of displaying directional arrows (arrow mode) or a horizontal line (caution mode).

**Lane Closure:** work that is carried out in a travelled lane that reduces the remaining useable width of one or more lanes below 2.5 m.

**Long Duration:** work that occupies a fixed location for longer than 1 day.

**Low Volume Road:** a road with an AADT of less than 300 vehicles per day.

**Moving Operations:** work that is either done *continuously*, usually at slow speeds, or *intermittently*, with brief stops related to the work.

**NCHRP:** designation of the National Highway Cooperative Research Program.

**Partial Lane Closure:** work that is carried out in a travelled lane without reducing the remaining useable lane width below 3.0 m.

**Passive:** a term used to describe the Activity Area when work is temporarily stopped, yet the road has not returned to its normal operating conditions.

**Pilot Vehicle:** a vehicle used on two lane roads to guide road users through a one lane section of a long or complex Work Area.

**Radar Speed Display Sign (RSDS):** a special type of Variable Message Sign equipped with a radar unit that displays an approaching vehicle's speed back to the driver.

**Roadside Work:** work that is carried out within 15 m of the travelled lanes, but outside the shoulder area.

**Short Duration:** work that occupies a fixed location for longer than 30 minutes, yet less than 1 day. At the end of each day, the road is restored to its normal condition.

**Shoulder Work:** work that is carried out on the shoulder area of a road, yet which does not encroach on the travelled lanes.

**Termination Area:** the component of a Work Area where traffic may return to its normal path and driving conditions.

**Traffic Control Agent:** an individual having overall responsibility for traffic control in a Work Area.

**Traffic Control Device:** refers to any sign, Flashing Arrow Board, Barrier, Barricade, Delineation Device, pavement marking, vehicle or any other Traffic Control Device as prescribed by this manual used to control traffic in a Work Area.

**Traffic Control Person (TCP):** an individual used in a Work Area to regulate traffic and prevent conflicts between vehicles and Work Area activities.

**Traffic Control Plan:** a plan prepared in advance of commencing work that addresses all aspects of traffic control in the Work Area.

**Trail Vehicle:** a truck that travels either on the shoulder or in the travelled lane, used to provide additional warning of upcoming work. A Trail Vehicle equipped with a TMA is a Buffer Vehicle.

**Transition Area:** the component of a Work Area where traffic must deviate from its normal path to proceed safely past the work.

**Transition Taper:** the gradual narrowing of a lane using Delineation Devices to direct traffic from its normal alignment to the path around the Work Area.

**Truck Mounted Attenuator (TMA):** an energy absorbing device, either mounted directly on the rear of a Buffer Vehicle or hauled on a trailer behind it, that satisfies the requirements of NCHRP 350 Test Level (TL)-3.

**Variable Message Sign (VMS):** an electronic sign capable of displaying a single fixed message or a number of sequential messages to provide road users with additional information about upcoming road work.

**Very Short Duration:** work that occupies a fixed location for less than 30 minutes, including the time required to setup and remove Traffic Control Devices.

**Work Area:** the entire length of road affected by construction, maintenance, or utility work, from the first advance warning sign to where the road is restored to its normal conditions.

**Work Vehicle:** any vehicle used to facilitate construction, maintenance, or utility work in a Work Area.





## 1 General Information

### 1.1 Introduction

The *Work Area Traffic Control Manual* (WATCM) provides a uniform set of traffic control guidelines for all work carried out on New Brunswick provincial roads. Any work that occurs within the right-of-way of a provincial road must conform to the guidelines prescribed by this manual, effective May 4<sup>th</sup>, 2009, which supercedes all previous versions.

The WATCM is meant to be a practical guide that assists the user in identifying the appropriate level of traffic control necessary for a particular activity or situation. Unless otherwise stated, the WATCM depicts the minimum level of traffic control required. It sets forth basic principles and prescribes guidelines for the design, application, installation, maintenance, and removal of the various types of Traffic Control Devices approved for use in New Brunswick. A number of illustrations of common traffic control layouts are also included. Snow removal activities are not covered in the WATCM.

The traffic control layouts contained in this manual cannot possibly cover all of the different scenarios that may occur. In cases where the user is unsure of which traffic control layout should be applied, they shall consult with their supervisor, or contact the Department of Transportation and Infrastructure's Maintenance and Traffic Branch.

### 1.2 Legal Authority

The WATCM provides specific guidelines on the erection and placement of work area traffic control devices on provincially designated roads in the province of New Brunswick and is supplementary to the Manual of Uniform Traffic Control Devices Canada (MUTCDC). Individuals engaged in work within the Right of Way of provincially designated roads are expected to utilize and comply with the WATCM.

The WATCM shall also be applied where the guidelines are referenced in contract documents and agreements between Contractors and the New Brunswick Provincial Government.

### 1.3 Planning & Preparation

#### *Traffic Control Plans*

Planning for traffic control in Work Areas is very important. Before any maintenance, construction, or utility work can begin on a provincial road, a *Traffic Control Plan* shall be prepared that addresses the following items as a minimum:

- Required devices, including placement and location (WATCM typical layout);
- Traffic Control Persons (where needed);
- Setup and removal procedures; and
- Public advisory notices (where applicable).

A Traffic Control Plan can vary in detail depending on the complexity and location of the work. In many cases, a simple reference to a typical layout contained in this manual may be adequate. However, for complex situations or special projects, a more detailed design will be required. Any user who is unsure of the level of detail required by the Traffic Control Plan should contact the Department of Transportation and Infrastructure's Maintenance and Traffic Branch.

### **Site Visits**

Site visits are also an important part of the planning process. It is highly recommended that a site visit be carried out prior to preparing the Traffic Control Plan to identify:

- Traffic volumes and speeds;
- Sight distance limitations;
- Sidewalks or other pedestrian routes;
- Conflicts with driveways or intersecting roads;
- Existing signs which may need to be removed or covered;
- The amount of shoulder space available; and
- Any other condition that may impact traffic control in the Work Area.

The findings from the site visit will assist in preparing the Traffic Control Plan.

### **Public Advisory Notices**

Public advisory notices are an effective means of alerting road users and pedestrians of planned roadwork activities, thus giving them the opportunity to adjust their travel schedule or choose an alternate route. Public advisory notices shall be issued by the New Brunswick Department of Transportation and Infrastructure (or whoever has jurisdictional authority over the road) in advance of any projects where significant delays (longer than 15 minutes) are expected, or where traffic will be detoured as a result of a road closure. Utility Agencies shall be responsible to issue public advisory notices related to their work.

## **1.4 Responsibility**

Each Work Area shall have a *Traffic Control Agent* who is responsible for the Traffic Control Plan. The specific duties of the Traffic Control Agent are described in Section 5.1 of this manual.

## **1.5 Technical Judgement**

Every Work Area presents its own unique and varying conditions that may not be specifically covered in this manual. These conditions must be addressed on a project by project basis by applying sound technical judgement.

The decision of whether to use a particular device at a particular location must consider the local conditions in the Work Area. Although this manual provides guidelines for the design and application of Traffic Control Devices, it is not a substitute for technical judgement. It is acceptable for a Traffic Control Agent to make changes to the Traffic Control Plan to adjust to local conditions, providing technical judgement is used and safety is not diminished. If there are questions in regards to specific issues, the Department of Transportation and Infrastructure's Maintenance and Traffic Branch may be contacted for guidance.

### 2.3 Work Area Components

A *Work Area* includes the entire length of road beginning from the first advance warning sign through to the last Traffic Control Device, where traffic may return to its normal operating conditions. A well-designed Work Area has seven components, as illustrated in Figure 2-1:

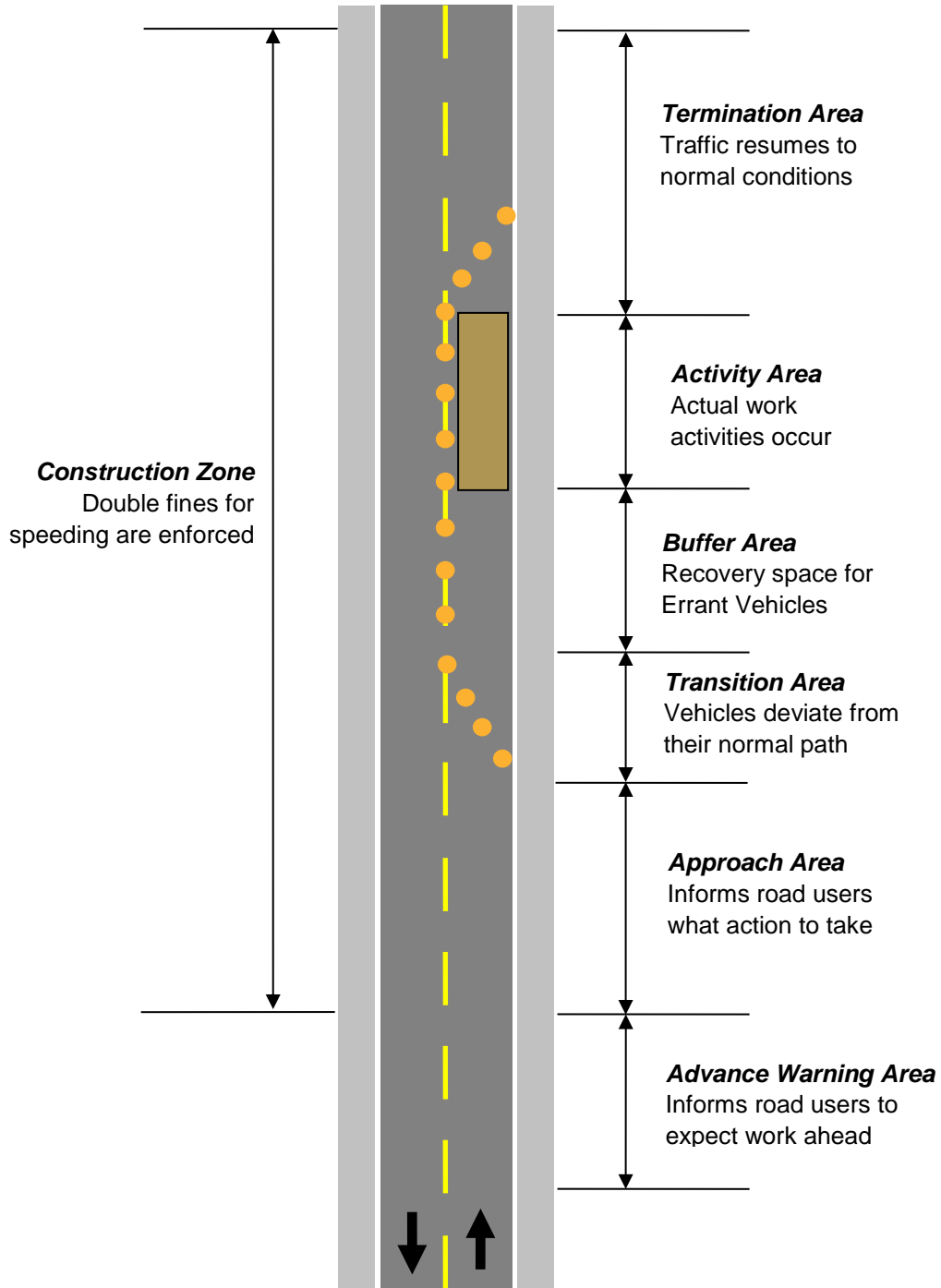


Figure 2-1: Components of a Work Area

**Advance Warning Area**

The Advance Warning Area is where road users are first alerted about upcoming road work. This is typically achieved by a Construction Ahead sign including the appropriate distance advisory tab. The length of advance warning required will vary depending on the posted speed of the roadway and the degree to which the work interferes with traffic.

Unless otherwise indicated on a typical layout, Table 2-1 shows the minimum advance warning distances that shall be provided for various posted speed limits. This distance is measured from the Construction Ahead sign to the start of the Transition Area. Supplementary Traffic Control Devices may be erected to provide additional advance warning in Work Areas where significant queuing occurs.

**Table 2-1: Minimum Advance Warning Distances**

Normal Posted Speed Limit (km/h)	Minimum Advance Warning Distance (m)
50	300
60 - 70	300
80 - 90	500
100 - 110	1000

**Approach Area**

The Approach Area is where road users receive final warnings of upcoming construction or maintenance activities and are informed of what action(s) to take. Such actions typically include lane changes, speed reductions, or passing restrictions. This information must be presented to road users at a sufficient distance so they can adjust to the altered situation before reaching it. The start of the Approach Area also corresponds to the start of the Construction Zone.

**Transition Area**

The Transition Area is where road users deviate from their normal path to safely proceed past the work. Not every Work Area will contain a Transition Area, as they are only used when work encroaches on one or more of the travelled lanes. Road users are typically guided by a Transition Taper, delineated by flexible drums. Minimum Transition Taper lengths are shown in Table 2-2.

**Table 2-2: Minimum Transition Taper Lengths**

Normal Posted Speed Limit (km/h)	Minimum Taper Length (m)	Minimum Number of Delineators
50	30	5
60 - 70	64	8
80 - 90	110	11
100 - 110	180	10

With the exception of Flashing Arrow Boards and Barricades used to emphasize the Lane Closure, it is imperative that no work materials, vehicles, or equipment be stored or parked in the Transition Area.

**Table 2-4: Minimum Illumination Requirements**

Illuminance Level	Minimum Average Illuminance (Lux)	Minimum Point Illuminance (Lux)
1	60	30
2	110	80
3	220	N/A

A minimum Level 1 illuminance shall be provided in any portion of the Work Area where personnel are present. Traffic Control Persons shall be illuminated from above with a minimum Level 3 illuminance.

Minimum illuminance requirements for other special operations are as follows:

***For paving operations:***

Level 2 – 15 m ahead of the paver/MTV and 30 m behind the paver.

Level 1 – 120 m ahead to 250 m behind the paver.

***For milling operations:***

Level 2 – 15 m ahead and 15 m behind the milling machine.

Level 1 – 120 m ahead to 250 m behind the milling machine.

Measurement of illuminance shall be taken at the road surface, in a uniform pattern spaced at 5 m throughout a representative test area. The Traffic Control Agent shall check illumination levels in Work Areas each time a change in lighting configuration is made and at least once overnight.

## **2.7 Urban Area Work**

Work Areas in urban environments are usually characterized by:

- Lower speeds (typically 50-70 km/h);
- Higher traffic and pedestrian volumes;
- More frequent driveways and intersections;
- Space limitations; and
- Increased roadside signage.

Each of these factors must be considered when preparing a Traffic Control Plan for work in an urban environment. The typical layouts contained in Sections 7 and 8 of this manual provide guidance with respect to device spacing on lower speed roads.

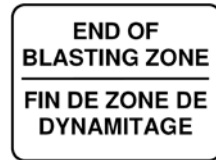


**Blasting Zone Ends**

**Description:** The *Blasting Zone Ends* sign marks the end of a blasting zone. It shall be placed 1 km downstream of the blasting area.

**Minimum Size:** 115 cm x 90 cm (#4921)

**Color / Sheeting:** Black on White, High Intensity



**Road Closed**

**Description:** The *Road Closed* sign is used in conjunction with Barricades to mark the location beyond which road users are not permitted to travel.

**Minimum Size:** 90 cm x 115 cm (#4021)

**Color / Sheeting:** Black and Red on White, High Intensity



**Next x km**

**Description:** The *Next x km* tab is used as a supplement to other traffic control signs to indicate the length of road on which a particular condition exists.

**Minimum Size:** 90 cm x 45 cm (#4313)

**Color / Sheeting:** Black on Orange, High Intensity



**Advisory Speed Tab**

**Description:** The *Advisory Speed Tab* is used as a supplement to Diversion signs to indicate the advised speed on a Diversion.

**Minimum Size:** 60 cm x 60 cm (#4179)

**Color / Sheeting:** Black on Orange, High Intensity



**Detour Tab**

**Description:** The *Detour Tab* is used in conjunction with appropriate route markers to guide road users through intersection along a Detour.

**Minimum Size:** 60 cm x 30 cm (#4142)

**Color / Sheeting:** Black on Orange, High Intensity



### Detour Ends

**Description:** The *Detour Ends* sign informs road users that they have reached the end of a detour and are resuming travel on their original route.

**Minimum Size:** 90 cm x 60 cm (#4156)

**Color / Sheeting:** Black on Orange, High Intensity



### Distance Advisory Tab

**Description:** The *Distance Advisory Tab* is used as a supplement to warning signs to indicate the length of road remaining before a road user encounters a particular condition. The distance may be specified in either metres or kilometres.

**Minimum Size:** 75 cm x 30 cm (#4311)

**Color / Sheeting:** Black on Orange, High Intensity



### 1 Lane Tab

**Description:** The *1 Lane Tab* is used as a supplement to the Road Narrows sign to warn road users that the road is reduced to one lane ahead. This tab is typically used during Lane Closures on two lane roads where traffic is controlled by yield signs.

**Minimum Size:** 75 cm x 45 cm (#4385)

**Color / Sheeting:** Black on Orange, High Intensity



### Hazard Marker

**Description:** The *Hazard Marker* is used for edge delineation when a hazard is immediately adjacent to the travelled lanes.

**Minimum Size:** 15 cm x 45 cm (#4181), 30 cm x 90 cm (#4183)

**Color / Sheeting:** Black on Orange, High Intensity





A 35 watt incandescent bulb is the standard element for FABs. Alternate elements such as halogen bulbs, low wattage bulbs, and groups of light-emitting diodes (LEDs) may be used provided they maintain the same flash rate and brightness as a 35 watt incandescent bulb. All FABs used during night work shall be equipped with at least one photocell that progressively reduces light intensity during hours of darkness to prevent road users from being temporarily blinded.

### 3.5 Flashing Lights

#### ***360 Degree Amber Lights***

All Work Vehicles stationed in a Work Area must be equipped with an amber light visible from all sides (360 degrees). This includes round or rectangular lighting devices. If the ability to view a light is obscured, other lights shall be mounted to ensure visibility on all sides. These lights shall be displayed whenever a vehicle is positioned such that it could influence traffic. Standard vehicle 4-way flashers shall not be used as a substitute.

#### ***Flashing Beacons***

Flashing amber and flashing red beacons may be mounted on Barricades or other special construction signs to provide additional emphasis, particularly at night. Amber warning lights are used to indicate “caution”, while red warning lights are used to indicate “do not enter”. Note: beacons shall not be used on Barricades in close proximity to traffic control signals.

Flashing beacons must be at least 30 cm in diameter and maintain a flash rate of 25 to 40 flashes per minute. Electrical, solar, and battery power sources are all acceptable, provided the beacons are visible for up to 800 m under clear night-time conditions. If a temporary power line must cross over the road, the clearance above the road surface shall be at least 7.0 m.

### 3.6 Traffic Control Signals

Traffic Control Signals may be used for work on two lane roads for which traffic is reduced to one lane. The area controlled by signals shall not include any intersections or driveways to avoid possible conflicts.

Traffic control signals may be either semi-permanently mounted or mounted on portable trailers. Communication between the traffic control units may either be by hard wiring or radio communication. The traffic control signals shall have two heads in each direction and be oriented to provide maximum visibility to the approaching road users. The signals must be designed in accordance with “The Manual of Uniform Traffic Control Devices for Canada.”

The use of Traffic Control Signals requires approval from the Department of Transportation and Infrastructure’s Maintenance and Traffic Branch.

