

4.10 TRAFFIC CONTROLLERS

4.10.1 Application

Situations requiring control of traffic by traffic controllers are listed in Table 4.8.

TABLE 4.8 USE OF TRAFFIC CONTROLLERS

Situation	Purpose of control
Bituminous surfacing under traffic	To slow down, stop or direct traffic, as appropriate
Single-lane operation	To restrict traffic flow to a single direction at any time and to alternate the direction of flow as necessary
Low-speed operation	To warn and slow down traffic at locations where a temporary speed limit would be required but has not been installed
Temporary total closures, e.g. blasting works	To stop traffic to inform drivers of the likely delay, and to hold traffic until it is safe to proceed
Plant crossings	To stop traffic as needed to avoid conflict with plant crossing or entering the roadway at an established plant crossing point
Limited sight distance within work site	To slow down and warn motorists of a hidden or partially hidden hazard ahead
Emergency situations	To stop and direct traffic as necessary

4.10.2 Equipment

Traffic controllers shall wear high visibility clothing as specified in Clause 3.16.4.

A STOP/SLOW hand bat (R6-8/T7-1) (see Clause 3.5.2) shall be used, except when a boom barrier is used. For night-time operations, an illuminated wand should be used in conjunction with the bat. If a boom barrier is used, the STOP sign, R6-8, may be mounted on the boom.

A temporary hazard marker (T5-5) (see Clause 3.9.3), a temporary barrier or a boom barrier may be used to assist the traffic controller.

Portable two-way radios or similar means shall be used for communication between traffic controllers (except in the vicinity of blasting works) if they are unable to communicate by sight.

4.10.3 Sight distance

Traffic controllers shall not be located in positions where the sight distance is less than 2D (where the value of D is the greater of the dimensions shown in Table 4.2) metres between the controller and oncoming traffic.

4.10.4 Control of approach speed

Approach speeds to locations where traffic controllers are operating shall be controlled to 60 km/h or less by means of appropriate advance signs and devices including a temporary speed zone.

4.10.5 Period of duty

Traffic controllers shall be relieved from their duty after not more than 2 hours for a period of rest or other duties of at least 15 min.

4.10.6 Traffic controller competency

Traffic controllers shall be appointed and operate in accordance with the "Traffic Controller Accreditation Scheme (Approved Procedure)".

4.11 PORTABLE TRAFFIC SIGNALS

4.11.1 General

Portable signals (see Clause 3.5.4(a)) are intended only for traffic control applications of a relatively short duration. For sites where work will continue for a longer period without the location of the work area changing, consideration should be given to the installation of temporary, rather than portable, traffic signals (see Clause 3.5.4(b)).

Portable traffic signals are intended to be applied primarily to shuttle control, i.e. where a portion of the roadway is closed so that a single lane has to be used alternately by traffic from opposite directions. Traffic capacities for single lane sections of various lengths under shuttle control are given in Clause 4.13.1.

Signals may also be adapted for machinery crossing application.

Typical use of portable traffic signals is shown in Figure 4.10.

4.11.2 Operation

The following gives guidelines for the three modes of operation of portable traffic signals:

(a) *Vehicle-actuated operation*

Vehicle-actuated operation allows the signals to operate automatically in response to vehicle demands.

Vehicle-actuated operation is the preferred mode and should be used wherever possible under the following conditions:

- (i) Traffic flow is not hindered by operations at the work area.
- (ii) Traffic control is required to operate after working hours.

(b) *Fixed-time operation*

Fixed-time operation does not respond to vehicle demand. Cycle times are a fixed length. Fixed-time operation is applicable to the following conditions:

- (i) Vehicle-actuated control is not possible.
- (ii) The flow of traffic on all approaches is relatively constant and is not hindered by operations at the work area.
- (iii) Traffic control is required to operate after working hours.

Failure of vehicle detectors in a vehicle-actuated system will usually cause the system to default to fixed-time operation.

(c) *Manual operation*

Manual operation allows operation of the signals by a traffic controller and is applicable to the following conditions:

- (i) Flow of traffic on each approach is variable and may be hindered from time to time by operations in the work area.
- (ii) A detector fails during the use of the vehicle-actuated mode and the fixed-time mode is not appropriate.
- (iii) Traffic must be kept out of the work area for an extended period, e.g. during blasting, priming or full width sealing.

4.11.3 Approach conditions and speed

Sight distance on the approach to traffic signals shall be a minimum of 150 m to the primary signal face. A roadworks speed limit no higher than 60 km/h shall be imposed if the signals would otherwise be in a higher speed limit zone.

4.11.4 Performance monitoring

Irrespective of the form of operation, signals shall be monitored to ensure that they are operating safely and effectively and do not cause unnecessary delays to traffic.

4.12 PILOT VEHICLE

A pilot vehicle may be used to guide traffic through a work site. This form of assistance to traffic management may be required where -

- (a) part of the length of the work site is out of view of the supervisor, work gang and the traffic controller;
- (b) the hazard to workers described in Clause 4.2(e) requires the traffic speed to be reduced to less than 40 km/h;
- (c) the traffic speed is required to be kept low to minimise damage to the works; or
- (d) traffic needs to follow a particular path through the site which may not be obvious unless a pilot vehicle is used.

Minimum identification of a pilot vehicle shall be a vehicle mounted warning device (see Clause 3.12.1). Traffic should be instructed, either verbally or by means of a special sign, to follow and not to pass the pilot vehicle.

4.13 MAINTAINING TRAFFIC FLOW

4.13.1 Length of single-lane operation under reversible flow

On two-way roads, two-way flow should be maintained wherever possible. This may necessitate the construction of a side track or detour. However, where this is not possible traffic may be restricted to one lane over short lengths, preferably not longer than indicated in Table 4.9, for short periods of time.

In general, where traffic flows are within the recommended limits shown in Table 4.9, single-lane operation requires active control by traffic controllers or by portable or temporary fixed traffic signals. The selection of the appropriate method of control requires consideration of -

- (a) traffic volumes;
- (b) duration of work;
- (c) site conditions and layout; and
- (d) personnel available

TABLE 4.9 DESIRABLE MAXIMUM LENGTH OF SINGLE-LANE OPERATION UNDER REVERSIBLE FLOW

Traffic volume (both directions) Vehicles per hour m	Length of single lane section
800	70
700	100
600	150
500	250
300	600
< 300 (length)	800

NOTE: This length is to be taken as the distance between the traffic controller or traffic signal positions for each traffic direction.

Where drivers have a clear view of the work area and the opposing approach for a distance greater than 150 m in a 60 km/h or lower speed zone; or greater than 250 m elsewhere, beyond the work area, controls may be modified as follows:

- (i) For traffic volumes 40 vph or less and posted speed limit during roadworks of 70 km/h or less, where the length of a single lane does not exceed 60 m - traffic control may not be required (see also Clause 4.13.5).
- (ii) Where the length of a single lane is less than 100 m and other requirements of Clause 3.5.3(a) are met - control may be exercised by the use of a GIVE WAY and ONE LANE sign assembly. This is not recommended where the posted speed limit during roadworks exceeds 80 km/h. Active single lane control is preferred.