### 3.7 Delineation Devices

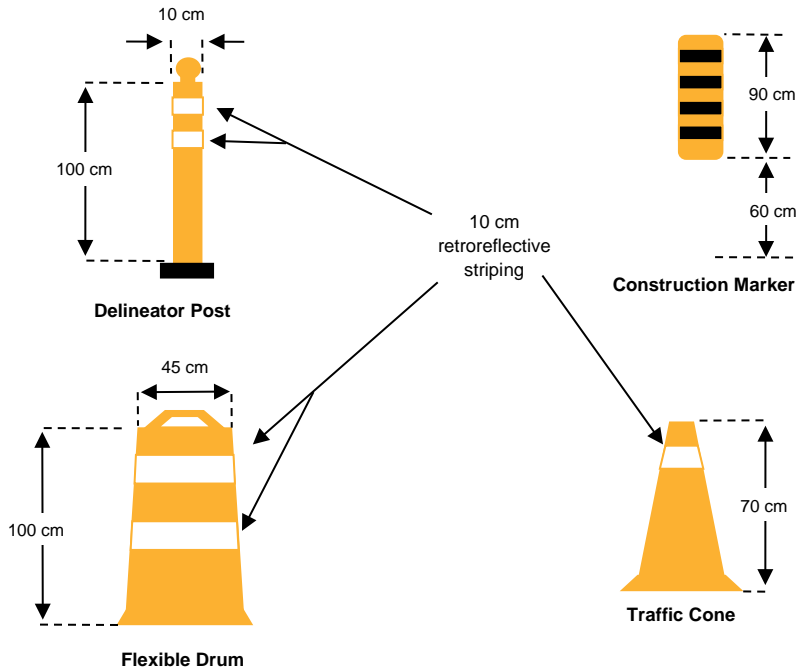
*Delineation Devices* are used to clearly highlight the traffic's path through any Work Area where Diversions or tapers are required. They also delineate a separation between traffic and the Activity Area. Delineation Devices shall be spaced sufficiently close such that the appropriate path is clearly recognized by road users at all times. The maximum centre to centre delineator spacing for tangents and tapers is shown in Table 3-3 for varying speed limits.

**Table 3-3: Maximum Spacing for Delineation Devices**

Normal Posted Speed Limit (km/h)	Maximum Spacing Tangents (m)	Maximum Spacing Tapers (m)
50	8	6
60 - 70	10	8
80 - 90	14	10
100 - 110	24	18

Note: Flexible drums are the preferred device for tapers. However, delineator posts may be used provided spacing is half the distance in Table 3-3.

There are four types of acceptable Delineation Devices: delineator posts, traffic cones, flexible drums, and construction markers. These devices must all be orange in colour and, with the exception of construction markers, shall display one or more bands of white retroreflective striping as shown in Figure 3-2 that meet, as a minimum, ASTM D4956 Type III. Delineation Devices must also have sufficient ballast so they are not easily displaced by wind or passing vehicles.



**Figure 3-2: Delineation Devices**

*Traffic Cones* are lightweight Delineation Devices that may be easily stacked for storage. They shall be constructed of polyvinyl chloride (PVC), have a minimum height of 70 cm, and display one 10 cm retroreflective white stripe. Traffic Cones may be placed along the tangent sections of the road adjacent to the Buffer and Activity Areas for Very Short and Short Duration Work only. They may not be used for night time operations. In addition, they are not recommended for providing delineation along tapers, due to the low visual target they offer.

*Delineator Posts* (commonly referred to as traffic candles) are lightweight Delineation Devices that offer the least amount of impedance to road users due to their narrow width. They shall be constructed of a low density polyethylene, have a minimum height of 100 cm, and display two 10 cm retroreflective white stripes. Delineator posts are commonly placed along the tangent sections of the road adjacent to the Buffer and Activity Areas. They are not recommended for providing delineation along tapers, due to the low visual target they offer. However, delineator posts may be used in tapers provided they are spaced at half the distance shown in Table 3-3.

*Flexible Drums* offer a larger visible warning than delineator posts and traffic cones. They shall be constructed of low density polyethylene, have a minimum height of 100 cm, and display two 10 cm retroreflective white stripes. Flexible drums are the preferred device for delineating tapers, and are also used on tangent sections adjacent to the Buffer and Activity Areas.

*Construction Markers* are signs consisting of nine alternating black and orange retroreflective stripes, each having a thickness of 10 cm. The base of a construction marker shall be mounted at least 60 cm above the road surface. Construction markers are typically used to delineate a hazard immediately adjacent to the travelled lanes, such as a continuous Barrier or a low shoulder. They shall not be used to provide centreline delineation in high speed or high volume Work Areas.

### **3.8 Temporary Pavement Markings**

*Temporary Pavement Markings* are used in Work Areas greater than 150 m in length, in combination with appropriate warning signs and Delineation Devices, to highlight the intended path that traffic is to follow.

Temporary pavement markings shall be used in Work Areas where a paved Diversion is constructed to bypass work activities or partial pavement removal (i.e. milling, grinding) or overlays have caused the original markings to be removed or covered.

For paved Diversions, all temporary markings must be in place before the Diversion is opened to traffic. During pavement removal and overlay operations, temporary markings shall be placed at the end of each work day, prior to night time conditions.

Wherever temporary markings are applied, any conflicting markings must be removed or covered as soon as possible, to avoid driver confusion. If the original markings will be restored within two weeks, they may be covered using black paint; otherwise the markings must be milled out.

There are three types of acceptable devices for temporary pavement marking: pavement marking tape, raised pavement markers, and pavement marking paint with glass beads. When applied, all three should be the same color as the original markings which they replace. In addition, these devices shall meet the following minimum retroreflectivity requirements: 250 millicandelas for white markings and 200 millicandelas for yellow markings.

*Pavement Marking Tape* shall be applied in 2 m strips spaced at 50 m on tangent sections of road and 25 m on horizontal and vertical curves.

*Raised Pavement Markers* shall be installed in groupings of three within a 2 m length and spaced at 50 m on tangent sections of road and 25 m on horizontal and vertical curves. Nails are not to be used to install raised pavement markers.

*Pavement Marking Paint* shall be applied in 2 m strips spaced at 50 m on tangent sections of road and 25 m on horizontal and vertical curves. Glass beads shall be applied over the paint's full width and length. Paint shall not be used as a temporary marking on the final lift of asphalt.

### 3.9 Barricades

*Barricades* provide complete closure of a road, street, or lane for an extended period of time. Their assemblies can vary in size and complexity, depending on the location of the closure. There are two types of Barricades: directional and non-directional.

Directional Barricades are used to divert traffic around a closure, or direct it onto a Detour. They shall consist of at least two Barricade boards as shown in Figure 3-3, with alternating orange and black stripes in a chevron pattern. All stripes shall be 24 cm wide. Orange stripes shall be retroreflective and meet ASTM D4956 Type III / Type IV. The appropriate direction shall be used depending on whether traffic is being moved to the right or left.

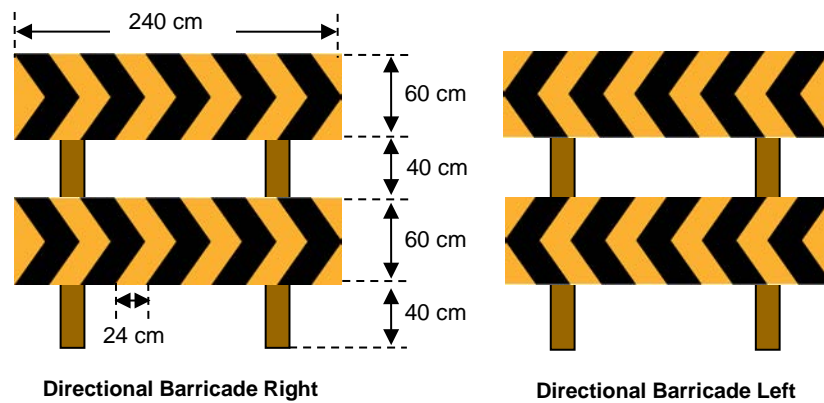


Figure 3-3: Directional Barricades

Non-directional Barricades are used for closures where traffic is neither directed to the right or left. They shall consist of at least two Barricade boards, as shown in Figure 3-4, with alternating orange and black vertical stripes. All stripes shall be 22 cm wide. Orange stripes shall be retroreflective and meet ASTM D4956 Type III / Type IV.

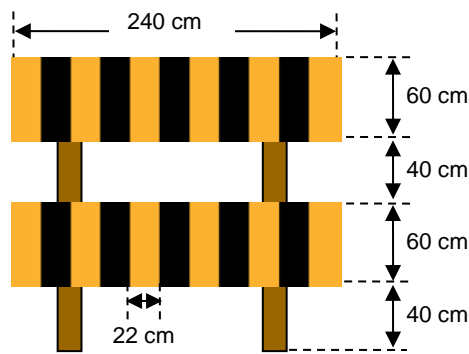


Figure 3-4: Non-Directional Barricade

Barricades shall be positioned at approximately 90 degrees to approaching traffic, to offer the largest target area. If Barricades are to remain in place during overnight hours, they must also be equipped with a minimum of two flashing red or amber beacons (as per Section 3.5). Beacons are not required for Low Volume Roads.

If a Work Area is to remain passive for an extended period (e.g. over the winter months), non-directional Barricades shall be installed on all approaches to drop-offs, embankments, river crossings, and other areas that pose a safety risk. They shall be placed the entire width of the road such that no gap exists that is greater than 2 m. Barricades shall also be accompanied by a Road Closed sign, which is to be installed in the center of the roadway. This sign may be mounted directly on the Barricade provided an odd number is used; otherwise it shall be individually post mounted.

### 3.10 Barriers

*Barriers* are used to prevent vehicles from entering into the Activity Area, thus providing extra protection for both workers and road users. However, because Barrier installation involves a high degree of worker exposure, their use is typically reserved for Long Duration projects that are expected to take longer than three days to complete. The exception is on bridge structures, where workers do not have an escape route, and Barriers are required for work that is expected to take longer than one day to complete. Specific guidance on the use of Barriers is provided in the typical layouts.

Barriers shall be properly installed otherwise they may pose a hazard instead of offering protection. Proper installation practices include:

- Securely fastening individual Barrier devices together to form a continuous structure that acts as a single unit when impacted;
- Ensuring that the Barrier is installed at a 4:1 taper where indicated in the typical layout figures;
- Ensuring that the Barrier does not encroach into the Buffer Area or Transition Area.
- Maintaining at least a 0.5 m offset between the Barrier and the adjacent travelled lane, where possible; and,
- Supplementing Barriers with appropriate retroreflective markings such as construction markers or other devices meeting, as a minimum, ASTM Type III.

There are many different types of Barrier devices available. The only Barrier device pre-approved for use on provincial roads is the F-shape concrete Barrier meeting the NCHRP 350 TL-3 standard. Other Barriers may be approved by the Department of Transportation and Infrastructure's Maintenance and Traffic Branch, provided the devices offer an equivalent level of protection.

### 3.11 Buffer Vehicles

Buffer Vehicles are stationed in advance of the Activity Area to protect workers from Errant Vehicles approaching a Work Area. Buffer Vehicles are required for setting up and removing Traffic Control Devices on multilane roads, Moving Operations on multilane roads, and for Short Duration work on bridges.

In addition to a Flashing Arrow Board, a Buffer Vehicle shall be equipped with a Truck Mounted Attenuator (TMA) meeting the requirements of NCHRP 350 TL-3 for all roads. The mass of the Buffer Vehicle shall be as per the TMA manufacturer's requirements.

### 3.12 Pilot Vehicles

A *Pilot Vehicle* may be used on two lane roads to guide road users through a one lane section of a Work Area, one direction at a time. They may also be used as means of controlling vehicle speeds or preventing vehicles from re-entering a closed lane prematurely (i.e before the road surface has had sufficient time to cool or cure). The following procedures shall be followed wherever Pilot Vehicles are used:

1. Minimize the length of road affected by the work.
2. Traffic Control Persons shall regulate traffic at each end on the one lane section.
3. The Pilot Vehicle shall move into position at the front of the queue about to be released by the Traffic Control Person.
4. When directed by the Traffic Control Person, the Pilot Vehicle shall guide traffic through the Work Area, travelling at a speed that does not permit gaps to form between vehicles.
5. At the opposite end of the Work Area, the Pilot Vehicle shall pull over at the earliest safe location, and allow the following vehicles to pass.
6. When the last following vehicle has passed, the Pilot Vehicle shall then repeat the same procedures to lead traffic in the opposite direction.

To minimize road user delay and driver frustration, two Pilot Vehicles should be used on higher volume roads where delays are significant. On lower volume roads, the same Pilot Vehicle may be used to guide traffic in both directions.

All Pilot Vehicles shall be equipped with a 360 degree amber light (as per Section 3.5) as well as the Follow Me sign.

## 4 Installation and Inspection of Traffic Control Devices

### 4.1 Sign Installation

#### **Sign Supports**

Signs in Work Areas shall either be mounted on fixed or portable sign supports.

Fixed supports can either be constructed of wood or metal, and shall be installed directly into the ground. Wooden posts shall be a maximum size of 10 cm x 10 cm. Metal posts shall be a maximum size 5 cm x 5 cm, and have 11 mm diameter holes drilled on 25 mm centers on all four sides. Signs are not to be mounted in orange steel drums.

Portable sign supports may be used in place of fixed supports provided they have sufficient ballast to prevent them from being easily blown over or displaced by wind or passing vehicles. Sand-filled bags are recommended for providing extra ballast. Materials that may pose a hazard to road users, such as concrete blocks, shall not be used to provide ballast.

Alternate mounting devices shall be approved by the Department of Transportation and Infrastructure’s Maintenance and Traffic Branch.

#### **Sign Spacing**

Signs shall be spaced so approaching road users have sufficient time to recognize the message and take any necessary action(s). The spacing shown in Table 4-1 shall be used as a minimum.

**Table 4-1: Minimum Sign Spacing in Work Areas**

Normal Posted Speed Limit (km/h)	Minimum Spacing (m)
50	50
60 - 70	75
80 - 90	100
100 - 110	150

In situations where the minimum spacing offers poor visibility to road users, such as on a hill or a curve where sight distance may be restricted, sign spacing should be increased accordingly. Similarly, the distance can also be increased where the minimum spacing causes signs to conflict with driveways.

#### **Sign Position and Height**

All signs on fixed supports shall be installed within a distance of 1.5 m to 4.0 m from the edge of the travelled lane, and oriented approximately 90 degrees to approaching traffic. In instances where portable sign supports cannot be placed at a minimum 1.5 m (due to narrow shoulders), the sign may be moved closer to the edge of the travelled lane provided it does not pose a hazard to approaching traffic.

## Section 4 – Installation and Inspection of Traffic Control Devices

The mounting height varies depending on the sign size and the type of sign support. Figures 4-1 and 4-2 depict the proper sign position and mounting height for fixed and portable sign supports. Note: tabs are to be installed directly below the sign and shall not be installed on top or in front such that the sign is obscured. Signs should be mounted at a consistent height through the Work Area.

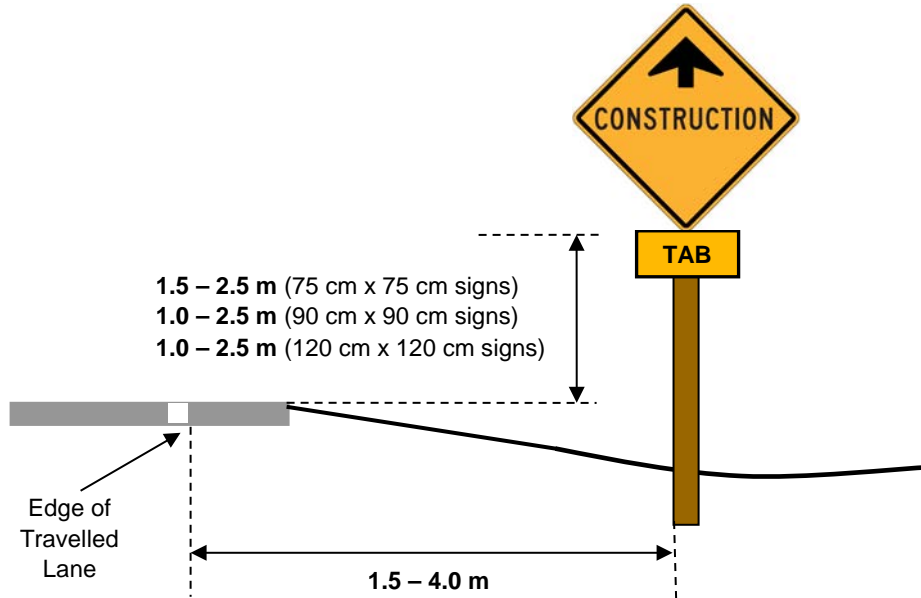


Figure 4-1: Sign Position and Height for Fixed Sign Supports

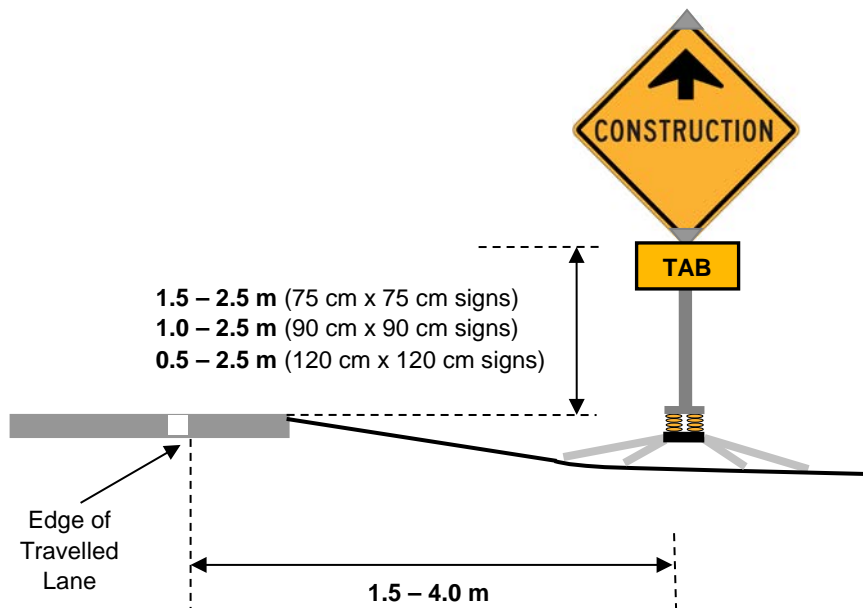


Figure 4-2: Sign Position and Height for Portable Sign Supports



### **Flags**

Orange flags must be used in instances where 120 cm x 120 cm signs depicting “human activity” are mounted on portable sign supports at a height between 0.5 m and 1.0 m. Human activity signs include: Road Work, Survey Crew, and Traffic Control Person. Other signs mounted at a height between 0.5 m and 1.0 m shall not display flags.

Flags must consist of a bright orange cloth or plastic material, at least 30 cm x 30 cm in size, and be mounted such that they hang just above the sign.

### **Double Posting**

Signs shall be double posted for all work carried out on all multilane divided roads. If the road is divided by a concrete median Barrier, and the minimum lateral distance cannot be achieved next to the inside lane, signs may be posted on top of the Barrier using a secure clamping device that is functional and will not pose a hazard to the motoring public. On roads with a posted speed limit of 100km/h or greater, the Traffic Control Agent may opt to use 90 cm x 90 cm signs next to the inside lane if they believe that 120 cm x 120 cm signs will pose a hazard to road users. Signs on multilane undivided roads shall be placed next to the right shoulder only.

If double faced signs (i.e. signs mounted on the reverse of other signs) are being used, care must be taken to ensure they are not visible from the opposing lane so as to not cause confusion.

## **4.2 Setup and Removal Procedures**

Setting up and removing Traffic Control Devices can be more hazardous than completing the actual work, as workers are often directly exposed to traffic during these times. To minimize worker exposure, it is essential that setup and removal activities are carried out in a quick, yet orderly, manner. For this reason, it is also important to plan every setup and removal in advance.

While it is recognized that every Work Area presents its own unique circumstances that can impact how setup and removal are carried out, the following safety principles shall be adhered to:

- All workers shall wear the appropriate personal protective equipment (see section 5)
- All vehicles involved in the setup and removal of Traffic Control Devices as a minimum must display 1) a 360 degree amber light on two lane roads; or 2) a Flashing Arrow Board on multilane roads;
- The Traffic Control Agent shall ensure that an onsite meeting is organized prior to the erection of work area traffic control devices. This meeting (commonly called a “tail gate meeting”) shall include all staff involved with the erection of work area traffic control devices and the organizer shall record the date and time of the meeting.
- No Delineation Devices, Barriers, or Barricades shall be installed until after all advance and approach signs have been setup;
- Work in the Activity Area shall only commence once all Traffic Control Devices are in place. However, in the case of a lane closure, Work may commence in the Activity Area once the lane closure taper has been effectively established and the centerline delineators have passed the Activity Area.
- A Dedicated Traffic Observer shall be present during all setup and removal activities to warn workers of potential hazards.

## Section 4 – Installation and Inspection of Traffic Control Devices

Some other best practices that can improve safety and should be followed whenever possible include:

- Offloading and loading Traffic Control Devices from the side of the truck farthest from traffic;
- Assembling and disassembling Traffic Control Devices away from the roadway;
- Avoiding pointing Work Vehicles towards the flow of traffic, especially at night.

Generally, signs are to be setup and removed beginning in the Advance Warning Area and then proceeding toward the Activity Area with the flow of traffic. Figures 4-3 to 4-10 (referenced below) illustrate the proper procedures and sequencing that shall be followed for common activities involved in the setup and removal of traffic control on two lane and multilane roads.

Two Lane Roads	
<b>Activity</b>	
Sign Setup	→ Figure 4-3
Lane Closure Setup (where required)	→ Figure 4-4
Lane Closure Removal (where required)	→ Figure 4-5
Sign Removal	→ Figure 4-6

Multilane Roads	
<b>Activity</b>	
Sign Setup	→ Figure 4-7
Lane Closure Setup (where required)	→ Figure 4-8
Lane Closure Removal (where required)	→ Figure 4-9
Sign Removal	→ Figure 4-10

**Sequence (Shown in Figure)**

1. In general, begin sign placement at the first advance warning sign on the right side of the road.
2. Install the duplicate sign on the left side.
3. Proceed with the flow of traffic, installing from the right to the left.

**High Traffic Volume Areas (Optional – Not Shown in Figure)**

- In areas with high traffic volumes, the Traffic Control Agent may elect to install signs in the following manner:
  - commence by installing all signs on one side of the road
  - progress with the flow of traffic, making two legal turns
  - recommence installing at the Advance Warning area for the opposite side.

**Special Instructions**

- In cases where vehicles do not encroach on the travelled lane, Buffer Vehicle may be substituted with a Trail Vehicle.
- Sign truck and Trail Vehicle / Buffer Vehicle shall display a FAB set to the appropriate directional arrow. In addition, Trail Vehicle / Buffer Vehicle shall remain a distance B behind the Sign Truck as per Table 2-3.
- An additional Trail Vehicle / Buffer Vehicle may be used to provide advance notification of the Sign Truck based upon site specific conditions such as restricted sight distances or high traffic volumes.
- For Lane Closures, the Construction Zone Ends signs may be installed after the closure has been established.
- A Dedicated Traffic Observer shall be present during all setup activities to warn workers of potential hazards.

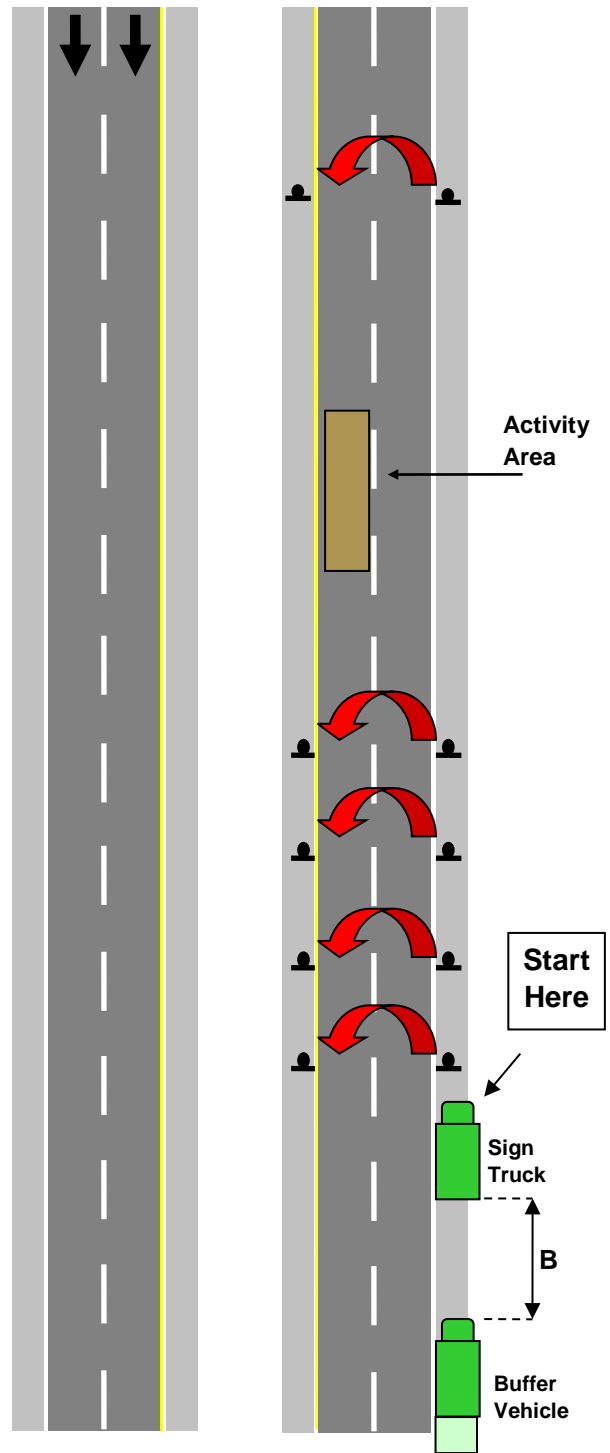


Figure 4-7: Sign Setup (Multilane Divided Roads)

**Sequence**

1. Ensure that all signs are in place.
2. Station the Buffer Vehicle in the lane to be closed immediately in advance of the start of the Transition Taper, with a FAB indicating the appropriate direction.
3. Lay out delineators in the Transition Taper, beginning at the shoulder and working towards the centreline.
4. Set up the FAB inside the Transition Taper.
5. Continue with the flow of traffic, laying out delineators in the Buffer and Activity Areas.
6. Lay out delineators in the terminating taper (if necessary).

**Special Instructions**

- Sign truck shall display a FAB set to caution mode.
- Buffer Vehicle shall be equipped with a FAB displaying the appropriate directional arrow and remain a distance B behind the Transition Taper as per Table 2-3.

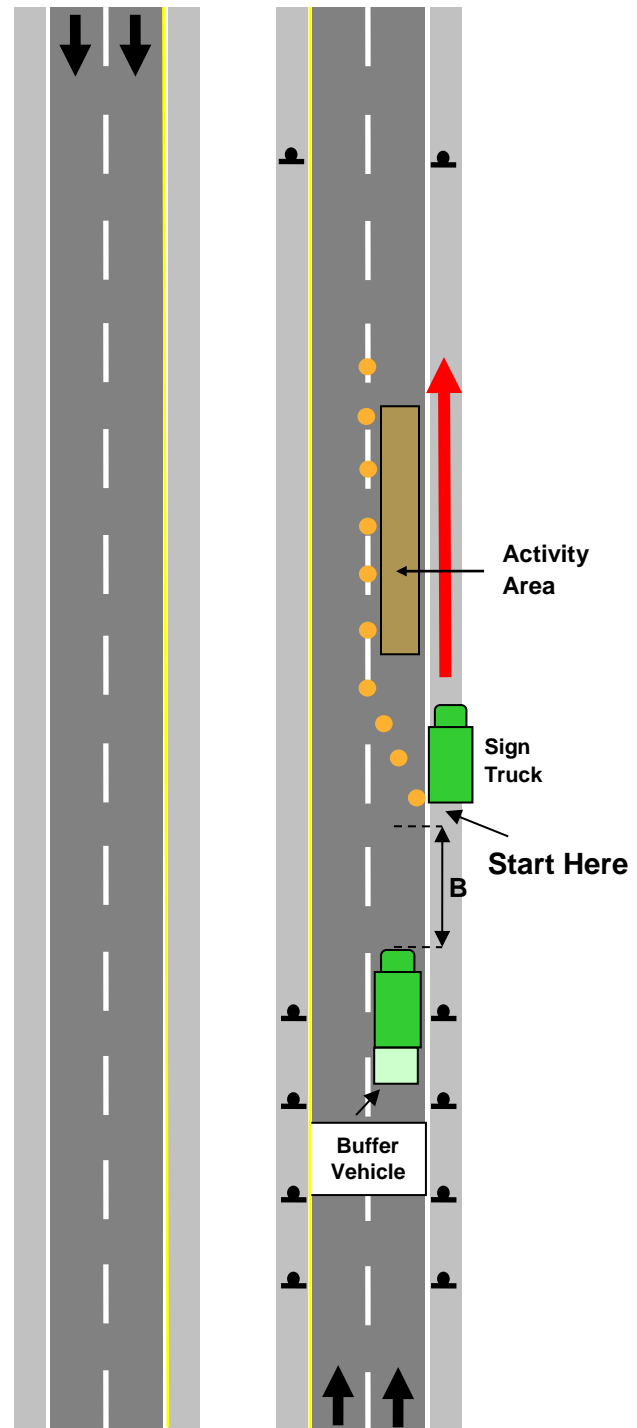


Figure 4-8: Lane Closure Setup (Multilane Roads)

**Sequence**

1. Ensure that all work activities are complete and that workers have vacated the Activity Area.
2. Station the Buffer Vehicle in the closed lane immediately in advance of the Transition Taper, with a FAB indicating the appropriate direction.
3. Pick up the delineators in the terminating taper (or at the furthest delineator if no termination taper exists).
4. Continue moving against the flow of traffic, picking up delineators in the Activity and Buffer Areas.
5. Remove the arrow board inside the Transition Taper.
6. Pick up delineators in the Transition Taper.

**Special Instructions**

- Sign truck shall display a FAB set to caution mode.
- Buffer Vehicle shall be equipped with a FAB, displaying the appropriate directional arrow and remain a distance B behind the Transition Taper as per Table 2-3.

**Lane Closure Switch**

The following steps are recommended when switching a lane closure:

1. Ensure that the Activity Area has been vacated.
2. Station the Buffer Vehicle in the closed lane, immediately in advance of the Transition Taper.
3. Remove the FAB inside the Transition Taper.
4. Move delineators in the Transition Taper to the centreline.
5. Wait for a break in traffic flow and then change the Lane Closed Ahead signs to depict the appropriate direction (the sign change may be done with Dedicated Traffic Observers and Sign Installers). Simultaneously, using communication devices to coordinate, move the Buffer Vehicle in the lane to be closed, immediately in advance of the Transition Taper.
6. Reconstruct Transition Taper.
7. Set up the FAB inside the Transition Taper.

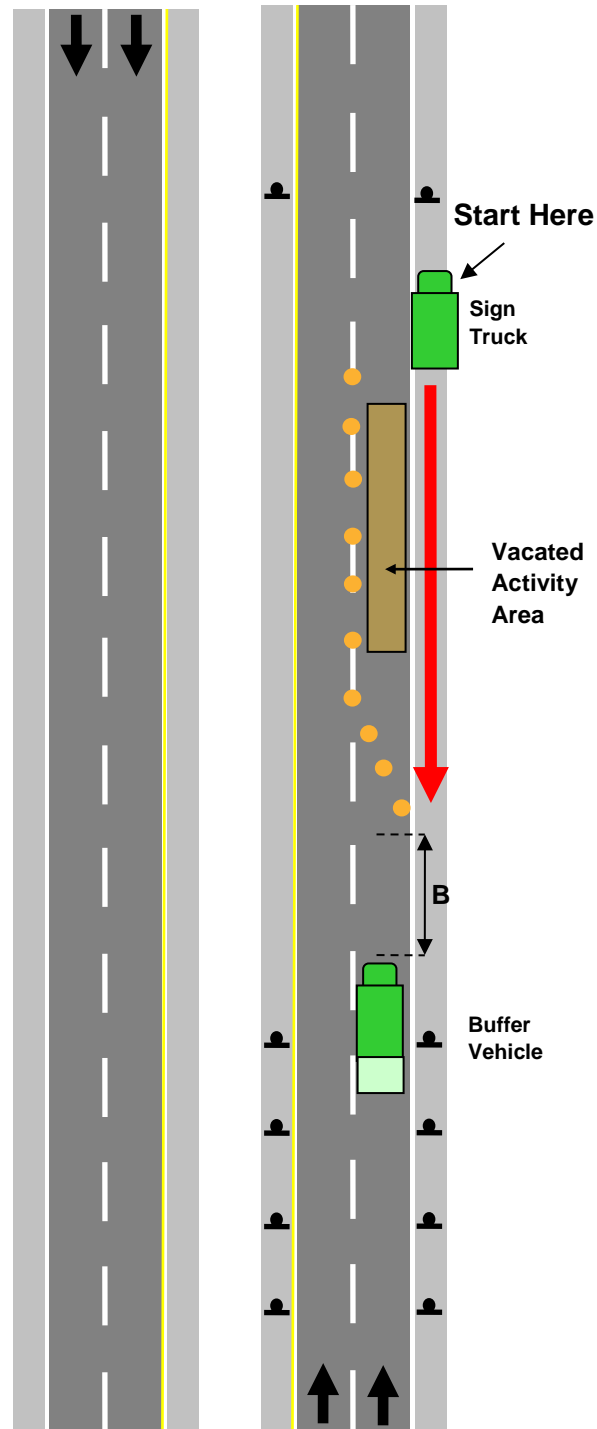


Figure 4-9: Lane Closure Removal (Multilane Roads)

**Sequence**

1. Ensure that the Activity Area is clear of all workers, equipment, and Delineation Devices.
2. In general, begin sign removal at the first advance warning sign on the right side of the road.
3. Remove the duplicate sign on the left side.
4. Proceed with the flow of traffic, removing all signs from the right to the left.

**High Traffic Volume Areas (Optional – Not Shown in Figure)**

- In areas with high traffic volumes, the Traffic Control Agent may elect to remove signs in the following manner:
  - commence by removing all signs on one side of the road
  - progress with the flow of traffic, making two legal turns
  - recommence removal at the Advance Warning area for the opposite side.

**Special Instructions**

- Sign truck shall display a FAB set to the appropriate directional arrow.
- Buffer Vehicle shall be equipped with a FAB, displaying the appropriate directional arrow and remain a distance B behind the Sign Truck as per Table 2-3.
- An additional Trail Vehicle / Buffer Vehicle may be used to provide advance notification of the Sign Truck based upon site specific conditions such as restricted sight distances or high traffic volumes.
- In cases where vehicles do not encroach on the travelled lane, Buffer Vehicle may be substituted with a Trail Vehicle.
- A Dedicated Traffic Observer shall be present during all removal activities to warn workers of potential hazards.

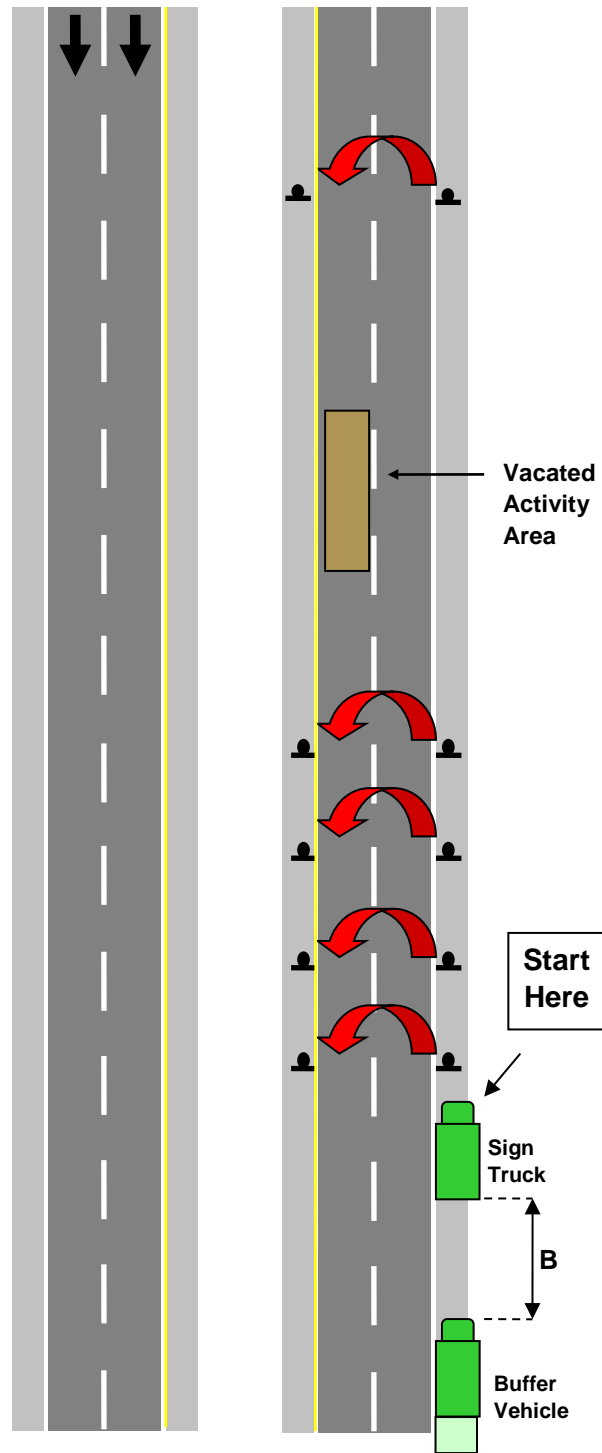


Figure 4-10: Sign Removal (Multilane Roads)

## 5 WATCM Traffic Personnel

WATCM Traffic personnel have varying responsibilities depending on the specific role and duties to which they are assigned. Sections 5.1 to 5.5 describe the various responsibilities and associated training requirements for the following types of Work Area personnel:

- Traffic Control Agents;
- Traffic Control Persons;
- Dedicated Traffic Observers;
- Device Installers; and
- Other Workers.

All Work Area personnel must receive appropriate training to match the job decisions they will be required to make prior to commencing their respective work activities.

### ***Personal Protective Equipment***

All WATCM Traffic personnel, regardless of their specific role, must wear personal protective equipment at all times, to maintain a high degree of visibility and protection. Personal protective equipment shall comply at a minimum with the provisions of the Occupational Health and Safety Act, Regulation 91-191. WATCM Traffic Personnel are also expected to comply with the policies and procedures for the use of personal protective equipment established by their employer.

## 5.1 Traffic Control Agents

### ***Responsibilities***

Each Work Area shall have a *Traffic Control Agent* who is responsible for properly implementing and maintaining the Traffic Control Plan. Specific duties of the Traffic Control Agent include:

- Ensuring that the minimum standards prescribed by this manual have been implemented;
- Exercising sound technical judgement in ensuring that the Traffic Control Plan suits local conditions;
- Ensuring that additional Traffic Control Devices and worker protection are used when necessary;
- Performing routine inspections and documentation of all devices in the Work Area; and
- Ensuring that any Traffic Control Devices that are damaged or in poor condition are immediately replaced;

**Training**

All Traffic Control Agents must successfully complete a WATCM training course as approved by the Department of Transportation and Infrastructure’s Maintenance and Traffic Branch after which the Traffic Control Agent shall keep up to date with revisions available on the DTI Website, with recertification required every three years.

**5.2 Traffic Control Persons**

**Responsibilities**

*Traffic Control Persons (TCPs)* are used in Work Areas to regulate traffic and prevent conflicts between vehicles and Work Area activities. The duties of a TCP are to:

- Direct traffic safely through the Work Area;
- Stop traffic whenever the progress of work requires, in order to provide a safe Work Area and ensure the safety of the workers; and
- Warn workers of impending danger.

Given the significant importance of these responsibilities, only individuals who have received proper training shall be used as TCPs.

**Training**

Traffic Control Persons shall complete training as per Occupational Health and Safety Act and the policies and procedures established by their employers.