4.13.2 Number of lanes for each direction of flow

On multilane roadways in peak periods, the normal number of traffic lanes in the direction of major flow should be available. Table 4.10 gives guidance on the number of lanes required at short term works and long term works of up to 7 days duration. For longer term works, precise calculation of capacity may be necessary to ensure that traffic demand can be met.

TABLE 4.10 DESIRABLE NUMBER OF LANES FOR EACH DIRECTION

Mid-block Vehicles per hour, one direction	Within 200 m of an intersection (upstream or downstream) Vehicles per hour, one direction	Desirable number of lanes for direction considered
Up to 1000	Up to 500*	1
1100 to 2000	600 to 1000	2
2100 to 3000	1100 to 1500	3
3100 to 4000	1600 to 2000	4

* Right turns out of the single lane may need to be prohibited depending on the proportion of heavy vehicles and the volume of opposing traffic.

NOTE: Volumes shown in the Table may need to be reduced by the amount shown if the following apply:

- (a) Pavement surface is rough or unsealed - reduce traffic volume by 30%.
- (b) Horizontal geometry through the restriction is reduced to a speed value of less than 40 km/h - reduce volume by 50%.
- (c) Volume of heavy vehicles exceeds 10 percent -
 - (i) downward, level or easy upgrade - reduce traffic volume by 20%; and
 - (ii) sustained upgrades >5% - reduce traffic volume by 40%.

Where the requirements of Table 4.10 cannot be complied with, parking bans or lane reversal or both may be necessary. If in extreme circumstances one direction of travel must be detoured, safety arrangements should be planned in advance so that conditions can be improved on the detour route prior to opening. In congested built-up areas many works, especially mobile and maintenance works, are necessarily confined to nights and weekends.

Right turns may need to be banned at appropriate locations in the work site to maintain traffic flow. Allowance might also be required for the effects on traffic flow of rough or unsealed surfaces, or altered geometry which markedly reduces speed.

Lane reversal requires special consideration of, and provision for pedestrians where the traffic flow is opposite to normal expectations, especially where traffic is diverted to the opposite side of a median. This should be avoided if at all possible, but failing that, every effort should be made to redirect pedestrian movements to locations beyond the work area or at least to marked crossings at signalised intersections (see Clause 4.14.8).

4.13.3 Lane widths

The minimum lane width to be provided through or past a work site shall be as per Table 4.11, with the following exceptions:

- (a) Curve widening of 0.5 m per lane shall be applied to curves of radius between 100 m and 250 m.
- (b) Curve widening on curves of less than 100 m radius shall, in addition to Item (a), take into account the swept path of long vehicles.
- (c) Where lanes on the approach to the work site are less than 3.0 m in width, the approach lane width may be adopted. This shall not however, apply to curves of radius 250 m or less, nor to locations where there are fixed vertical obstructions such as fences or safety barriers within 300 mm of the edge of the lane on one or both sides.
- (d) Two-way roadway width on residential streets may be reduced to 5.5 m, see Clause 4.13.5(a).

TABLE 4.11 MINIMUM LANE WIDTHS

Posted speed limit during roadworks, km/h	Minimum lane width, m
60 or less	3.0
61 to 90	3.2
greater than 90	3.4

4.13.4 Edge clearances

Clearance between edge of traffic lane and delineating devices or road safety barrier system shall be as below. This clearance shall be measured to the traffic-side edge of delineating devices or barrier. This edge shall also be the line from which clearances to the work area are measured for the purpose of determining treatments in Clause 4.2.

- (a) Edge of traffic lane to line of traffic cones, bollards or longitudinal channelising barricades -
 - (i) posted speed limit during roadworks up to 60 km/h - 0.5 m; and
 - (ii) posted speed limit during roadworks above 60 km/h - 1.0 m.
- (b) Edge of traffic lane to roadworks delineators or temporary hazard markers - 1.0 m.
- (c) Edge of traffic lane to road safety barrier system -
 - (i) posted speed limit during roadworks 40 km/h or less - 0.3 m;
 - (ii) posted speed limit during roadworks 41 to 80 km/h - 0.5 m; and
 - (iii) posted speed limit during roadworks greater than 80 km/h - 1.0 m.

In the absence of marked lines on the pavement these clearances shall be added to the nominal lane widths provided according to Clause 4.13.3.

If the edge of the traffic lane is kerbed, delineation devices shall be placed 0.3 to 0.5 m clear behind the face of kerb.

NOTE: Road safety barriers should not be placed behind kerbs on high speed roads (above 70 km/h).

Containment fences marking the limit of work area shall be placed as specified in Clause 4.2.

Clearances adjacent to excavations are given in Appendix E.

4.13.5 Work in residential streets

Where work is in residential streets, the following should be observed:

- (a) If the remaining clear roadway width is 5.5 m or more, two-way operation should be maintained. If 5.5 m cannot be maintained, the width should be reduced to a maximum of 3.5 m to ensure vehicles operate in single file under shuttle working conditions. The need to accommodate the swept path of large vehicles negotiating a work site should also be considered.
- (b) The normal method of traffic operation for shuttle working will be a natural 'give and take', provided that there is clear visibility past the work area and beyond it for at least 75 m or to the end of the roadway if less than 75 m away and the length of shuttle lane does not exceed 60 m.
If these conditions cannot be maintained active traffic control will be required i.e. traffic controllers, or temporary or portable traffic signals.
- (c) The length of the approach taper should be approximately 15 m where two-way operation is maintained. Where shuttle working under natural give and take is in operation, the taper should be at 45 degrees on both the approach and departure sides of the works.
- (d) The need for advance warning should be determined in accordance with Clause 4.7.1.

4.14 DETOURS, SIDE-TRACKS AND CROSSOVERS

4.14.1 General

In situations where it becomes impracticable to accommodate traffic within the existing roadway, one of the following forms of traffic detour should be considered:

(a) *Side-tracks*

A temporary roadway may be constructed beside or near the existing roadway, usually within the same road reserve. It may cater for one or both directions of travel.

(b) *Detours via existing roads*

Traffic in one or both directions may be detoured via existing roads suitably located to carry traffic around the work area.

(c) *Crossovers*

Part of a divided road is converted to a two-way roadway by closing one roadway and constructing temporary crossovers to transfer traffic in that direction to the other roadway.

(d) *Detours for heavy or over-dimensional vehicles*

See Clause 4.14.10.

Where used, the above forms of detour shall be provided in accordance with the requirements and recommendations in the clauses below. Typical signing arrangements are illustrated in Figures 4.13, 4.14 and 4.15.