**Required Signage**

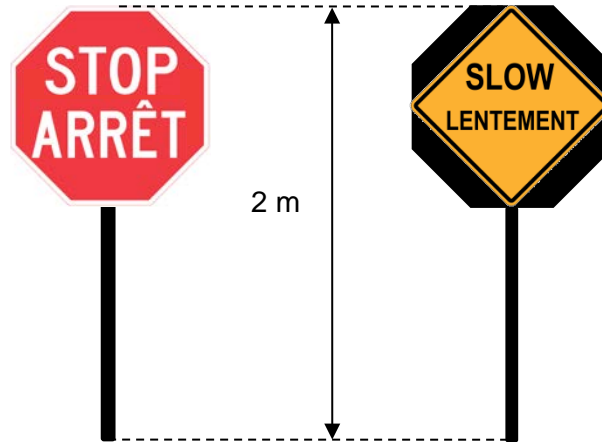
A Traffic Control Person Ahead sign shall always be erected in advance of the TCP to inform road users of their presence and prepare them to obey given direction. This sign shall be in place before the TCP commences signalling, at the appropriate distance as indicated in Table 5-1. When the TCP is not directing traffic, this sign shall be removed, covered, or turned away from traffic.

**Table 5-1: Placement Distances for Traffic Control Person Ahead**

Normal Posted Speed Limit (km/h)	Distance (m)
50	100 - 150
60 - 70	150 - 225
80 - 90	200 - 300
100 - 110	300 - 450



A *Stop/Slow Paddle* shall be used by the TCP to direct traffic. Both the stop sign and the slow sign are to be 50 cm X 50 cm, and mounted on the top of a pole such that the top of the signs is a minimum of 2 m above the roadway. Both signs shall also be retro-reflective with high intensity sheeting. At no time should the TCP use red flags to control traffic.



**Position & Location**

A TCP shall stand just outside the travelled lane at a location approximately 40-50 m in advance of the Activity Area or Transition Taper. In situations where the posted speed is 60 km/h or less, this distance may be reduced to 20-30 m. For patching, milling, and paving, these distances shall be relative to the Work Vehicles (i.e. asphalt truck, etc.). For all situations, the TCP must be able to see (and be seen by) approaching traffic for at least 150 m.

Once a TCP has been assigned a position, they must immediately plan an escape route (i.e. a place to move to avoid Errant Vehicles that may disregard their signals). In the event this does occur, the TCP must move out of the path of the vehicle and then immediately warn the workers.

While signalling, a TCP must:

- Be alert at all times, and aware of work activities and oncoming traffic;
- Face on-coming traffic, and never turn their back on moving traffic;
- Refrain from using cell phones or other electronic devices;
- Stand alone, and not mingle with workers or the public; and
- Not perform any other work.

If conversations with road users are unavoidable, the TCP must remain in position and keep conversation brief.

**Signalling Procedures**

Proper signalling methods and procedures are taught in the TCP course. These procedures shall be followed at all times to ensure that traffic is directed in a safe and consistent manner. Common procedures are described in Table 5-2.

**Table 5-2: Common Signalling Procedures**

<p><b>To stop traffic:</b></p> <ol style="list-style-type: none"><li>1. Stand just outside the travelled lane</li><li>2. Place the paddle on the edge of the lane with the stop sign facing oncoming traffic</li><li>3. Use hand signals to indicate to the road user where to stop</li><li>4. Give full attention to the approaching vehicle until it has come to a complete stop</li></ol>
<p><b>To move traffic from a stopped position:</b></p> <ol style="list-style-type: none"><li>1. Verify that opposing traffic has stopped and that the last opposing vehicle has passed</li><li>2. Check the construction activity to ensure that the lane will be clear</li><li>3. Reverse the paddle to display slow</li><li>4. Use hand signals to direct traffic to the appropriate path</li></ol>
<p><b>To allow traffic to proceed at a reduced speed:</b></p> <ol style="list-style-type: none"><li>1. Stand just outside the travelled lane</li><li>2. Place the paddle on the edge of the lane with the slow sign facing oncoming traffic</li><li>3. Use hand signals to direct traffic to the appropriate path or to reduce speed, as needed</li></ol>

**Communication**

Clear and effective communication amongst TCPs is vital to ensuring that traffic control is carried out in the safest possible manner.

When TCPs are in sight of each other, they should use pre-arranged visual signals to communicate. Effective signals include raising and lowering or waving the paddle before changing from slow to stop, and vice-versa. Before changing traffic flow, signals must be acknowledged by the other TCP.

When TCPs are not in sight of each other, a third TCP should be placed at an intermediate location to relay signals. The intermediate TCP must also be equipped with a stop/slow paddle.

Two-way radios should be used when TCPs are not in sight of each other. When using two-way radios, the following precautions should be taken:

- Test radios in advance and carry spare batteries;
- Establish clear voice signals for each situation and stick to them;
- Speak crisply and distinctly;
- Repeat any messages that are not understood; and
- Avoid unnecessary talk.

### 5.3 Dedicated Traffic Observers

#### ***Responsibilities***

*Dedicated Traffic Observers are used to monitor oncoming traffic and warn workers of potential hazards or threats during the setup and removal of Traffic Control Devices and for other activities that require a worker to be on or near the travelled lane for only a very brief period. To do so, they must be located in a position with a clear view of traffic. The means by which the traffic observer will warn the workers shall be determined before the activity begins. Dedicated Traffic Observers shall not be engaged in other activity while monitoring traffic. An example of such an activity may include removing debris from the road.*

**Training**  
All Dedicated Traffic Observers must attend a WATCM awareness session as approved by the Department of Transportation's Maintenance and Traffic Branch.

### 5.4 Device Installers

#### ***Responsibilities***

*Sign Installers* include any person(s) directly involved with the setup and removal of Traffic Control Devices in a Work Area.

#### ***Training***

All device installers must attend a WATCM awareness session as approved by the Department of Transportation's Maintenance and Traffic Branch

### 5.5 Other Workers

#### ***Responsibilities***

*Other Workers* include any other person(s) on site while the work is being carried out. This includes equipment operators, general labourers, inspectors, etc.

#### ***Training***

All workers must attend a WATCM awareness session as approved by the Department of Transportation's Maintenance and Traffic Branch.



## 6 Selecting the Appropriate Traffic Control Layout

Sections 7 and 8 contain typical traffic control layouts for common work activities. When selecting the most appropriate layout for a particular activity, the following four factors must be considered:

- Work Location
- Work Duration
- Traffic Volumes
- Vehicle Speeds

Each of these factors is described in the following sections.

### 6.1 Work Location

The location of an Activity Area within the right-of-way is a major factor when selecting the appropriate traffic control layout. The more an Activity Area encroaches onto the road and interferes with the flow of traffic, the greater the level of traffic control required. There are four categories of work location:

<b>Roadside ...</b>	Work that is carried out within the road right-of-way, but outside the shoulder area.
<b>Shoulder ...</b>	Work that is carried out on the shoulder area of the road, but which does not encroach on the travelled lanes.
<b>Partial Lane Closure...</b>	Work that is carried out in a travelled lane without reducing the remaining useable lane width below 3.0 m. (Note: Partial Lane Closures shall not be used on multilane roads).
<b>Lane Closure...</b>	Work that is carried out on the travelled way and reduces the remaining useable width of one or more lanes to less than 3.0 m.

## Work Duration

Work duration is the length of time that an Activity Area occupies a single location or several adjacent locations that are sufficiently close to be effectively considered as one. There are four categories of work duration:

<b>Moving Operations...</b>	Work that is either done <i>continuously</i> , usually at slow speeds, or <i>intermittently</i> , with brief stops related to the work. Examples of Moving Operations include: line painting, mowing, sweeping, and pavement testing.
<b>Very Short Duration...</b>	Work that occupies a fixed location for up to 30 minutes, including the time required to setup and remove Traffic Control Devices.
<b>Short Duration...</b>	Work that occupies a fixed location for longer than 30 minutes, yet less than 1 day.
<b>Long Duration...</b>	Work that occupies a fixed location for longer than 1 day.

As work duration increases, so too does the exposure for workers. As a result, the magnitude of traffic control is typically greater for longer duration Work Areas.

### 6.2 Traffic Volumes

The level of traffic control required may also depend on the traffic volumes through the Work Area. Low Volume Roads typically require a less complex traffic control layout since worker exposure to traffic is reduced.

For the purposes of selecting the appropriate traffic control layout, a Low Volume Road is any road with an AADT of less than 300 vehicles per day.

### 6.3 Vehicle Speeds

The faster a vehicle is travelling, the more distance the driver will require to recognize, interpret, and react to any traffic control devices or personnel which they may encounter in a Work Area. For this reason, as the posted speed changes in the Work Area, so does the:

- Size of Traffic Control Devices;
- Distance for providing advance warning;
- Spacing between devices in the Approach Area; and the
- Lengths of tapers and Buffer Areas.

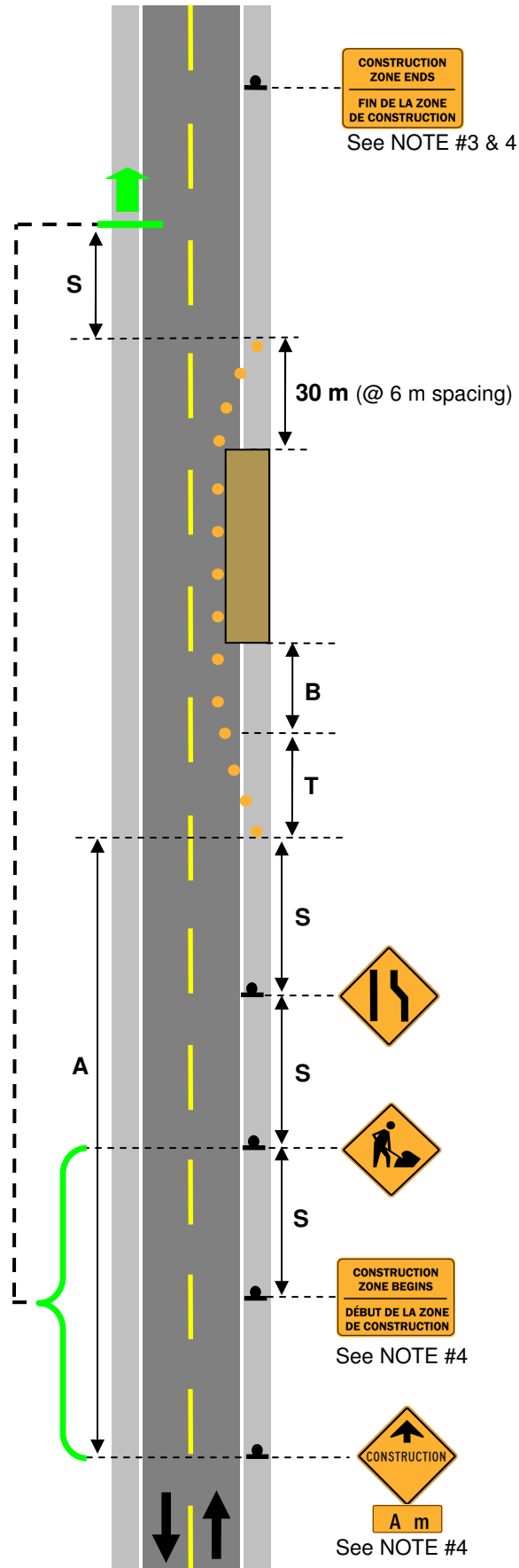
Each layout contained in Chapters 7 and 8 includes a table that specifies the minimum dimensions for each of these items.

**NOTES:**

1. Must maintain a minimum 2.5 m useable road width in the lane in which work is taking place.
2. Sign opposite approach in the same manner, without the Road Narrows sign.
3. Construction Zone Ends sign to be placed directly across from Construction Zone Begins sign on the opposite approach.
4. For Very Short Duration Partial Lane Closures on roads with AADT  $\leq$  300 and Existing Speed Limit  $\leq$  50 km/h:
  - identified signs may be eliminated,
  - T maybe reduced to T/3,
  - Termination Taper may be reduced to two delineation devices.

Partial Lane Closure Short Duration All Volumes				
V	50	60-70	80-90	100
A	350	350	500	1000
S	50	75	100	150
T	30	64	110	180
D	6 / 8	8 / 10	10 / 14	18 / 24
B	35	50	70	75

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- T – Taper Length (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)
- B – Buffer Area Length (m)



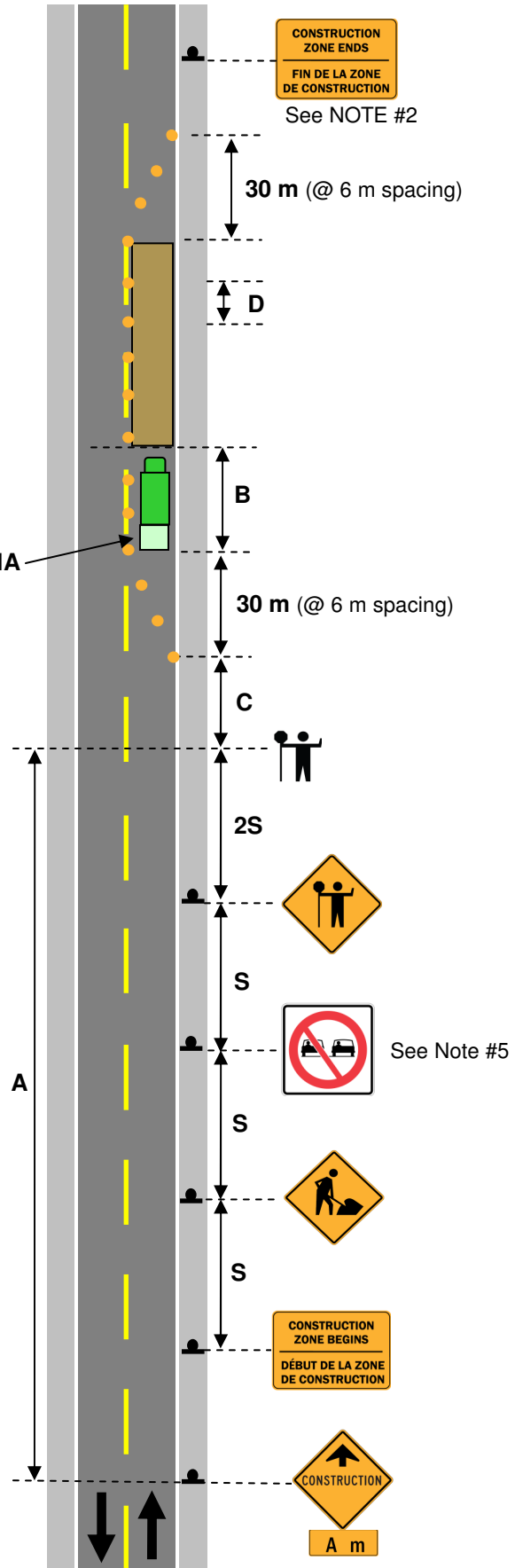
**NOTES:**

1. Sign opposite approach in the same manner.
2. Construction Zone Ends sign to be placed directly across from Construction Zone Begins sign on the opposite approach.
3. Buffer Vehicle with TMA only required when working on bridge structures.
4. When working on bridges, the Activity Area shall be extended such that TCPs are not located on the structure.
5. No passing sign is optional on roads with less than 300 vehicles per day or  $\leq 50$  km/hr.

**Single Lane Closure  
(inc. Bridges)  
Short Duration  
(greater than 30 min, less than 1 day)  
All Volumes**

V	50	60-70	80-90	100
A	350	500	1000	1000
S	50	75	100	150
C	30	40	50	50
D	6 / 8	6 / 10	6 / 14	6 / 24
B	35	50	70	75

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- C – Traffic Control Person Setback (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)
- B – Buffer Area Length (m)





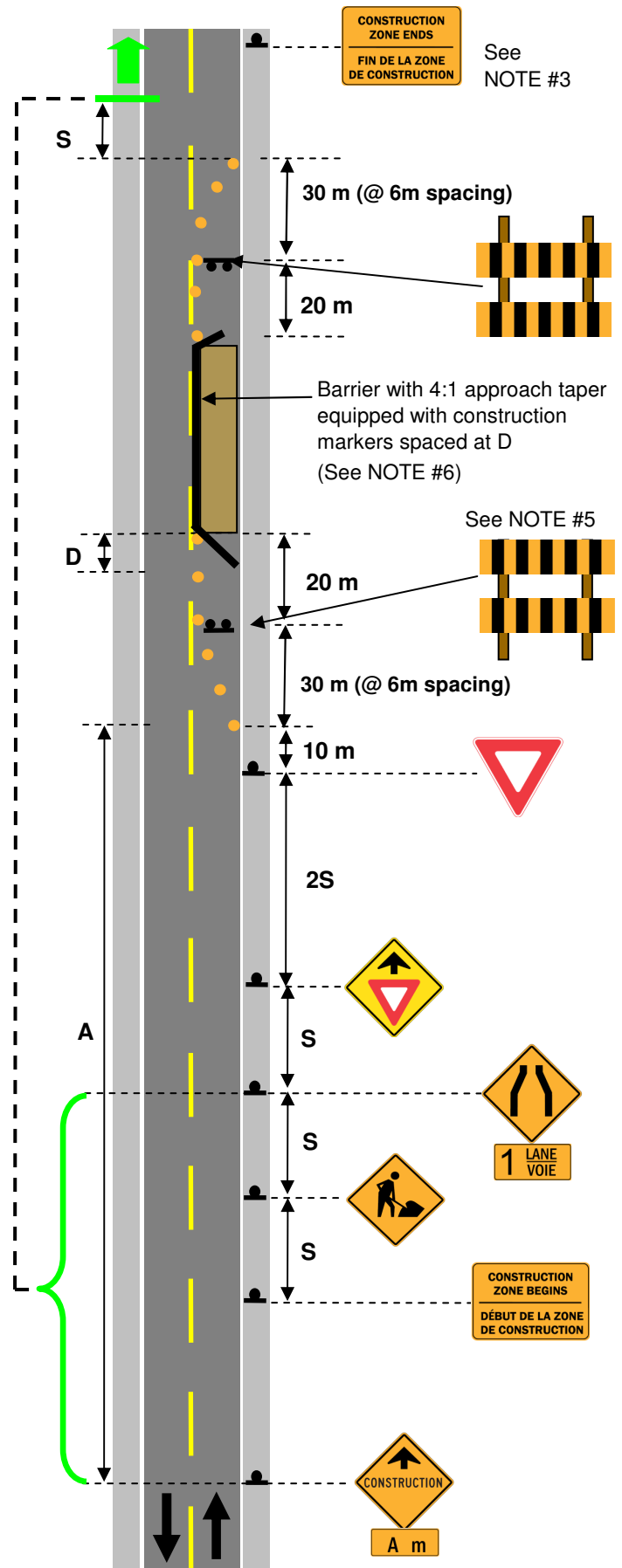
**NOTES:**

1. Layout requires approval from the Department of Transportation's Maintenance and Traffic Branch.
2. Sign opposite approach in the same manner, without the Yield Ahead and Yield signs.
3. Construction Zone Ends sign to be placed directly across from Construction Zone Begins sign on the opposite approach.
4. Tapers shall be at least 30 m in length, and have a delineator spacing of 6 m.
5. Flashing arrow boards (set to the caution mode) may be used in place of barricade boards.
6. Continuous barrier may be replaced by flexible drums or delineator posts if anticipated work duration is 3 days or less.
7. For work on bridge structures, a continuous Barrier is required for all Long Duration Work.

See NOTE #1

Single Lane Closure (inc. Bridges) Long Duration (greater than 1 day) AADT less than 300 vehicles per day				
V	50	60-70	80-90	100
A	350	500	1000	1000
S	50	75	100	150
D	6 / 8	6 / 10	6 / 14	6 / 24

V – Existing Speed Limit (km/h)  
 A – Advance Warning Distance (m)  
 S – Minimum Sign Spacing (m)  
 D – Maximum Delineator Spacing in Taper/Tangent (m)



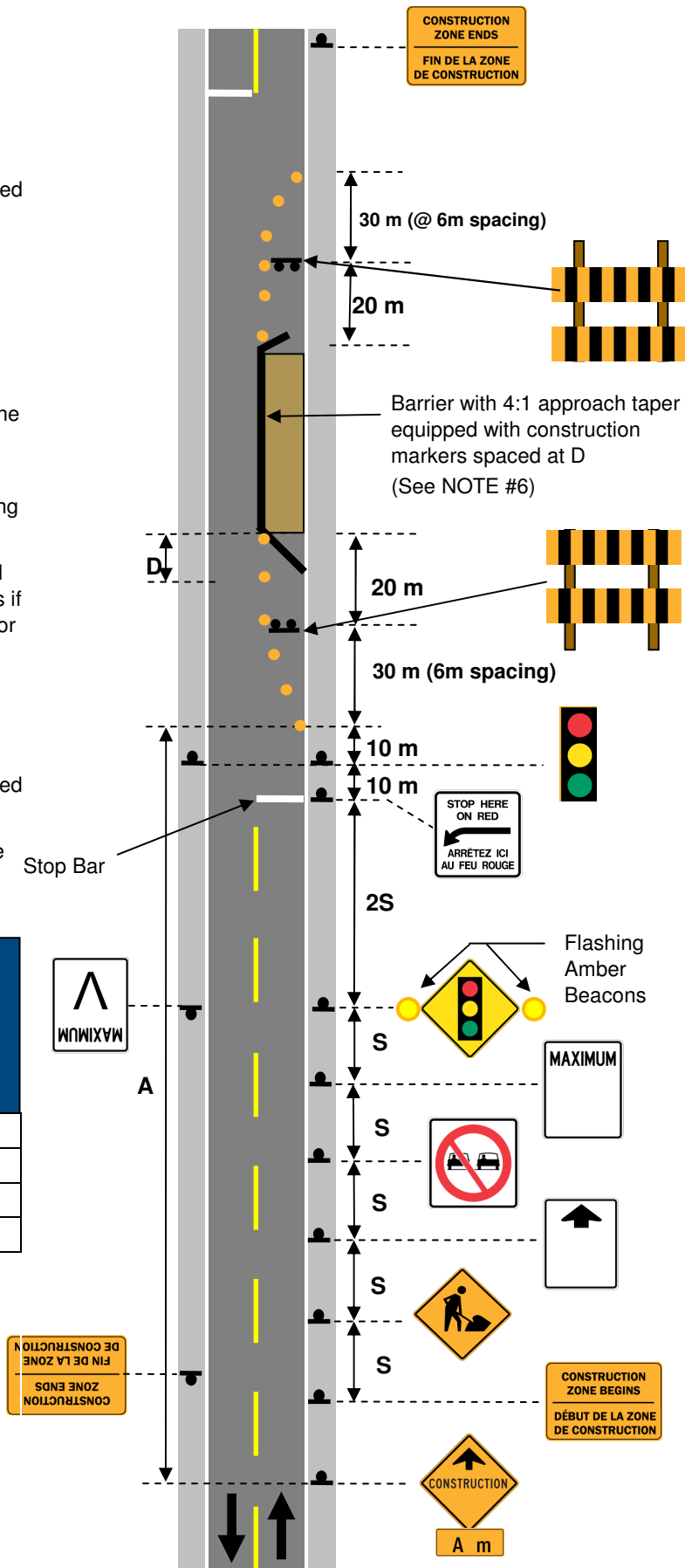
**NOTES:**

1. Layout requires approval from the Department of Transportation's Maintenance and Traffic Branch.
2. Speeds shall not be reduced more than 20 km/h below the original speed limit unless approved by DTI's Maintenance and Traffic Branch. Speed reductions are not required where the original speed limit is 60 km/hr or less.
3. Construction Zone Ends sign to be placed directly across from Construction Zone Begins sign on the opposite approach.
4. Tapers should be at least 30 m in length, and have a delineator spacing of 6 m.
5. Continuous barrier may be replaced by flexible drums or delineator posts if anticipated work duration is 3 days or less (except for work on bridges).
6. For work on bridge structures, a continuous Barrier is required for all Long Duration Work.
7. Centreline markings must be removed between Traffic Signal Stop Bars.
8. Sign opposite approach in the same manner.

**Single Lane Closure  
(inc. Bridges)  
Long Duration (greater than 1 day)  
AADT greater than  
300 vehicles per day**

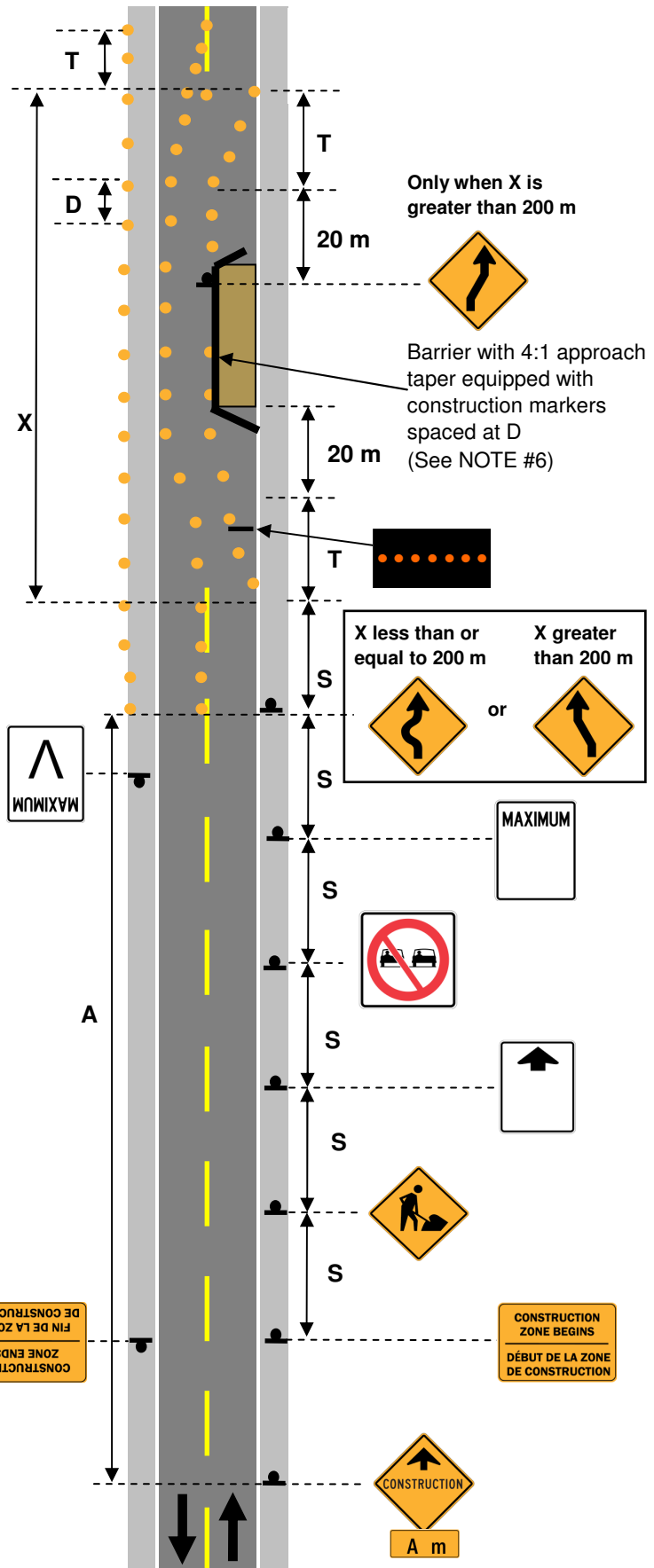
V	50	60-70	80-90	100
A	350	500	1000	1000
S	50	75	100	150
D	6 / 8	6 / 10	6 / 14	6 / 24

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)



**NOTES:**

1. Sign opposite approach as shown in Figure 7-8b.
2. X is the length of the Diversion.
3. Speeds shall not be reduced more than 20 km/h below the original speed limit unless approved by the Department of Transportation's Maintenance & Traffic Branch.
4. Speed reductions are not required where the original speed limit is 80 km/hr or less.
5. A minimum shoulder width of 2.5 m is required. The shoulder shall be paved for original speeds of 80 km/h or higher.
6. Continuous Barrier may be replaced by flexible drums or delineator posts if anticipated work duration is 3 days or less.
7. Confusing pavement markings must be removed.

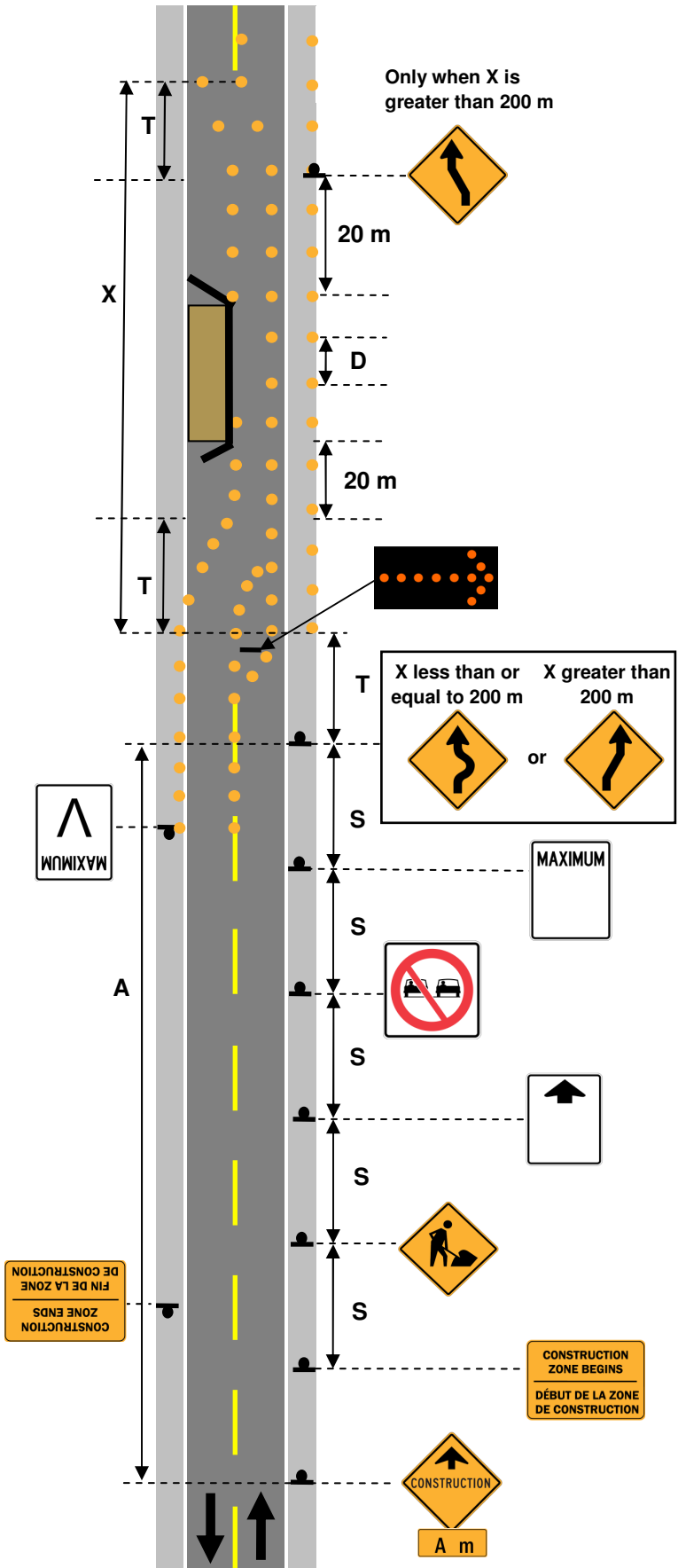


Shoulder Diversion Short or Long Duration (greater than 30 min) All Volumes				
V	50	60-70	80-90	100
A	350	500	1000	1000
S	50	75	100	150
T	30	64	110	180
D	6 / 8	8 / 10	10 / 14	18 / 24

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- T – Taper Length (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)

**NOTES:**

1. Sign opposite approach as shown in Figure 7-8a.
2. Speeds shall not be reduced more than 20 km/hr below the original speed limit unless approved by the Department of Transportation's Maintenance & Traffic Branch.
3. Speed reductions are not required where the original speed limit is 80 km/h or less.
4. Confusing pavement markings must be removed.

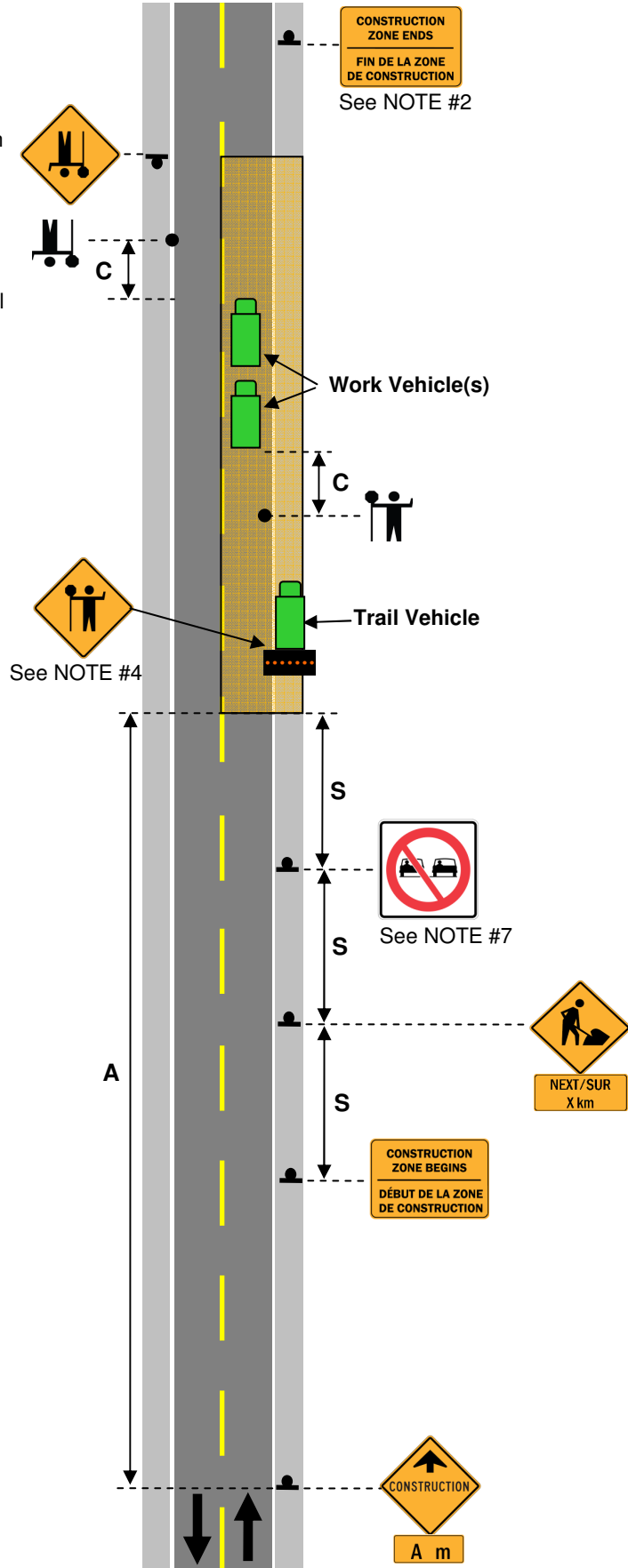


Shoulder Diversion Short or Long Duration (greater than 30 min) All Volumes				
V	50	60-70	80-90	100
A	350	500	1000	1000
S	50	75	100	150
T	30	64	110	180
D	6 / 8	8 / 10	10 / 14	18 / 24

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- T – Taper Length (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)

**NOTES:**

1. Sign opposite approach in the same manner.
2. Construction Zone Ends sign to be placed directly across from Construction Zone Begins sign on the opposite approach.
3. The length of the Activity Area shall not exceed 2 km.
4. Traffic Control Person Ahead signs shall be positioned within 2S m to 3S m of the TCP at all times (shall be mounted on Trail Vehicle where used).
5. All work vehicles shall be equipped with 360 degree amber lights as a minimum.
6. Trail vehicle not required on roads with a speed limit of 80 km/h or less.
7. No passing sign is optional on roads with less than 300 vehicles per day.

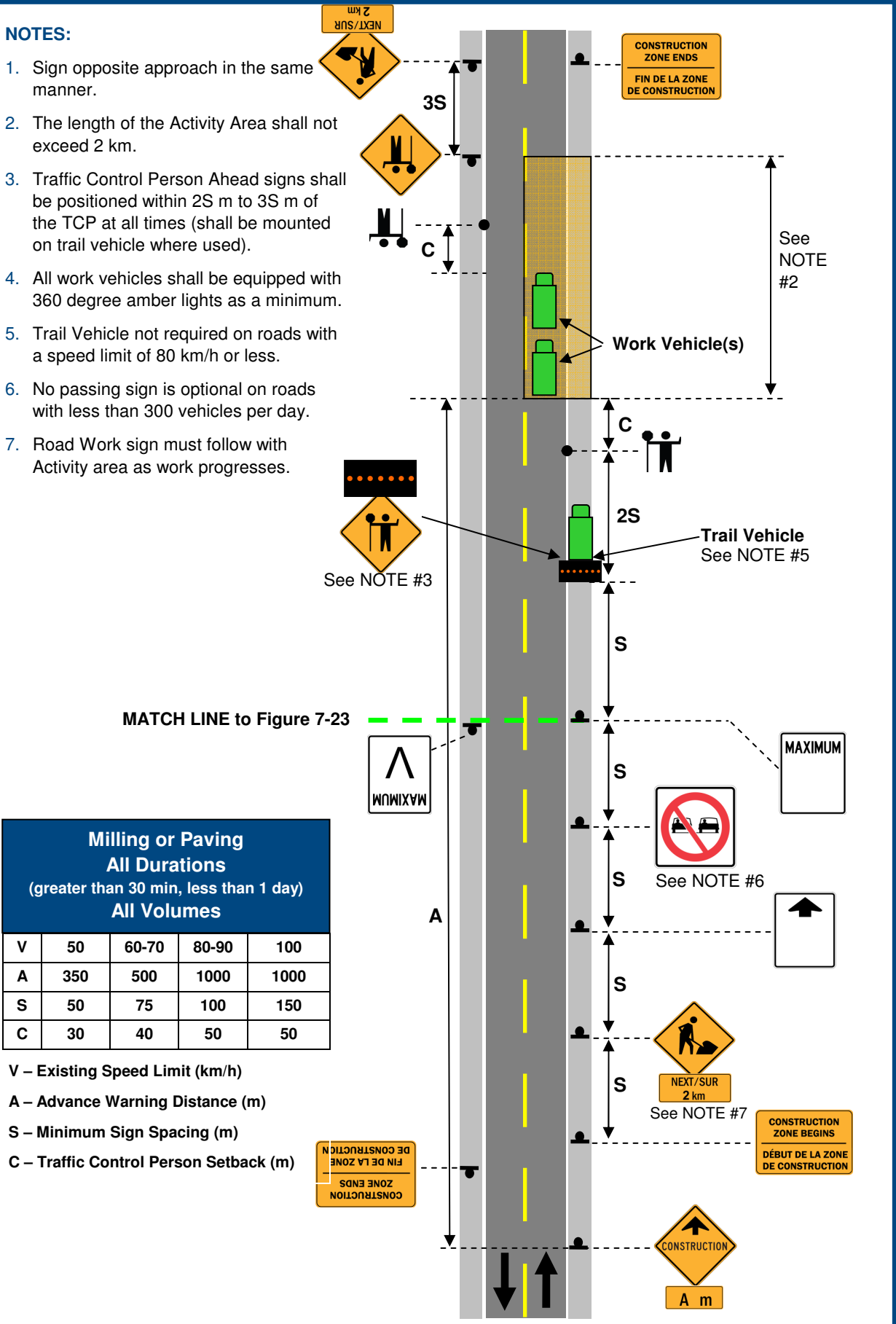


Patching Short Duration (greater than 30 min, less than 1 day) All Volumes				
V	50	60-70	80-90	100
A	350	350	500	1000
S	50	75	100	150
C	30	40	50	50

V – Existing Speed Limit (km/h)  
 A – Advance Warning Distance (m)  
 S – Minimum Sign Spacing (m)  
 C – Traffic Control Person Setback (m)

**NOTES:**

1. Sign opposite approach in the same manner.
2. The length of the Activity Area shall not exceed 2 km.
3. Traffic Control Person Ahead signs shall be positioned within 2S m to 3S m of the TCP at all times (shall be mounted on trail vehicle where used).
4. All work vehicles shall be equipped with 360 degree amber lights as a minimum.
5. Trail Vehicle not required on roads with a speed limit of 80 km/h or less.
6. No passing sign is optional on roads with less than 300 vehicles per day.
7. Road Work sign must follow with Activity area as work progresses.