4.14.2 Surface condition

Pavement and pavement surface condition shall be appropriate to and adequate for the type and volume of traffic using the facility and its location. The following requirements shall be observed:

- (a) Temporary pavements shall have sufficient structural strength to carry the anticipated heavy vehicle traffic.
- (b) Pavements on detours via existing roads shall be checked to ensure that they are structurally adequate to carry the increased volumes and loads.
- (c) Pavements on detours and side-tracks shall be monitored to ensure that any indications of impending pavement failure are dealt with promptly.

4.14.3 Alignment, width and capacity

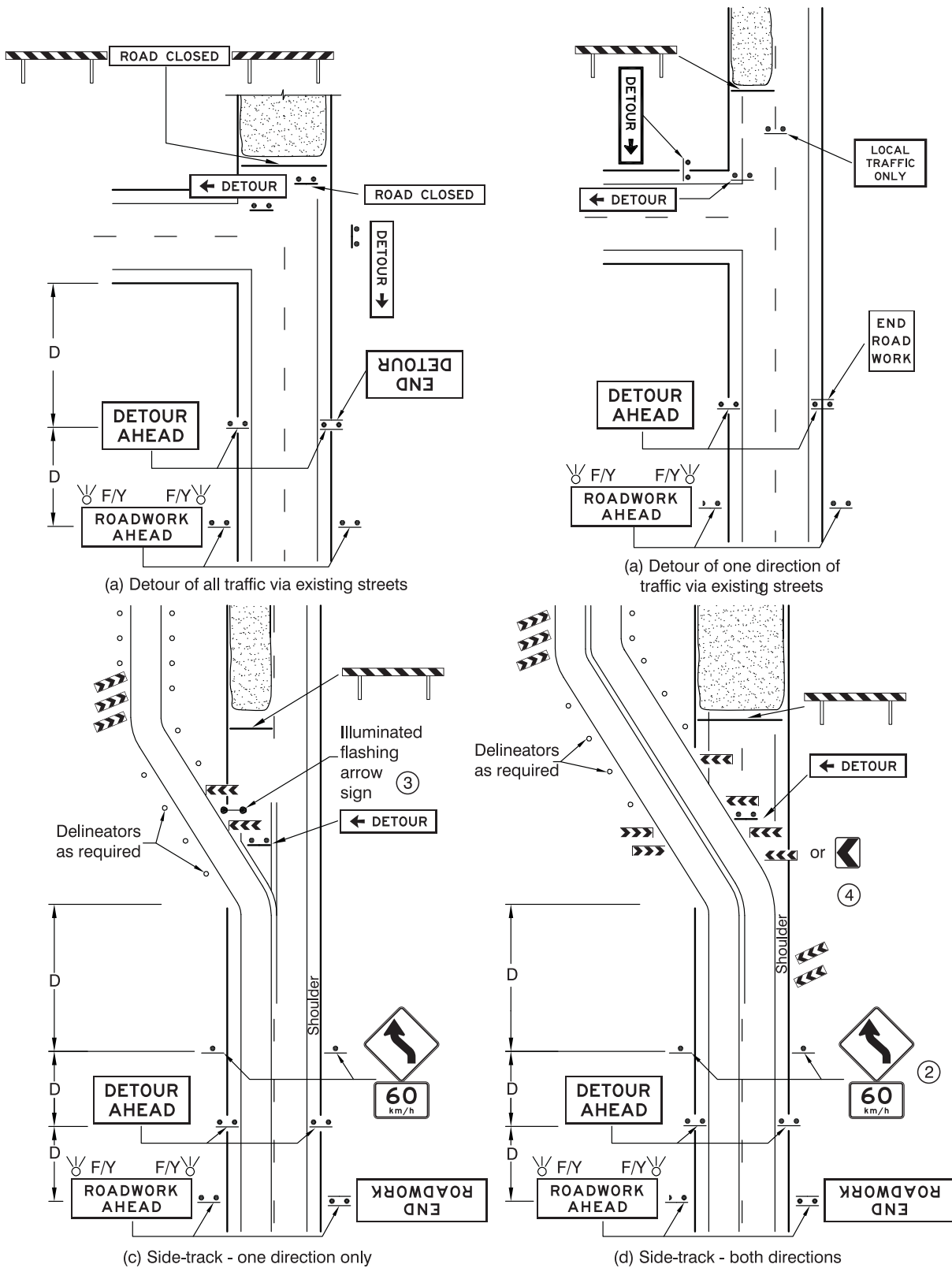
For detours which will be in use for periods in excess of 14 days, the lane width and design speed should match, as nearly as practicable, those of the approach road.

Every attempt should be made to maintain capacity on roads which normally run close to their capacity, particularly during peak hours in built-up areas. In addition to maintaining the required number of lanes in accordance with Clause 4.13.2, note should be taken of the effect on capacity of -

- (a) traffic lanes less than 3.0 m in width; and
- (b) unsealed or rough surfaces.

Either condition could lead to lane capacity being reduced by as much as 50 percent.