Milling or Paving All Durations (greater than 30 min, less than 1 day) All Volumes				
V	50	60-70	80-90	100
A	350	500	1000	1000
S	50	75	100	150
C	30	40	50	50

V – Existing Speed Limit (km/h)  
 A – Advance Warning Distance (m)  
 S – Minimum Sign Spacing (m)  
 C – Traffic Control Person Setback (m)

**Figure 7-22**

**NOTES:**

1. Sign opposite approach in the same manner.
2. Original speed shall be reinstated directly across from the reduced speed sign on the opposite approach.
3. Speed reductions only required with speed limits of 90km/h or greater.
4. Repeat appropriate sign every 1 km of milled or paved surface.
5. Delineation Devices only required where the difference in elevation between the travelled lane and the shoulder is greater than 75 mm. Flexible drums or delineator posts may be used in place of construction markers.
6. Pavement marking tape (or paint) shall be applied in 2 m strips and spaced at 50 m on tangents and 25 m or curves. Raised pavement markers shall be installed on milled surfaces in groupings of three within a 2 m length and be spaced the same as pavement marking tape.
7. If milling involves full depth removal, then Grooved Pavement Sign shall be replaced by Pavement Ends sign.
8. Bump signs shall be used any time there is a differential in surface thickness on the main lanes.

MATCH LINE to Figure 7-22

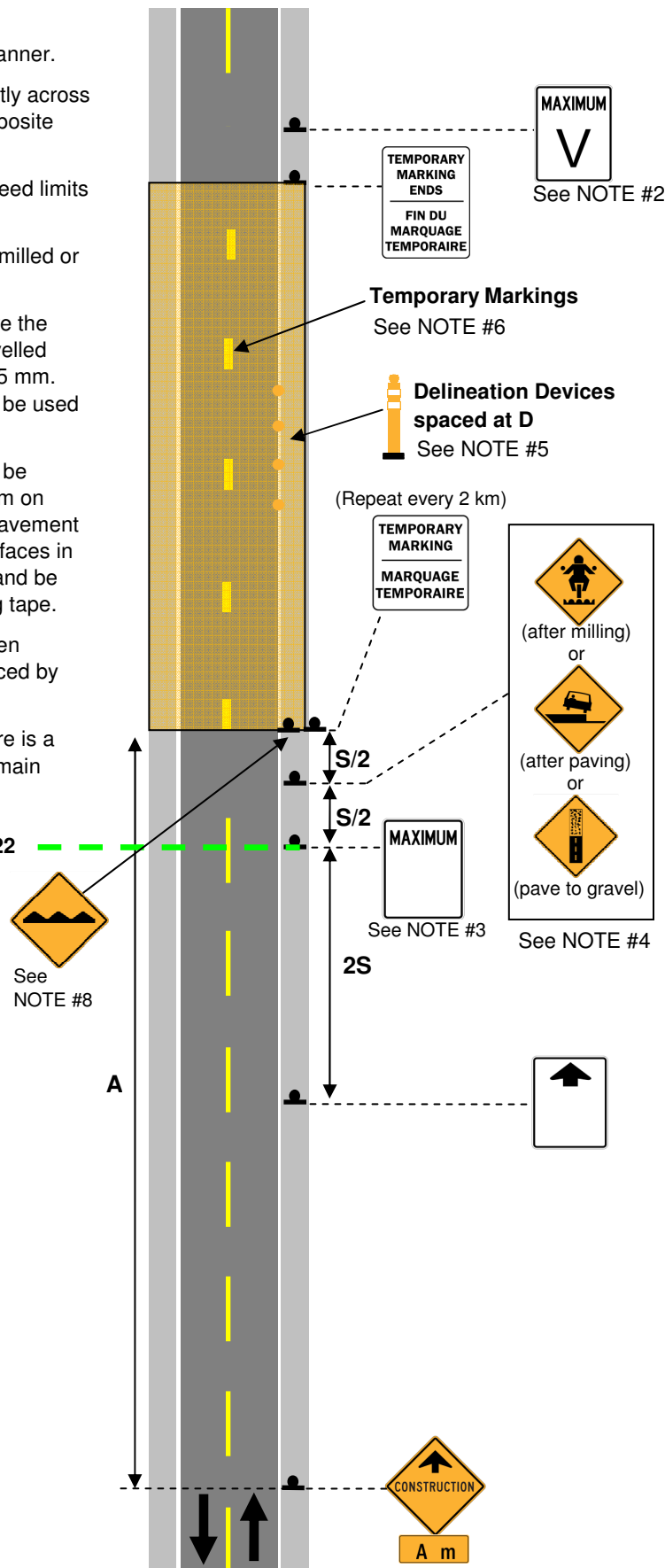
After Milling or Paving Any Duration All Volumes				
V	50	60-70	80-90	100
A	300	500	1000	1000
S	50	75	100	150
D	8	10	14	24

V – Existing Speed Limit (km/h)

A – Advance Warning Distance (m)

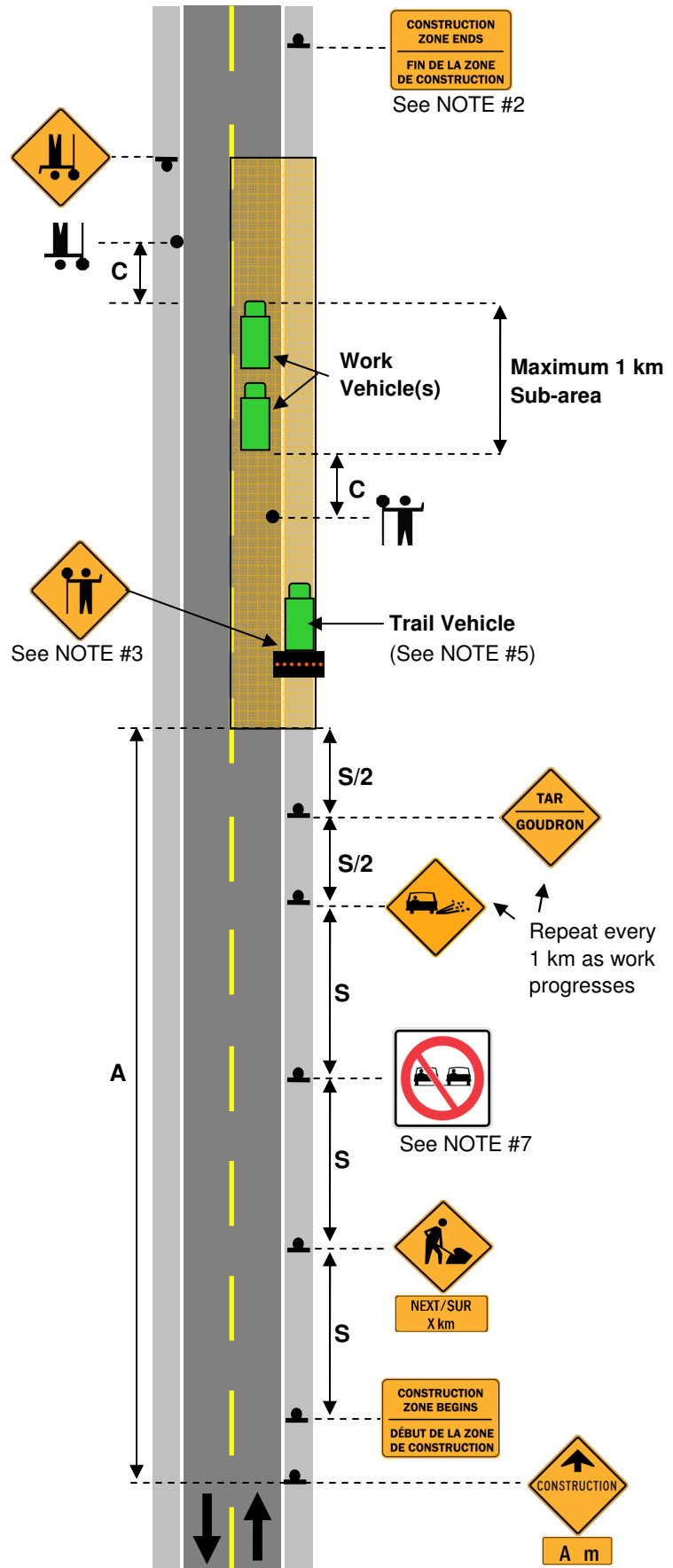
S – Minimum Sign Spacing (m)

D – Maximum Delineator Spacing (m)



**NOTES:**

1. Sign opposite approach in the same manner.
2. Construction Zone Ends sign to be placed directly across from Construction Zone Begins sign on the opposite approach.
3. Traffic Control Person Ahead signs shall be positioned within 2S m to 3S m of the TCP at all times (shall be mounted on trail vehicle).
4. The Activity Area shall not exceed 4 km.
5. All work vehicles shall be equipped with 360 degree amber lights as a minimum.
6. Trail vehicle not required on roads with a speed limit of 80 km/h or less.
7. No passing sign is optional on roads with less than 300 vehicles per day.



Chip Sealing Short Duration (greater than 30 min, less than 1 day) All Volumes				
V	50	60-70	80-90	100
A	350	500	1000	1000
S	50	75	100	150
C	30	40	50	50

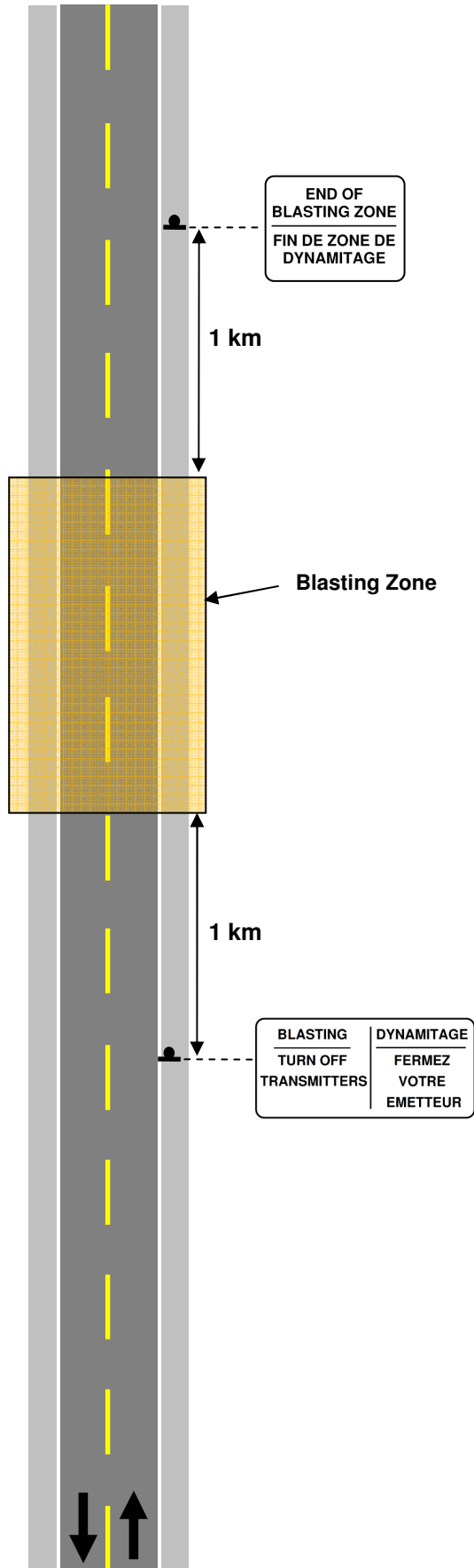
V – Existing Speed Limit (km/h)  
 A – Advance Warning Distance (m)  
 S – Minimum Sign Spacing (m)  
 C – Traffic Control Person Setback (m)



**NOTES:**

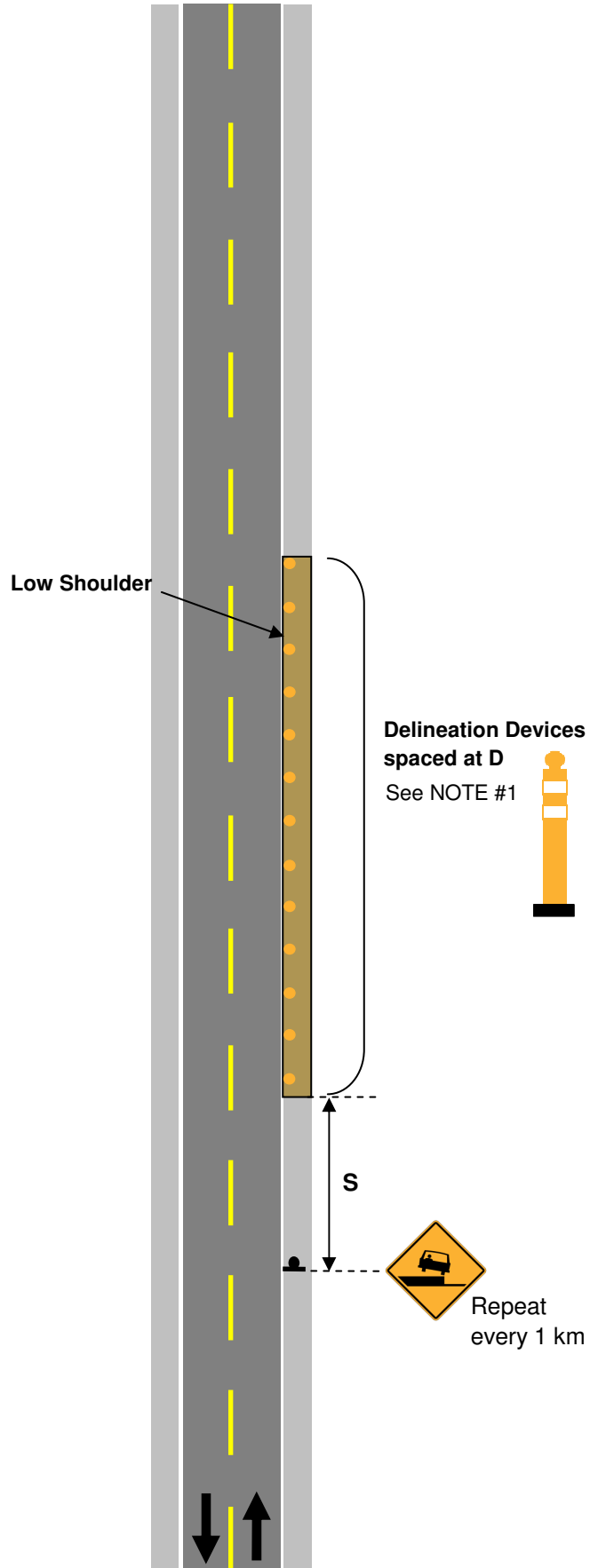
1. Sign opposite approach in the same manner.

**Blasting Zone  
Any Duration  
All Volumes**



**NOTES:**

1. Delineation Devices only required where the difference in elevation between the travelled lane and the shoulder is greater than 75 mm.

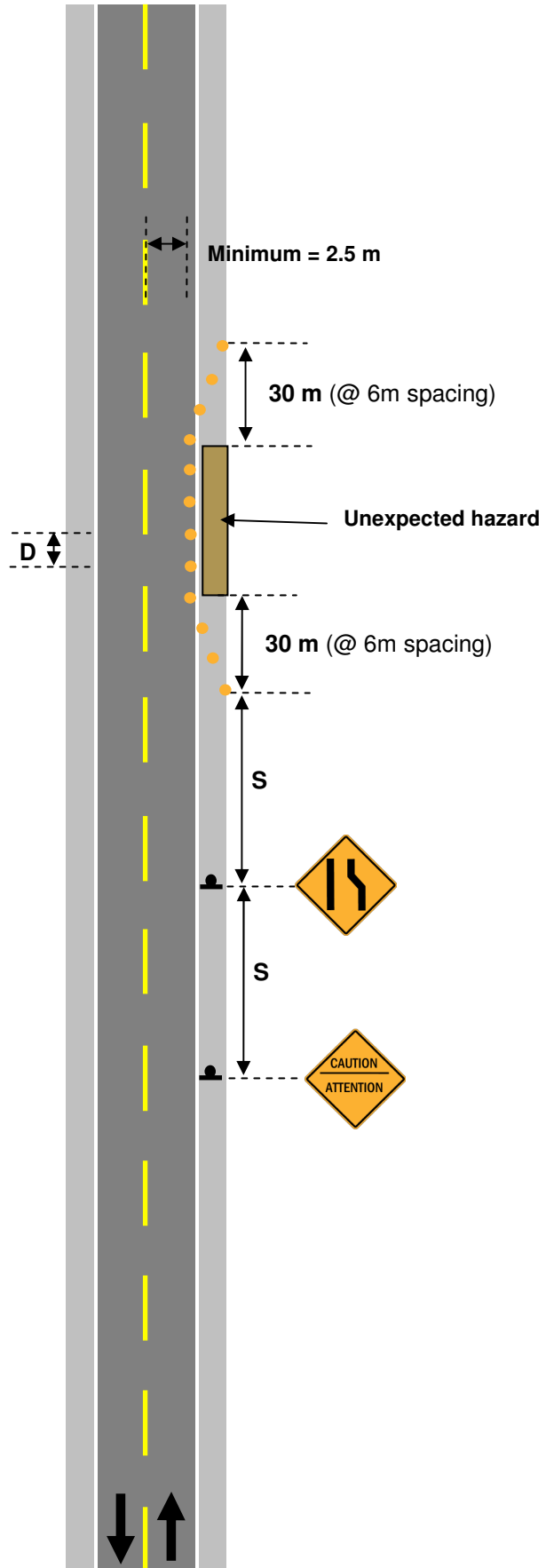


Low Shoulder Any Duration All Volumes				
V	50	60-70	80-90	100
S	50	75	100	150
D	8	10	14	24

V – Existing Speed Limit (km/h)  
 S – Minimum Sign Spacing (m)  
 D – Maximum Delineator Spacing (m)

**NOTES:**

1. This layout shall only be used to delineate the hazard until it can be fixed, at which time an appropriate layout such as Figure 7-2, 7-3, 7-4 must be used.



Other Hazards Any Duration All Volumes				
V	50	60-70	80-90	100
S	50	75	100	150
D	6 / 8	8 / 10	10 / 14	18 / 24

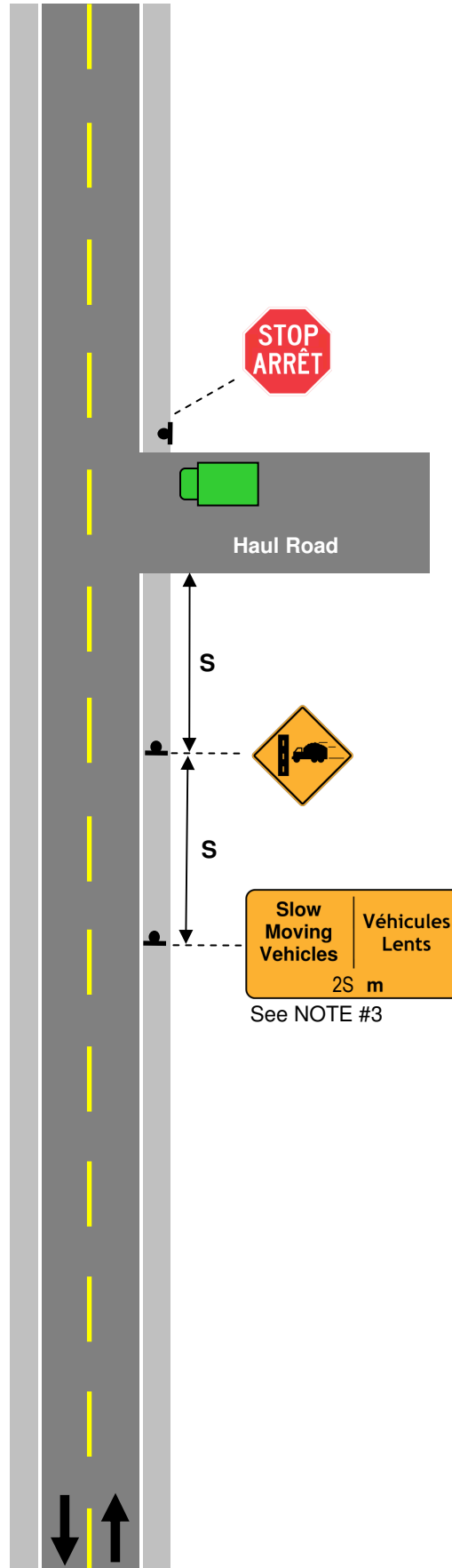
V – Existing Speed Limit (km/h)

S – Minimum Sign Spacing (m)

D – Maximum Delineator Spacing in Taper/Tangent (m)

**NOTES:**

1. Sign opposite approach in the same manner.
2. Signs are only required where there are more than 50 truck movements per day or where off-road vehicles are crossing.
3. Slow Moving Vehicles sign to be used only where mainline AADT exceeds 5000 vpd and truck volumes using the haul road exceed 200 vpd.
4. The Left Truck Entrance sign shall be used on both approaches where trucks are crossing the road.