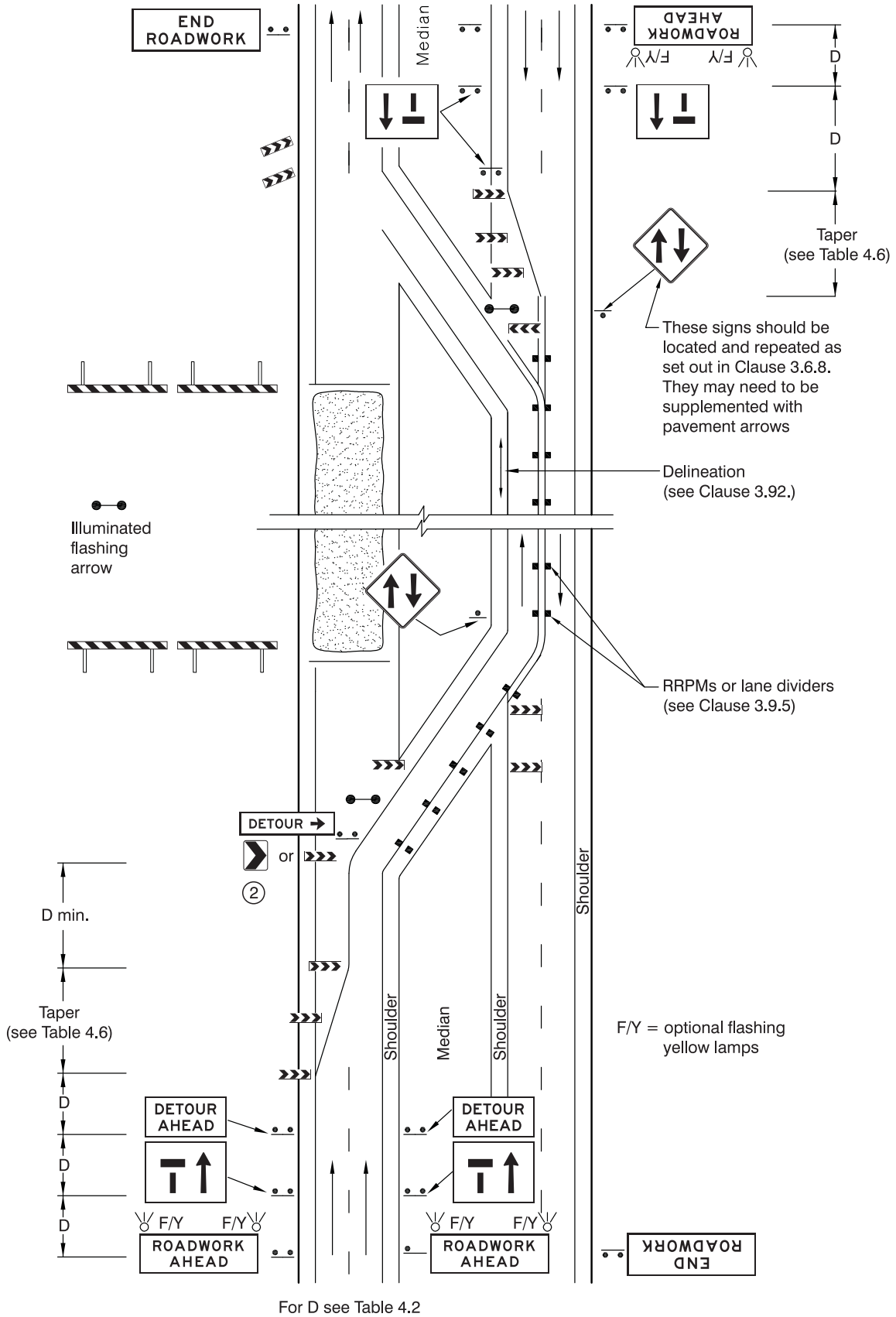
Works may need to be scheduled so that peak hour capacities are maintained.



NOTES:

- 1 Roadworks speed zoning is not shown but may be required, see Clause 4.9.3.
- 2 Advisory Speed signs should not be used if the side track is unsealed.
- 3 Optional use of illuminated flashing arrow sign, Clause 3.12.2, where the visual background of the work area is such that extra delineation of the diverge is required.
- 4 For semi-permanent side-tracks at major works, permanently mounted Chevron Alignment markers, D4-6, (see Part 2 of the Manual) should be used instead of temporary hazard markers.

FIGURE 4.13 APPROACHES TO DETOURS AND SIDE-TRACKS



NOTES:

- 1 A temporary speed zone for traffic safety purposes may be required (see Clause 4.9.3).
- 2 For semi-permanent side-tracks at major works, permanently mounted Chevron Alignment markers, D4-6, (see Part 2 of the Manual) should be used instead of temporary hazard markers.

FIGURE 4.14 APPROACHES TO A CROSSOVER

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4.14.4 Provision for pedestrians, bicycles, wheelchairs and public transport

Where there is a demand for use of the detour by pedestrians, cyclists or wheelchairs, facilities such as footpaths, cycle tracks and sealed shoulders as appropriate to the demand and the safety requirements should be provided. Use of the signs and devices specified in Clause 3.14 may be necessary to guide pedestrians and to ensure their safety.

Where public transport stops need to be temporarily relocated on a detour, provision shall be made for safe pedestrian access to the stop. Provision should also be made for the public transport vehicle to stop clear of moving traffic.

4.14.5 Access for local traffic

Provision shall be made for local traffic to bypass barriers to gain access to properties within the closed-off section of road. Gaps should be left in barriers in locations which will not encourage through traffic to use them either by mistake or intentionally, e.g. locating the gap to the far side of the roadway and making it as small as practicable. The sign LOCAL TRAFFIC ONLY (G9-40-2) should be placed beside the gap.

4.14.6 Delineation

The following are requirements and recommendations for delineation at side-tracks and detours:

- (a) A side-track having the same standard of alignment, width and pavement surface as the approach route, shall be delineated as for a permanent roadway in accordance with Part 2 of the Manual.

NOTE: Such a side-track represents the ideal and should be sought after for long-term sidetracks. It will rarely require roadworks signing.

- (b) Side-tracks where any of the factors in Item (a) are below the standard of the approach road, shall have the following delineation:

- (i) Delineators, red on the left side and white on the right, at the following spacing:

(A) Straights and curves greater than 200 m radius - 20 m spacing, in pairs.

(B) Curves up to 200 m radius - 6 m on outside of curve, 12 m on inside.

(C) On roads with volumes of 1500 vpd or less, spacings increased up to the following:

(1) Long flat straights - up to 100 m.

(2) Short and undulating straights - up to 50 m.

(3) Curves greater than 200 m radius - up to 25 m.

- (ii) On sealed pavements the following linemarking:

(A) Dividing line, marking in accordance with Part 2 of the Manual, including barrier line where warranted.

(B) Edge lines at traffic volumes greater than 1500 vpd.

- (iii) Temporary hazard markers at the beginning of the side-track if either it begins with a small radius curve, or it could appear in some visibility conditions that the road does not diverge.

- (c) At detours using existing roads or streets, upgrading of linemarking to that consistent with the volume using the detour should be undertaken whenever the detour is likely to be in use for more than three days.

- (d) At crossovers, the temporary diversion through the median shall be delineated with traffic cones or bollards at 2 m spacing.

The temporary dividing line on the single open roadway shall be treated with extra delineation as appropriate. Depending on traffic volumes and speeds the following additional delineation should be considered:

- (i) Conversion of the dividing line to double unbroken.
- (ii) Reducing spacing of RRPMS to one half or one quarter of normal spacing.
- (iii) Use of lane dividers (see Clause 3.9.5).

4.14.7 Continuity of signing at a detour

Where a detour via existing roads is provided, signing of the detour at all changes of direction and at other locations where reassurance is needed shall be applied consistently throughout for each direction of travel. Signing arrangements should be checked to ensure that all detour signs are prominently displayed.

4.14.8 Reversed traffic direction

Where, at a detour or crossover, traffic is required to travel temporarily in the wrong direction, the following safety measures should be considered:

(a) *Intersections*

Intersections should be checked and temporarily modified as necessary to ensure that crossing and turning movements can be made safely. Any movements needing to be temporarily banned should be adequately catered for elsewhere.

(b) *Roadside hazards*

Potential hazards resulting from the reversal of direction such as fixed roadside objects protected in one direction only, and safety barrier and bridge parapet trailing ends which will become leading ends, should be risk assessed and remedial action taken accordingly.

(c) *Pedestrian management*

Where it is necessary to cater for pedestrians crossing a temporary two-way roadway at zebra crossings, uncontrolled mid-block crossing points or at intersections where there is traffic turning through a pedestrian crossing point, the following steps should be considered:

- (i) Control of the point at which pedestrians cross by means of containment fences, and if appropriate, pedestrian mazes.
- (ii) People to patrol the site to assist pedestrians crossing the road.
- (iii) Use of signs LOOK BOTH WAYS, TWO-WAY TRAFFIC (T8-5) (see Clause 3.14.5) to face pedestrians about to cross the road, as shown in Figure 4.15.

(d) *Entering traffic*

Use of signs LOOK BOTH WAYS, TWO-WAY TRAFFIC (T8-5) should also be considered at side road approaches to a temporary two-way roadway as shown in Figure 4.15 to warn entering traffic.

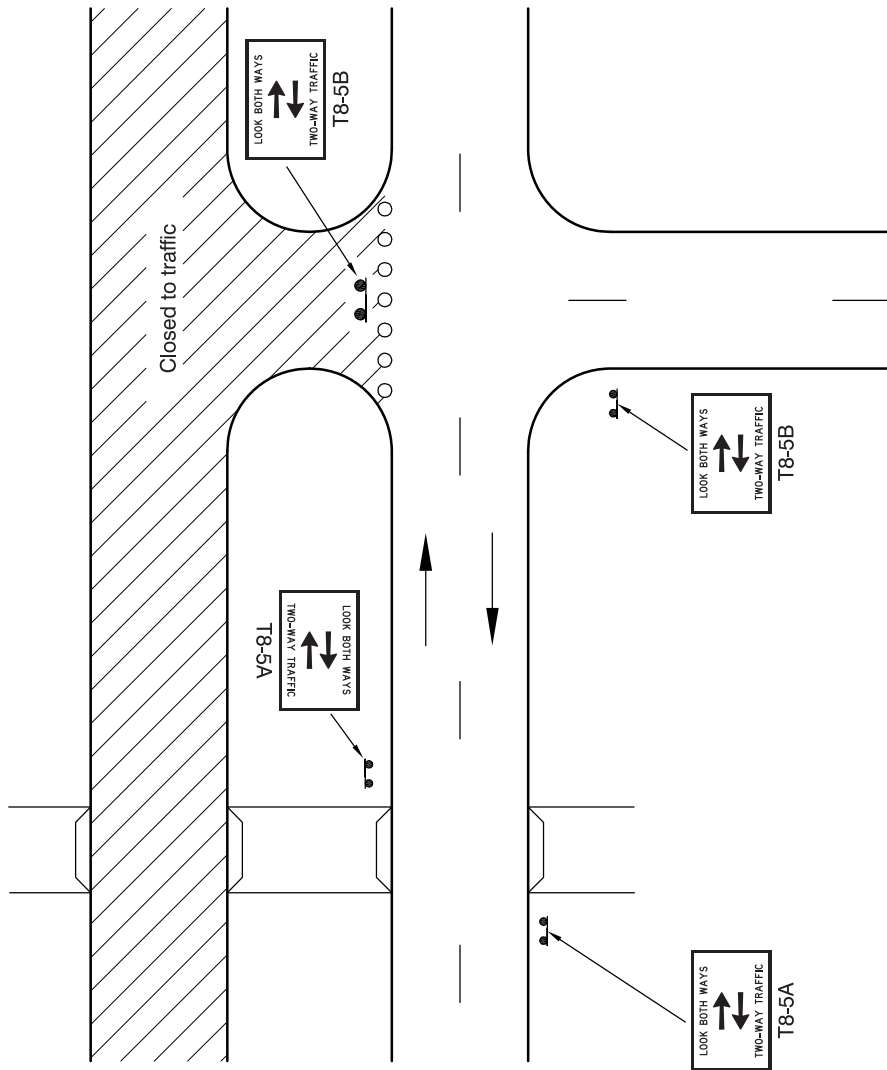


FIGURE 4.15 'LOOK BOTH WAYS' SIGNS

4.14.9 Freeway exit closures

Where a freeway exit is to be closed advice shall be provided -

- (a) in advance of the previous exit if traffic is to be detoured by that exit; or
- (b) in advance of the closed exit if traffic is to be detoured by the succeeding exit.

Advice shall take the form of black on yellow temporary signs mounted in conjunction with each advance and position sign for the relevant exit in Item (a) or (b) above, indicating the exit which is closed and which alternative exit should be taken. The legend should as far as practicable be equal in legibility to the legends on the associated permanent direction signs.

All necessary direction signs and detour signs shall be provided on the adjacent street system for diverted traffic.

4.14.10 Detours for high and heavy vehicles

Detours for high or heavy vehicles will usually be required -

- (a) if works on road or other factors have temporarily reduced the height clearance or load carrying capacity of the original road; or
- (b) if the route is a designated overdimensional load route on which overdimensional clearances have been temporarily reduced.

Signposting of a typical high vehicle detour is illustrated in Figure 4.16.

NOTE: A second physical over-height barrier may be required in the case shown in Figure 4.16, if the risk of collision is high or the consequences especially severe, or both.