Temporary Haul Roads Any Duration All Volumes				
V	50	60-70	80-90	100
S	50	75	100	150

V – Existing Speed Limit (km/h)

S – Minimum Sign Spacing (m)

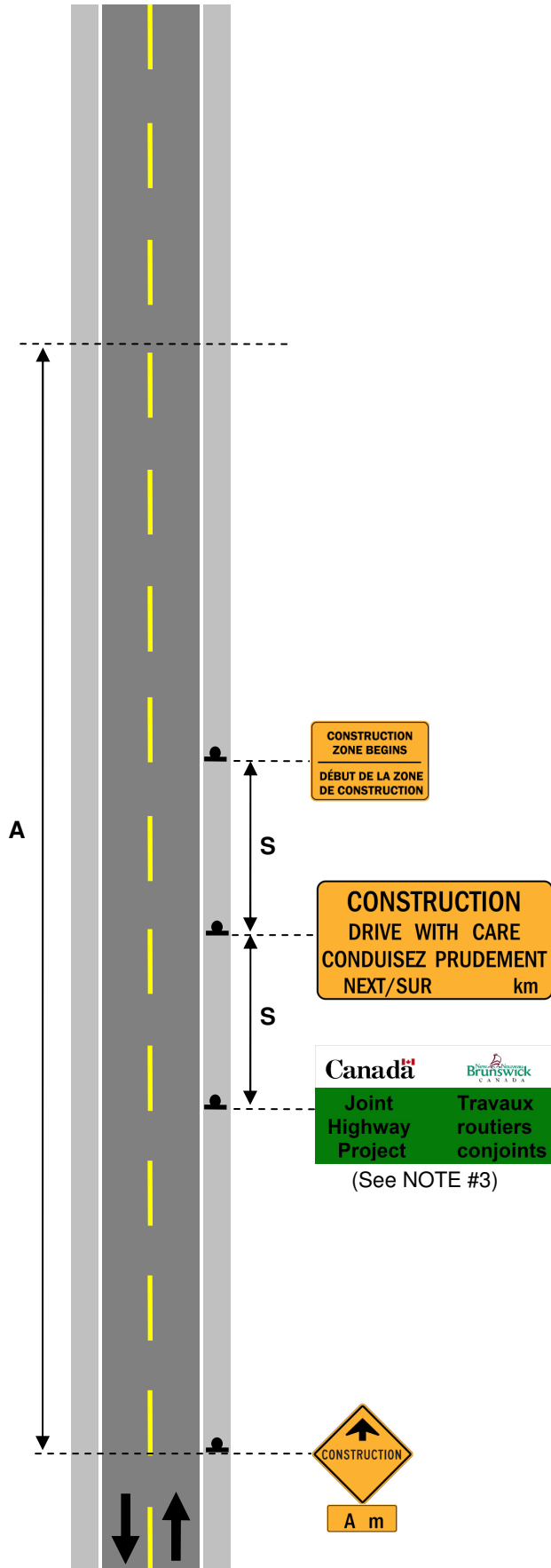
Slow Moving Vehicles | Véhicules Lents  
2S m  
See NOTE #3

**NOTES:**

1. Sign opposite approach in the same manner.
2. Do not repeat Construction Ahead or Construction Zone Begins.
3. Only use sign when applicable.
4. When merging Figure 7-31 with other typical layouts, the distance A shall be referenced to the same location as in the accompanying layout.
5. Used for Jobs over 3.0 km.

Advance Signing (Major Project) Long Duration All Volumes				
V	50	60-70	80-90	100
A	500	1000	1500	2000
S	50	75	100	150

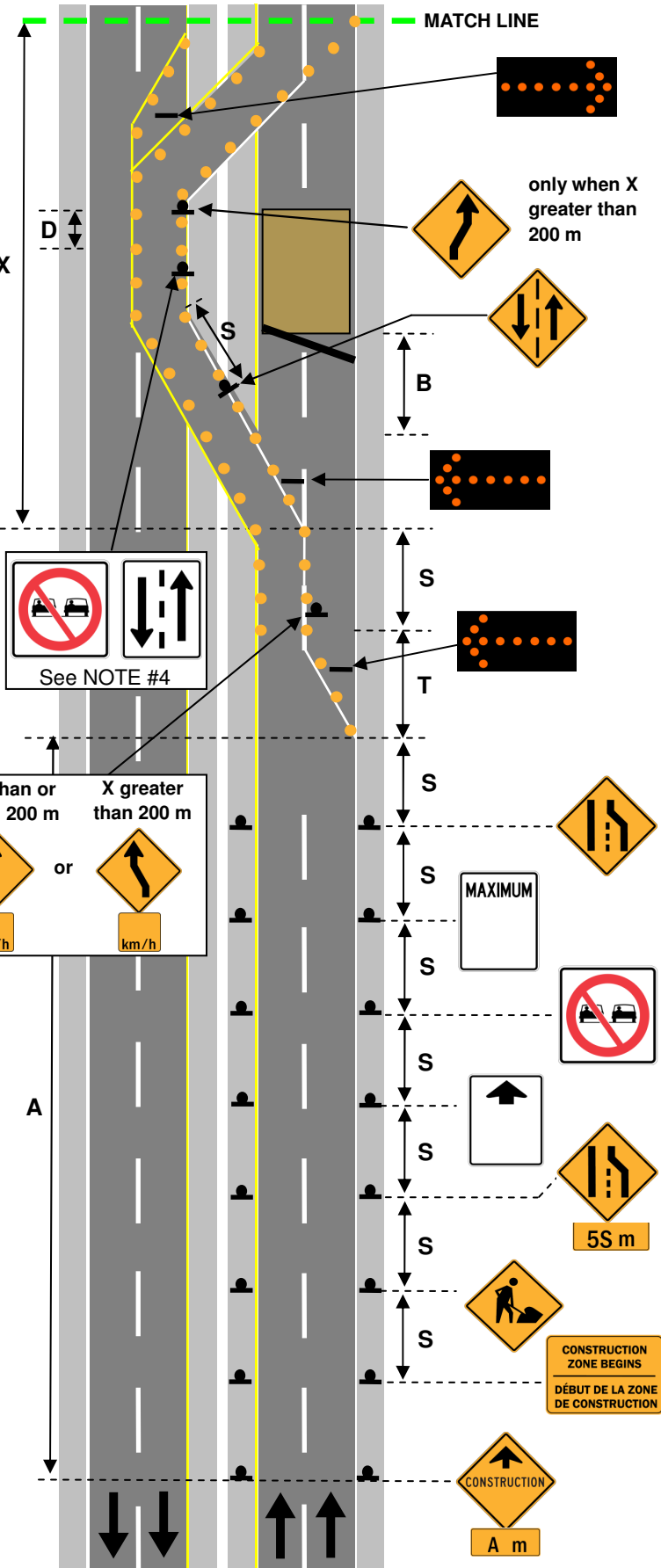
V – Existing Speed Limit (km/h)  
 A – Advance Warning Distance (m)  
 S – Minimum Sign Spacing (m)





**NOTES:**

1. Sign opposite direction as shown in Figure 8-8b
2. X is the length of the Diversion.
3. Diversions that are planned for three days or more shall be paved.
4. Alternate Two Way Traffic sign and No Passing sign every 0.5 km of Diversion. X
5. Non-applicable pavement markings shall be removed for Long Duration Work.
6. Regulatory speeds shall not be reduced more than 20 km/h.
7. Advisory speed to be determined by the Department of Transportation's Maintenance & Traffic Branch. Advisory Speed Tabs only required if the difference between the Diversion speed and the reduced speed is greater than 10 km/hr.
8. Continuous barrier may be replaced by flexible drums or delineator posts if anticipated work duration is 3 days or less.



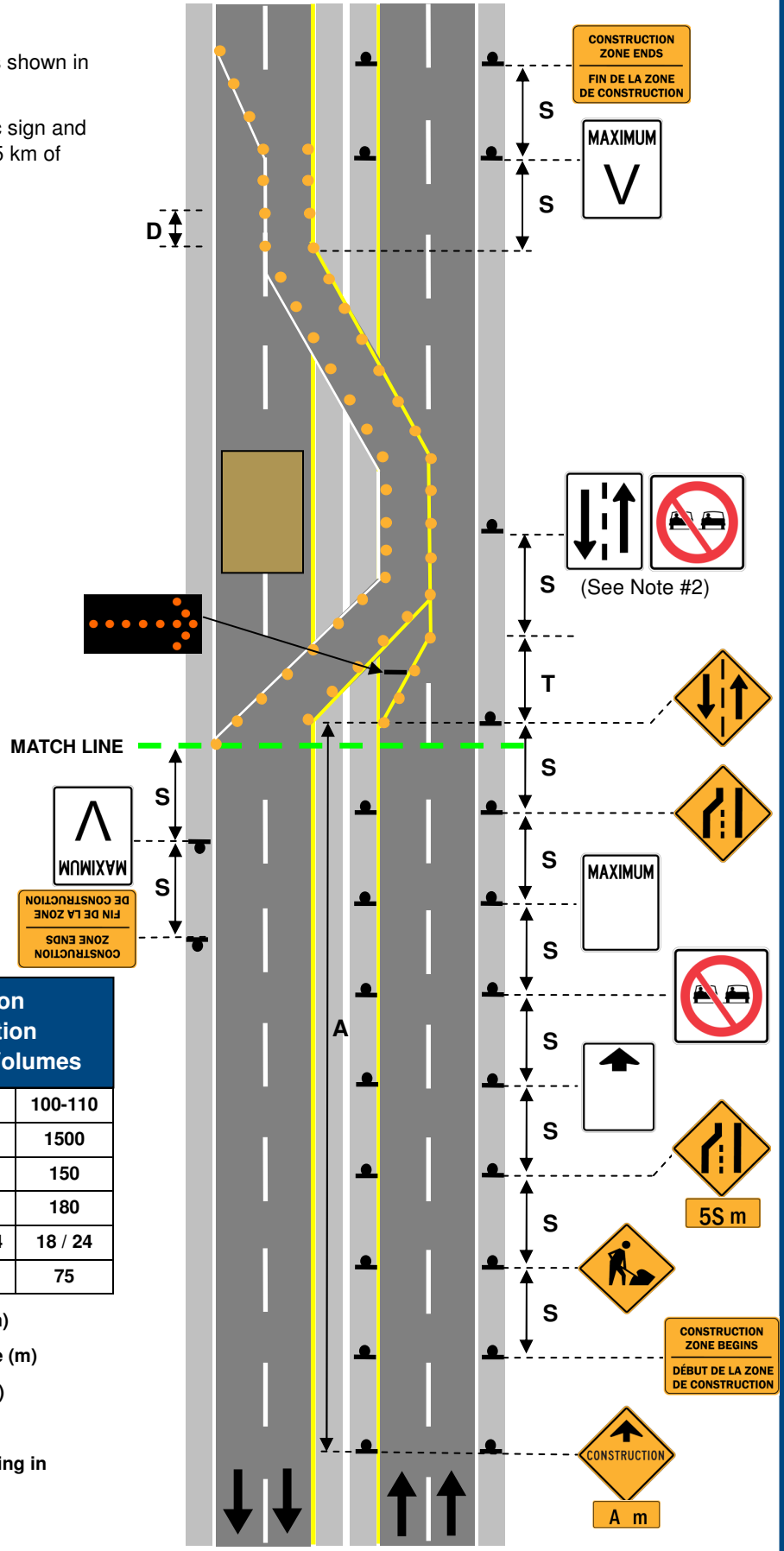
**Multilane Diversion  
Short / Long Duration  
(greater than 30 min)  
All Volumes**

V	50	60-70	80-90	100-110
A	500	1000	1000	1500
S	50	75	100	150
T	30	64	110	180
D	6 / 8	8 / 10	10 / 14	18 / 24
B	35	50	70	75

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- T – Taper Length (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)
- B – Buffer Area Length (m)

**NOTES:**

1. Sign opposite direction as shown in Figure 8-8a.
2. Alternate Two Way Traffic sign and No Passing sign every 0.5 km of diversion



**Multilane Diversion  
Short / Long Duration  
(greater than 30 min) All Volumes**

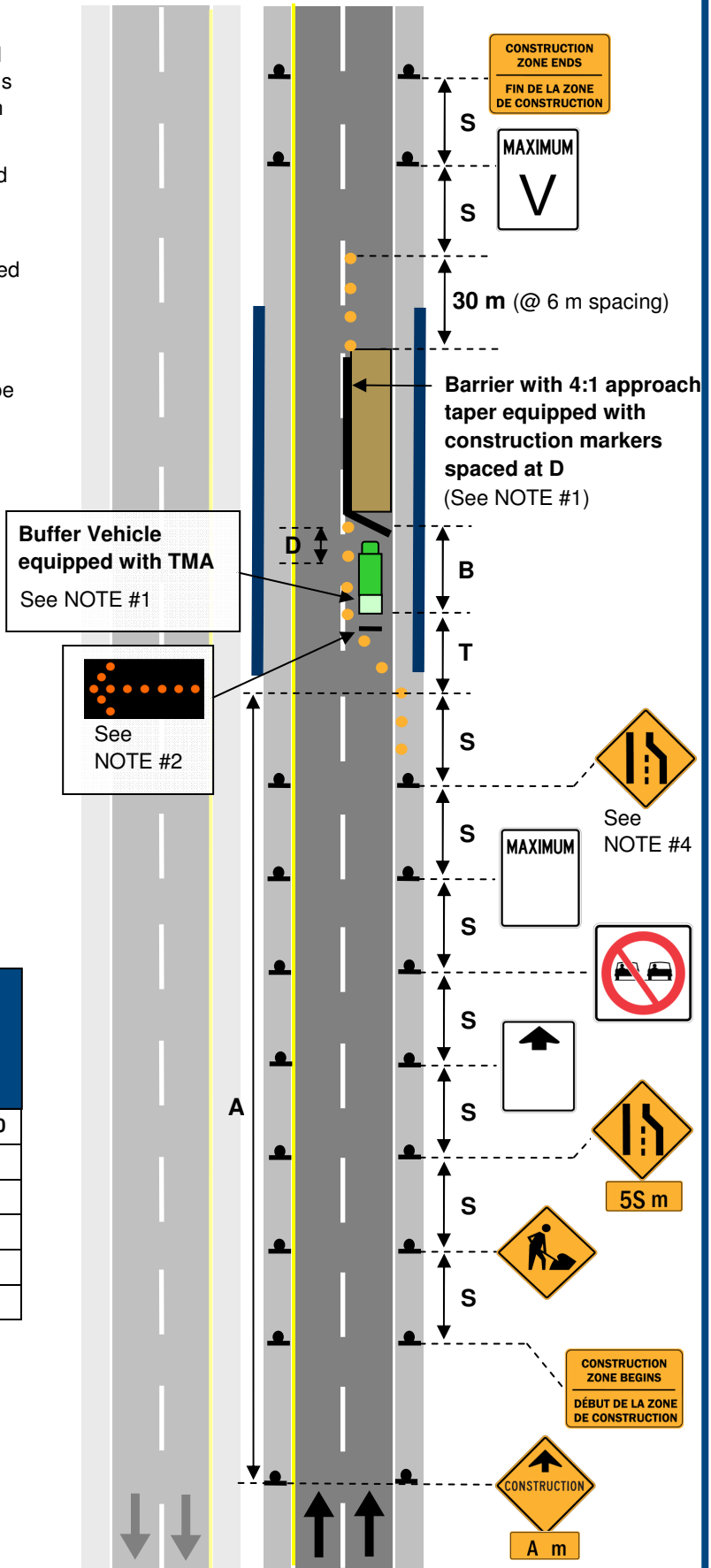
V	50	60-70	80-90	100-110
A	500	1000	1000	1500
S	50	75	100	150
T	30	64	110	180
D	6 / 8	8 / 10	10 / 14	18 / 24
B	35	50	70	75

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- T – Taper Length (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)
- B – Buffer Area Length (m)



**NOTES:**

1. Continuous Barrier may be replaced by a buffer vehicle and flexible drums or delineator posts for short duration work.
2. Flashing Arrow Board to be mounted on buffer vehicle when used.
3. Speeds shall not be reduced more than 20 km/h below the original speed limit unless approved by the Department of Transportation's Maintenance & Traffic Branch.
4. Left Lane Closed Ahead sign shall be used if work is in the other lane.



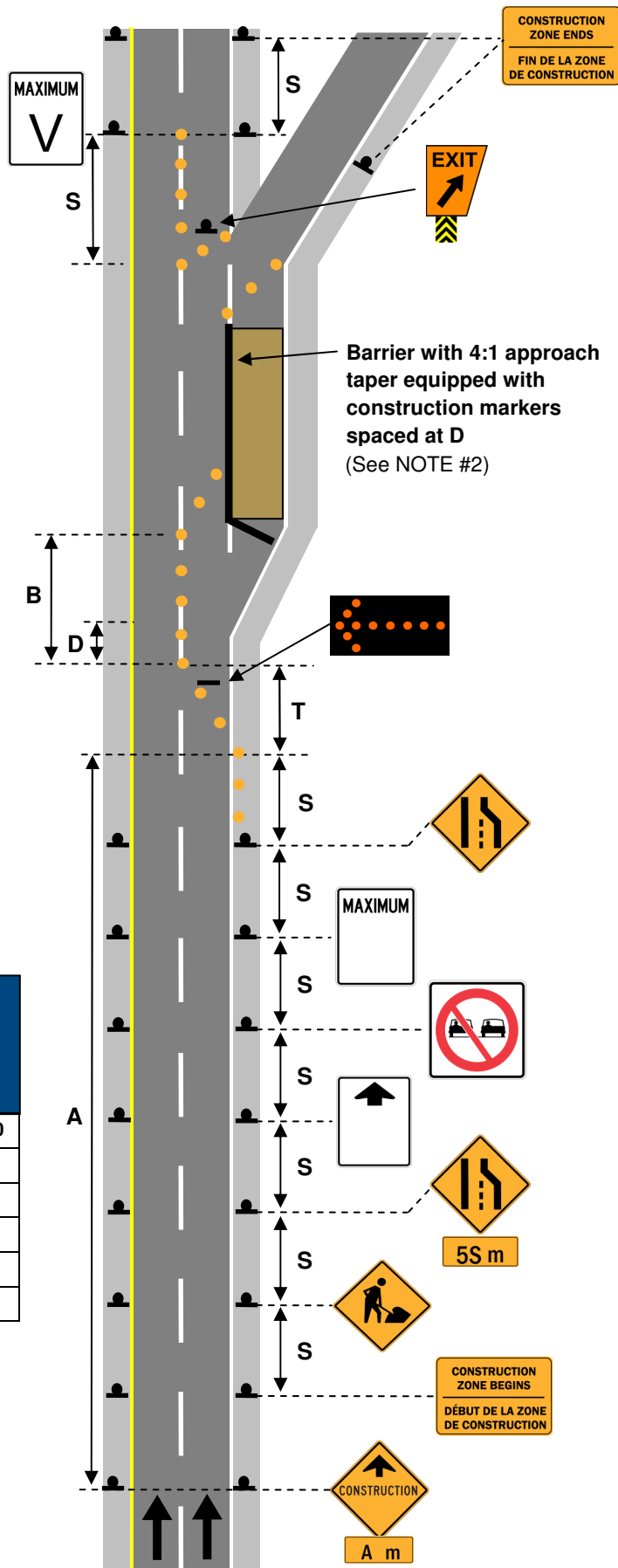
**Bridge (Single Lane Closure)  
Short / Long Duration  
(greater than 30 min)  
All Volumes**

V	50	60-70	80-90	100-110
A	500	1000	1000	1500
S	50	75	100	150
T	30	64	110	180
D	6 / 8	8 / 10	10 / 14	18 / 24
B	35	50	70	75

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- T – Taper Length (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)
- B – Buffer Area Length (m)

**NOTES:**

1. Speeds shall not be reduced more than 20 km/h below the original speed limit unless approved by the Department of Transportation's Maintenance & Traffic Branch.
2. Continuous barrier may be replaced by flexible drums or delineator posts if anticipated work duration is 3 days or less.