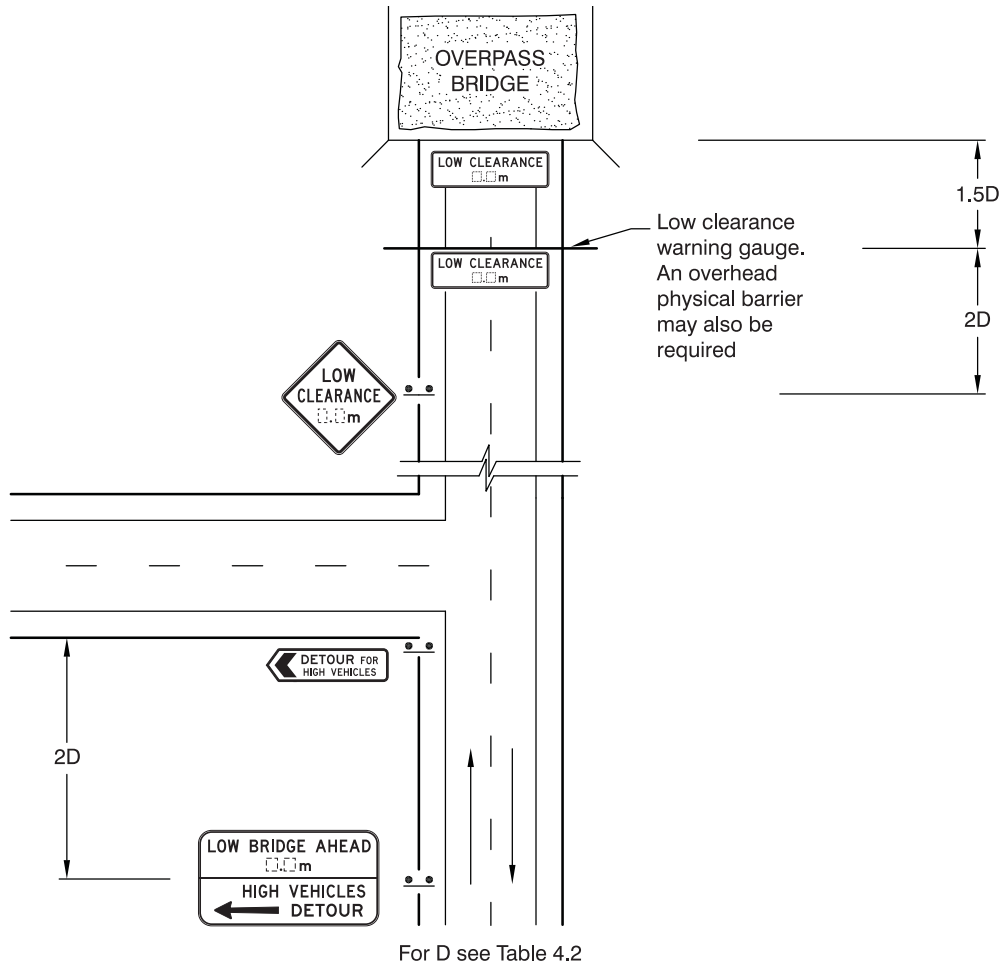


FIGURE 4.16 DETOUR FOR HIGH VEHICLES

4.15 EXCAVATION WORKS

Requirements for traffic protection or delineation at longitudinal excavations adjacent to traffic lanes are given in Appendix E.

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SECTION 5. ARRANGEMENT DIAGRAMS FOR TRAFFIC GUIDANCE SCHEMES

5.1 SCOPE

This Section provides diagrams of traffic guidance schemes which illustrate the application of traffic control devices to various work site situations and circumstances. The diagrams, which indicate the appropriate positions of the signs and devices required to guide traffic safely around, through or past the work site, should cover most road work situations. Each diagram is accompanied by notes.

5.2 APPLICATION

The traffic guidance schemes illustrated include examples of applications to short-term and long-term works, and to all types of roads, e.g. multilane roadway and two-way.

Work site situations which are not specifically covered by the diagrams should be signed by adapting the most appropriate diagram according to the principles outlined in this Manual.

No one standard arrangement of signs and devices can operate for every work site, or for different operations at a particular site. It may be necessary to vary warning signs and devices at a work site, not only from day to day, or from day to night operation, but also from hour to hour (see Clause 2.6.2).

Whenever it is necessary to undertake roadworks within an intersection, warning signs must be erected on each of the approaches on which traffic is affected by the works (see Diagrams 8, 9, 10, 42, 43 and Appendix F). It is also important to consider the needs of pedestrians (see Clause 3.14).

5.3 DIAGRAM SELECTION

The Table 5.1 is the primary reference used to select the diagram appropriate to the prevailing or expected work site conditions.

In some cases Table 5.1 refers directly to an appropriate diagram which shows the traffic control devices and their arrangement. In other cases, reference is made to Tables 5.2 to 5.5 which provide a further selection guide to determine the appropriate diagram.















The situation diagrams illustrate the traffic arrangements for various roadwork applications. For bridgework, the ROADWORK AHEAD (T1-1) sign should be replaced with the BRIDGEWORK AHEAD (T1-2) sign.

The diagrams selected using this procedure should satisfy the requirements of safety and public convenience if consideration is given to the following factors:

- (a) Duration of work.
- (b) Type of work site.
- (c) Width restricted.
- (d) Lane configuration.
- (e) Actual width available for traffic.
- (f) Time of restriction.
- (g) Traffic diversion options.
- (h) Availability of personnel.
- (j) Traffic volumes.

5.4 DIAGRAM SYMBOLS

Symbols used in Diagrams 1 to 37 are as follows:

	ANTIGLARE SCREEN		TRAFFIC CONES
	BARRIER		TRAFFIC CONTROLLER
	DELINEATORS		TRAFFIC SIGNAL HEAD
	MESH FENCING		TRAFFIC SIGNAL LOCATION
	RAISED RETROREFLECTIVE PAVEMENT MARKERS		VEHICLE
	SIGN, CAB-MOUNTED		WORK AREA
	SIGN, LOCATION		
	TEMPORARY HAZARD MARKER		

5.5 DIAGRAMS

The diagrams are divided into nine categories which are set out below together with a brief description of the type of work site covered by each diagram.

(a) Short-term work

- 1 Frequently changing: clear of traffic lanes
- 2 Full lane closure: residential street - low speed
- 3 Part lane closure: two-way road - low speed
- 4 Full lane closure: two-way road
- 5 Traffic through work area: two-way road
- 6 Lane closure: work in centre lane - multilane road
- 7 Left or median lane closure: multilane road
- 8 Occupation of centre of roadway: two-way road
- 9 Temporary closure of roadway: multilane road

(b) Lane and roadway closures

- 10 Shoulder closure - all roads
- 11 Part lane closure: two-way road
- 12 Lane closure: two-way road or bridge
- 13 Long-term lane closure: two-way road
- 14 Long-term lane closure: multilane road
- 15 Closure over 2 outer lanes: multilane road
- 16 Closure over 2 central lanes: multilane road

- 17 Closure of one side: multilane road - low speed
- 18 Closure of one side: multilane road - high speed
- 19 Lane closure: major roundabout
- 20 Part lane closure: minor roundabout
- 21 Haul road crossing: two-way road
- 22 Road closed: blasting

(c) *Detours and sidetracks*

- 23 High vehicle detour: two-way road
- 24 Heavy vehicle detour: two-way road
- 25 One lane sidetrack: two-way road
- 26 Two-way sidetrack: two-way road
- 27 Sidetrack crossing median (crossover): multilane, divided road
- 28 One direction detour: two-way road
- 29 Detour all traffic: two-way road
- 30 Exit closure: multilane, one-way roadway

(d) *Special work situations*

- 31 Road temporarily closed: two-way road
- 32 Linemarking: all roads
- 33 Kerbside work: intersection of a minor and a low speed road
- 34 Kerbside work: intersection of a minor and a high speed road
- 35 Kerbside work: intersection of two high speed roads
- 36 Work occupying the full width of a footpath
- 37 Closure of two outer lanes: one direction - multilane road