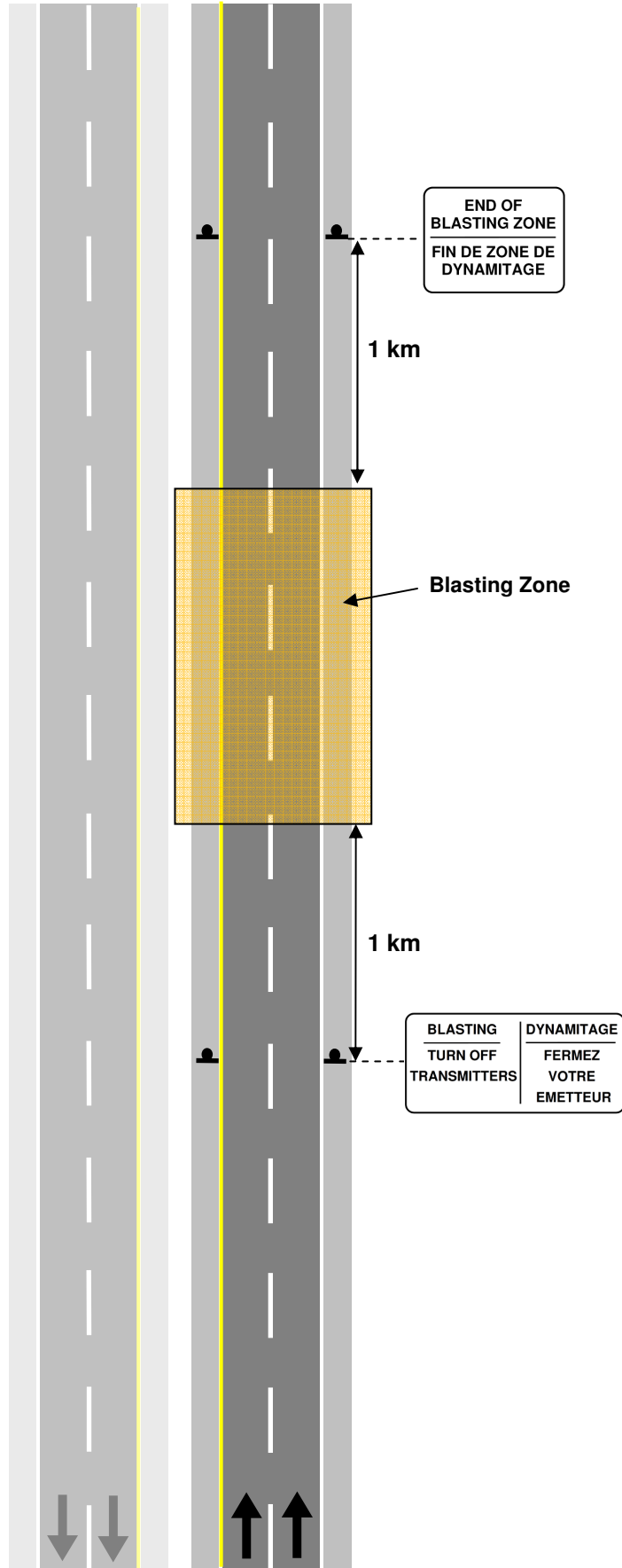
Deceleration Lane Closure Short / Long Duration (greater than 30 min) All Volumes				
V	50	60-70	80-90	100-110
A	500	1000	1000	1500
S	50	75	100	150
T	30	64	110	180
D	6 / 8	8 / 10	10 / 14	18 / 24
B	35	50	70	75

- V – Existing Speed Limit (km/h)
- A – Advance Warning Distance (m)
- S – Minimum Sign Spacing (m)
- T – Taper Length (m)
- D – Maximum Delineator Spacing in Taper/Tangent (m)
- B – Buffer Area Length (m)

**NOTES:**

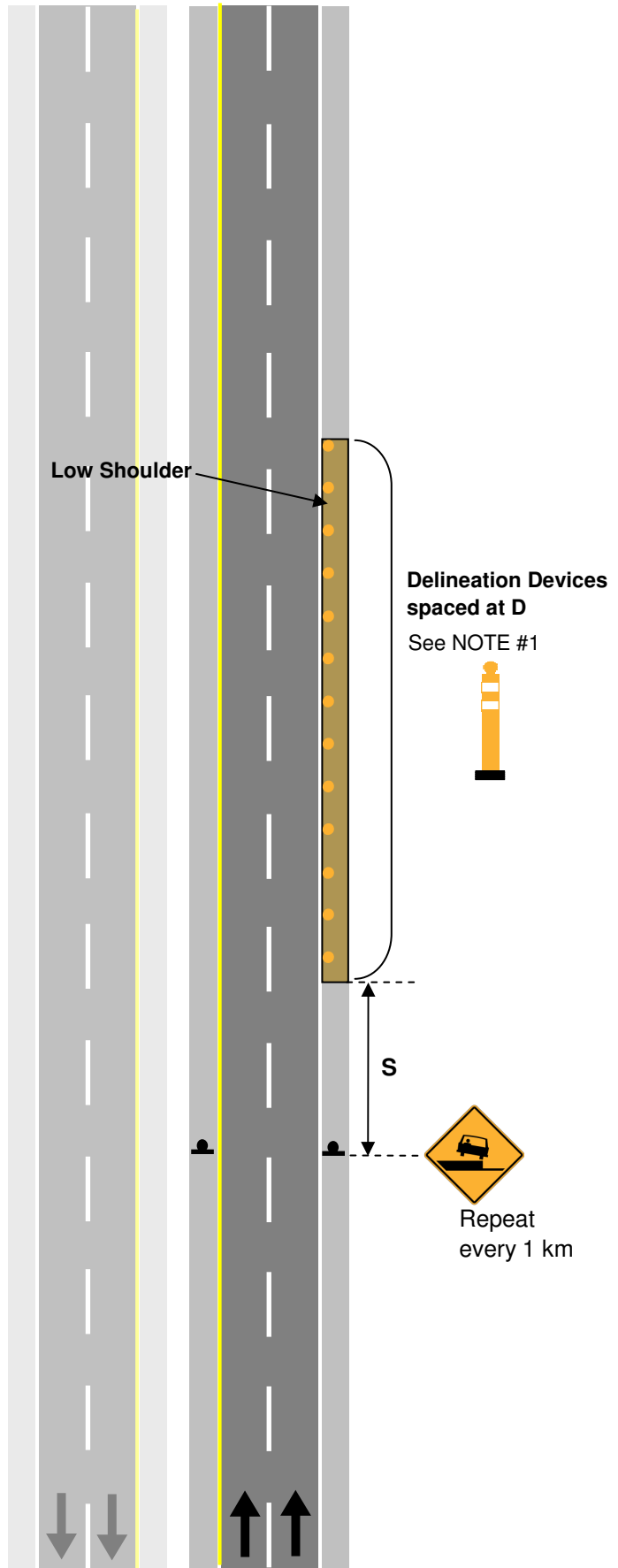
1. Sign opposite direction in the same manner.

**Blasting Area  
Any Duration  
All Volumes**



**NOTES:**

1. Delineation Devices only required where the difference in elevation between the travelled lane and the shoulder is greater than 75 mm.



Low Shoulder Any Duration All Volumes				
V	50	60-70	80-90	100-110
S	50	75	100	150
D	8	10	14	24

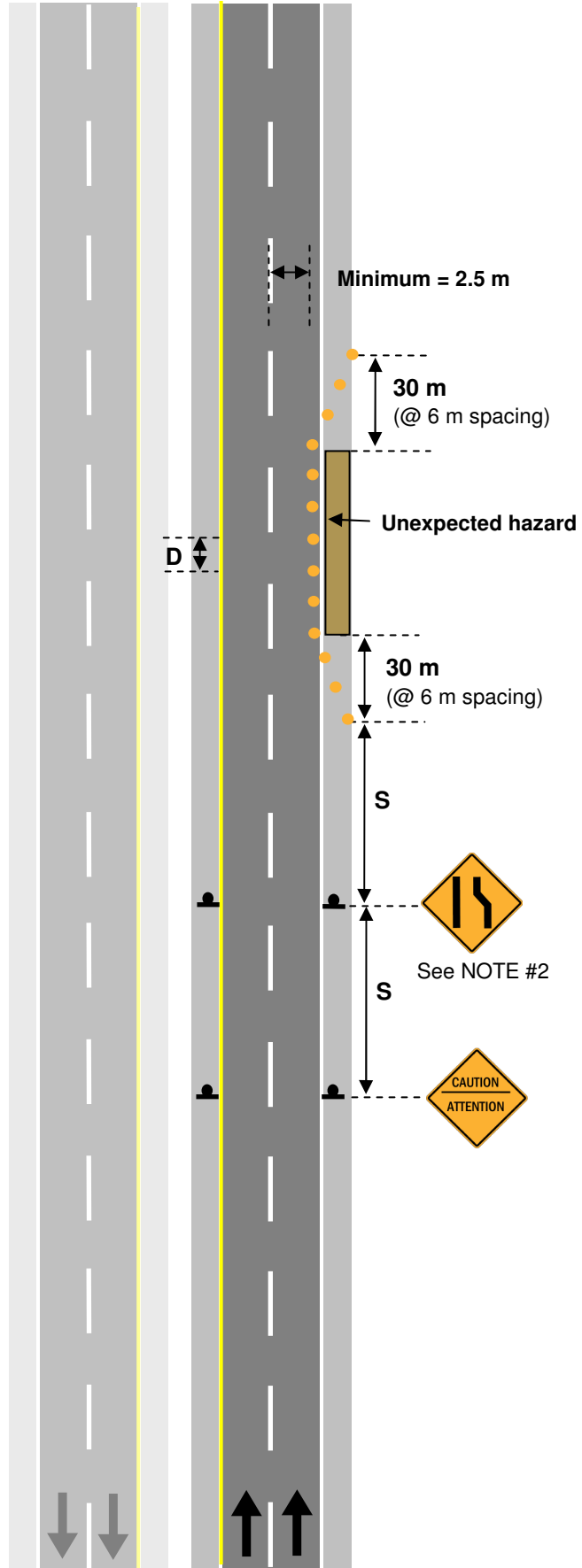
V – Existing Speed Limit (km/h)

S – Minimum Sign Spacing (m)

D – Maximum Delineator Spacing (m)

**NOTES:**

1. This layout shall only be used to delineate the hazard until it can be fixed, at which time an appropriate layout such as Figure 8-3, 8-4, or 8-5 must be used.
2. Use Left Road Narrows sign if hazard is on the left shoulder.



Other Hazards Any Duration All Volumes				
V	50	60-70	80-90	100-110
S	50	75	100	150
D	6 / 8	8 / 10	10 / 14	18 / 24

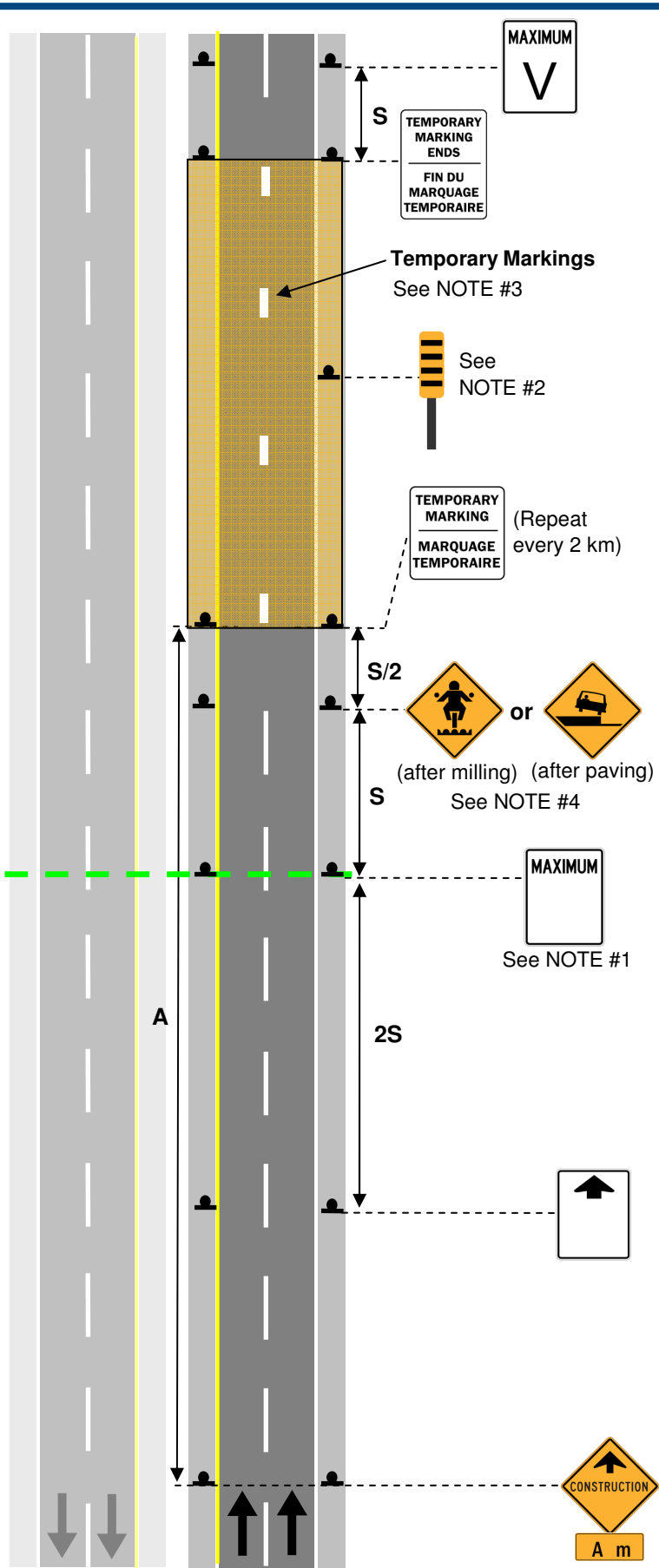
V – Existing Speed Limit (km/h)

S – Minimum Sign Spacing (m)

D – Maximum Delineator Spacing in Taper/Tangent (m)

**NOTES:**

1. Speeds shall be reduced to a maximum of 80 km/h on all milled surfaces with normal speed limits of 90 km/h or greater.
2. Delineation Devices only required where the difference in elevation between the travelled lane and the shoulder is greater than 75 mm.
3. Pavement marking tape (or paint) shall be applied in 2 m strips and spaced at 50 m on tangents and 25 m or curves. Raised pavement markers shall be installed in groupings of three within a 2 m length and be spaced the same as pavement marking tape.
4. Repeat appropriate sign every 1 km of milled or paved surface.
5. If milling involves full depth removal, then Grooved Pavement sign shall be replaced by Pavement Ends sign.
6. Bump signs shall be used any time there is a differential in surface thickness on the main lanes.

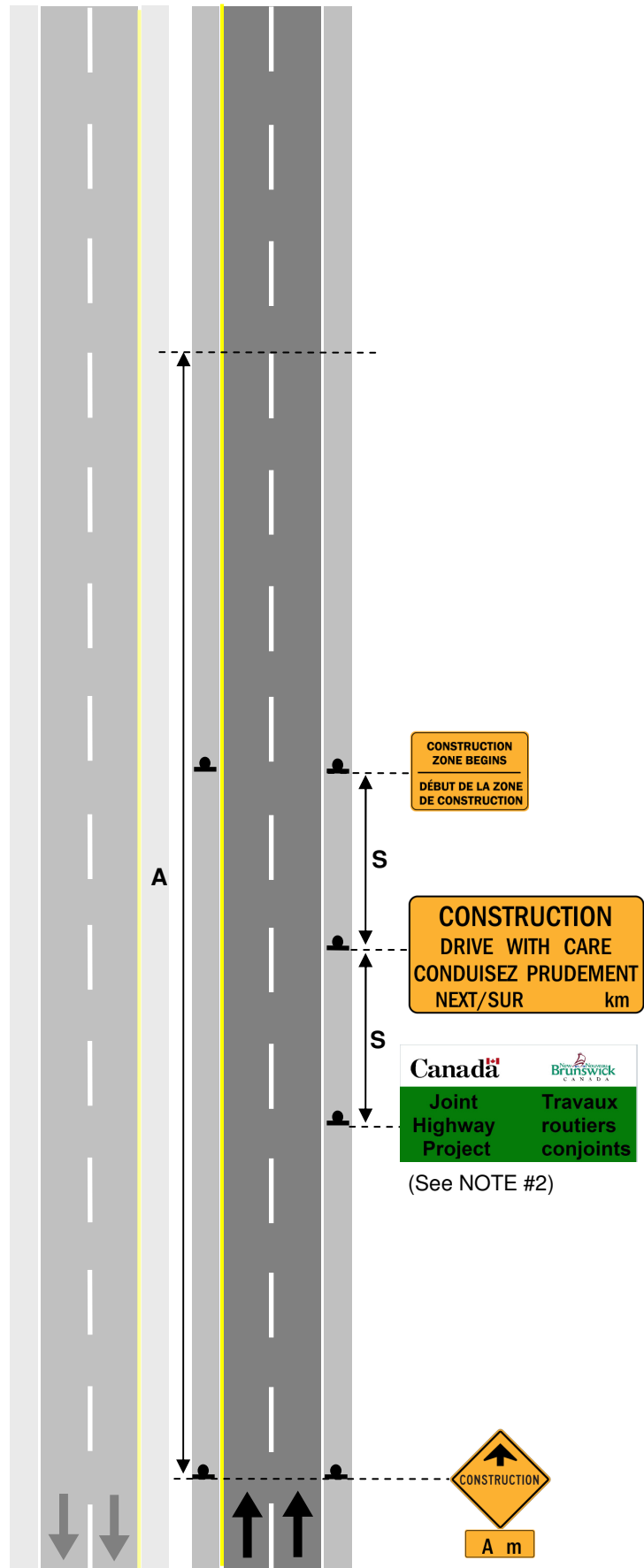


After Milling or Paving Any Duration All Volumes				
V	50	60-70	80-90	100-110
A	300	500	1000	1000
S	50	75	100	150

V – Existing Speed Limit (km/h)  
 A – Advance Warning Distance (m)  
 S – Minimum Sign Spacing (m)

**NOTES:**

1. Do not repeat Construction Ahead or Construction Zone Begins.
2. Only use sign when applicable.
3. When merging Figure 8-21 with other typical layouts, the distance A shall be referenced to the same location as in the accompanying layout.
4. Used for Jobs over 3.0 km.



Advance Signing (Major Project) Long Duration All Volumes				
V	50	60-70	80-90	100
A	500	1000	1500	2000
S	50	75	100	150

V – Existing Speed Limit (km/h)  
 A – Advance Warning Distance (m)  
 S – Minimum Sign Spacing (m)