Table 5.1 DIAGRAM SELECTION FOR ROADWORKS SITUATIONS

Description of Works	Diagram Selection/Road Type		
	2 way	Multi-lane undivided	Multi-lane divided (freeway type operations)
Closure of footpath	36	36	–
Closure of shoulder	Table 5.2	10	10
Closure of traffic lane(s)	Table 5.3	Table 5.5	Table 5.5
Temporary road closure	Table 5.4	22	9
Work under traffic	5	–	–
Bridgeworks	Select the appropriate description and Diagram from this table and also refer to Clause 5.2		
Detours			
– High vehicle detour	23	Adapt 23 to multilane case (See Notes 1 and 5).	
– Heavy vehicle detour	24	Adapt 24 to multilane case (See Notes 2 and 5).	
– One lane sidetrack	25	Adapt 25 to multilane case (See Note 3).	
– Two-lane sidetrack	26	Adapt 26 to multilane case (See Note 3).	
– Sidetrack crossing median	–	–	27
– One direction detour	28	Adapt 28 to multi-lane case (See Note 2)	–
– All traffic detour	29	Adapt 29 to multi-lane case (See Note 2)	–
– Exit ramp closure	–	–	30
Miscellaneous situations			
– Frequently changing work area	1	1	
– Blasting	22	22	
– Haul road crossing	21	–	
– Pavement marking	8 32	6 and 7 Adapt 32 to multilane case	
– Short-term kerbside work at an intersection in a built-up area	33	34 and 35	
– Roundabouts	20	19	

Table 5.2 CLOSURE OF SHOULDER - TWO-WAY ROAD

Duration of Works	AADT. Veh/Day	Pavement Encroachment (1)	Lighting Conditions	Method of Control	Diagram No.
SHORT TERM WORKS	0-400	Minor	day/night'	usually not needed	1
			day/night	usually not needed	3, 10
		None	day/night		
	Over 400	None	day/night	usually not needed	3 11
		Minor			
	LONG TERM WORKS	0-400	Minor	day/night	usually not needed
None					
None					
Over 400		Minor	day/night	usually not needed	10

NOTE:

1. A minor pavement encroachment is one that leaves at least the following formed width of trafficable road -

- Approach speed less than 60 km/h - 5.5 m
- Approach speed 60 km/h or greater - 6 m

Consideration should be given to a lane closure or road widening to allow two-way traffic, when large combination vehicles are present.

Table 5.3 CLOSURE OF TRAFFIC LANE - TWO-WAY ROAD

Duration of Works	AADT Veh/Day	Available Width (m) (1)	Other Considerations		Method of Control	Diagram No.	
SHORT-TERM WORKS	N/a	3.5, or 5.5 and over	Residential street, visibility between ends of closure	adequate	not needed	2	
				inadequate	Traffic Controllers	4	
	0-150	3.0-5.9	Visibility between ends of closure	inadequate	Traffic Controllers	4	
				adequate	GIVE WAY sign	12	
		6.0 and over		not usually needed	8, 11		
	150-1500	3.0-5.9			Traffic Controllers	4	
		6.0 and over			not usually needed	8, 11	
	1500-3000	3.0-5.9				Controllers-consider use of boom barriers	4
					No		
		6.0 and over	Available width fully sealed?	Yes	not usually needed (1)	11	
		over 3000	6.0 and over	Available width fully sealed?	Yes	Traffic Controllers	4
	No						
	3.0-5.9						
LONG-TERM WORKS	0-150	3.0-5.9	Visibility between ends of closure	inadequate	Temporary Traffic signals	12	
				adequate	GIVE WAY sign	12	
		6.0 and over		not usually needed	13		
	150-1500	3.0-5.9			Temporary Traffic signals	12	
	over 1500	6.0 and over			not usually needed	13	
		6.0 and over	Available width fully sealed?	Yes	Temporary Traffic Signals	12	
				No			
		3.0-5.9					

NOTE:

1. Formed width of the roadway (sealed or unsealed). This width is the minimum lane width to be provided (see Clause 4.13.3).

Table 5.4 TEMPORARY ROAD CLOSURE - TWO-WAY ROAD

Duration of Works	Nature of Works	AADT	Description	Diagram No.
Day Only	Blasting or where unsafe to traverse works during closure	All	Complete Road Closure	22
	Elsewhere	All		22, 31
Night	Work area to be made trafficable and barriers removed by nightfall. Elsewhere, and where an alternative route is available (see Diagram 29).			

Table 5.5 MULTILANE ROADS

Configuration	Duration of Works	No. of Lanes	Diagram No.
One Lane Closed	Short-term	4 to 8	7
	Long-term	4 to 8	14
Two Lanes Closed – Equal No. of Lanes in both directions	Short-term	4	6
	Long-term	6 or 8	15 – 2 outer lanes closed 16 – 2 centre lanes closed
Two Lanes Closed – Unbalanced flows	Short-term	4 to 8	37
One Side Closed	Short-term	4	17 - low speed 18 - high speed
	Long-term	4	27
Temporary road closure	All	3	9

NOTE: For detours refer Table 5.1.

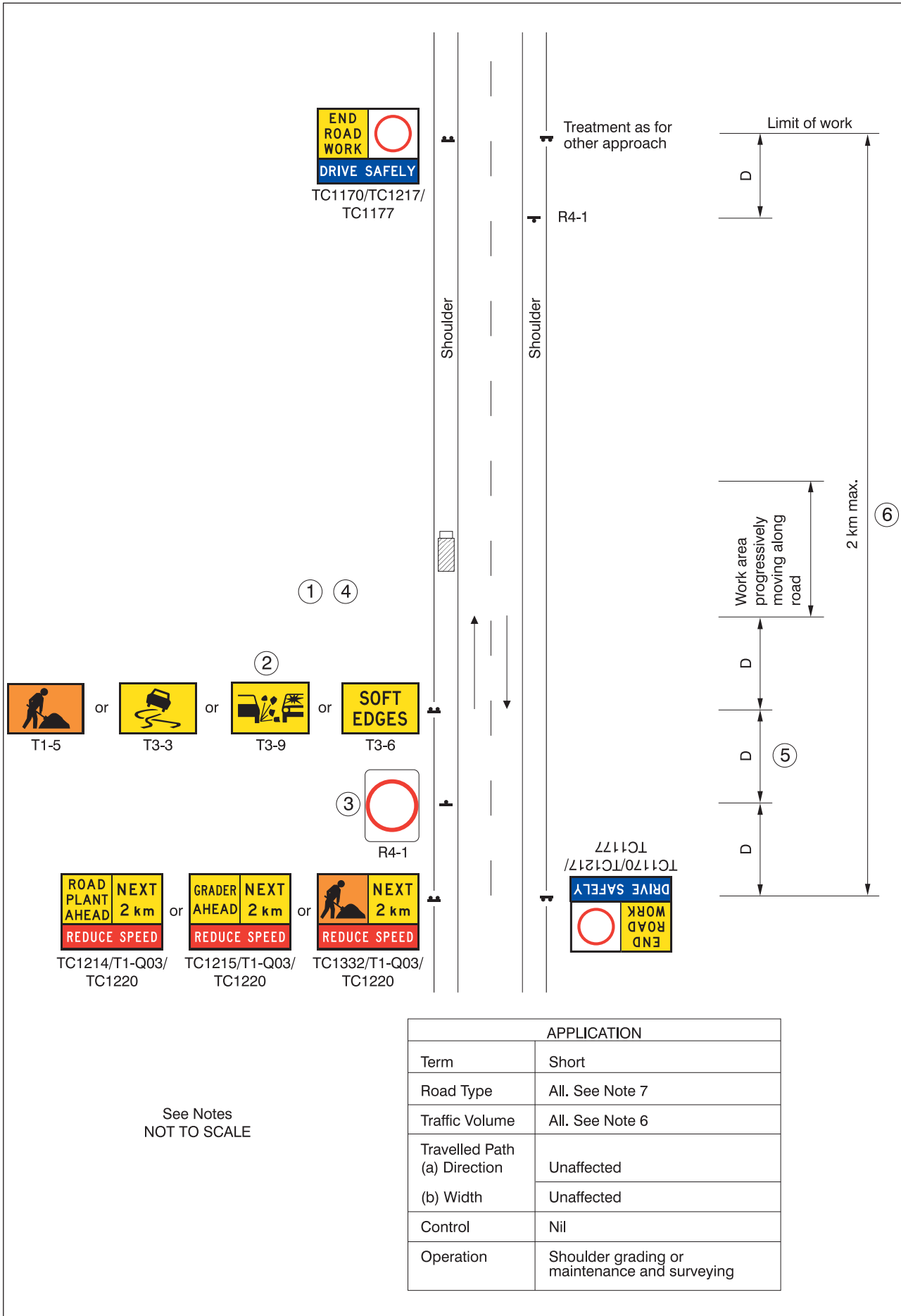
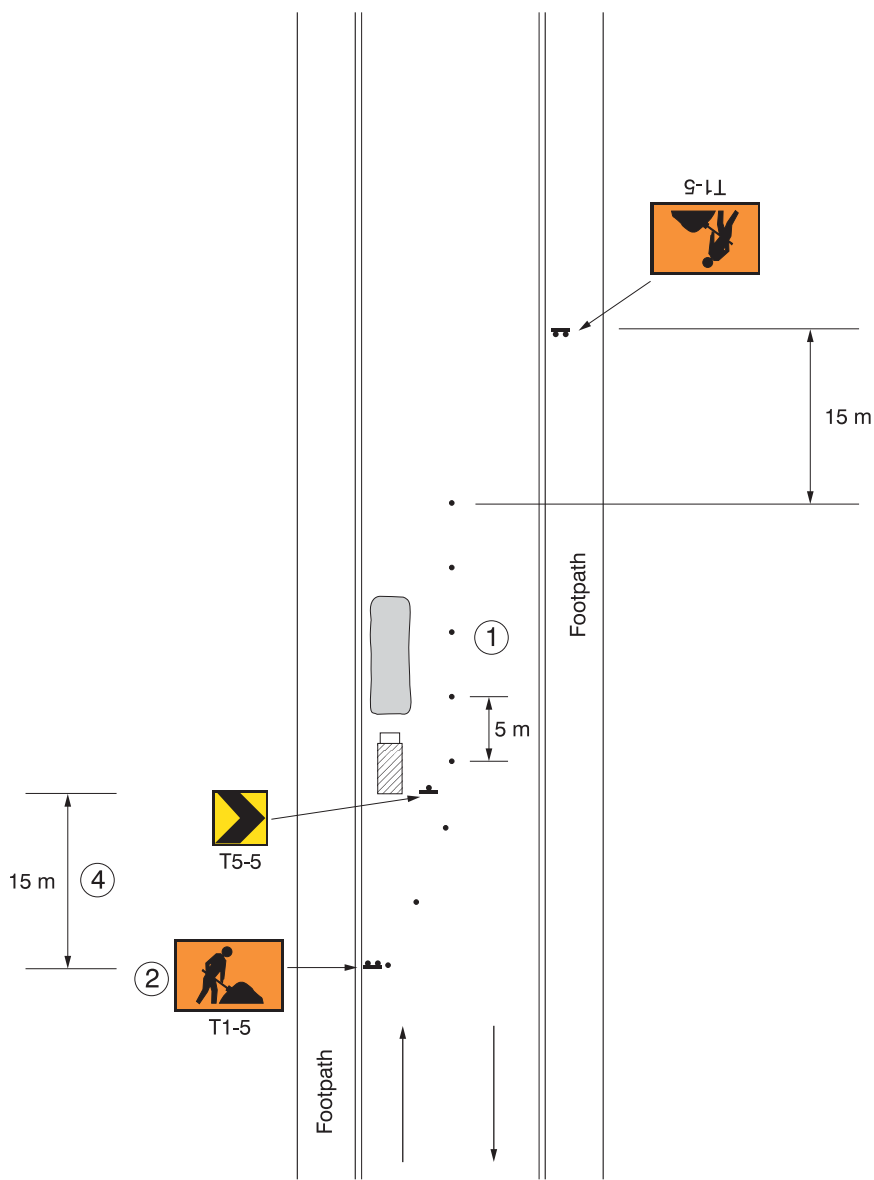


DIAGRAM 1 SHORT TERM - FREQUENTLY CHANGING: CLEAR OF TRAFFIC LANES

NOTES TO DIAGRAM 1:

1. Frequently changing work area involving machine running on shoulders (see Clauses 4.3.4 and 4.3.5). Job examples - grass mowing, shoulder grading, table drain clearing. Advance warning signs may be omitted if the sight distance exceeds 150 m in a 60 km/h or lower zone, or 250 m elsewhere and a vehicle mounted warning device is displayed and no windrow is present near the pavement edge.
2. Where a shoulder is being graded, and if (for example) the shoulder material is soft or is to remain temporarily on the pavement, then the appropriate sign Slippery, Loose Stones, SOFT EDGES, etc should be shown a minimum distance D (see Table 4.2) metres ahead of the hazard. Where workers will be working on the shoulder the Workers (symbolic) sign should be repeated in this location. Workers (symbolic) signs shall be used when workers are actually working.
3. Consider the need for a temporary speed zone to meet workplace or traffic safety requirements (see Clause 4.2). Remove when workers have left the work area.
4. For work not involving machines running on shoulders, consider the need for cones at 5-25 m spacing along the edge of the pavement.
5. The distance D for sign spacing is given in Table 4.2.
6. On sealed roads with traffic volumes less than 1500 vpd, where sight distance to the vehicle-mounted warning device is greater than 250 m in both directions, the distance between signs at the limits of work may be increased to 10 km. Where this sight distance is not available, an additional sign e.g. GRADER Ahead must be placed in advance of work to warn motorists.
7. For works on unsealed roads see Clause 4.5.



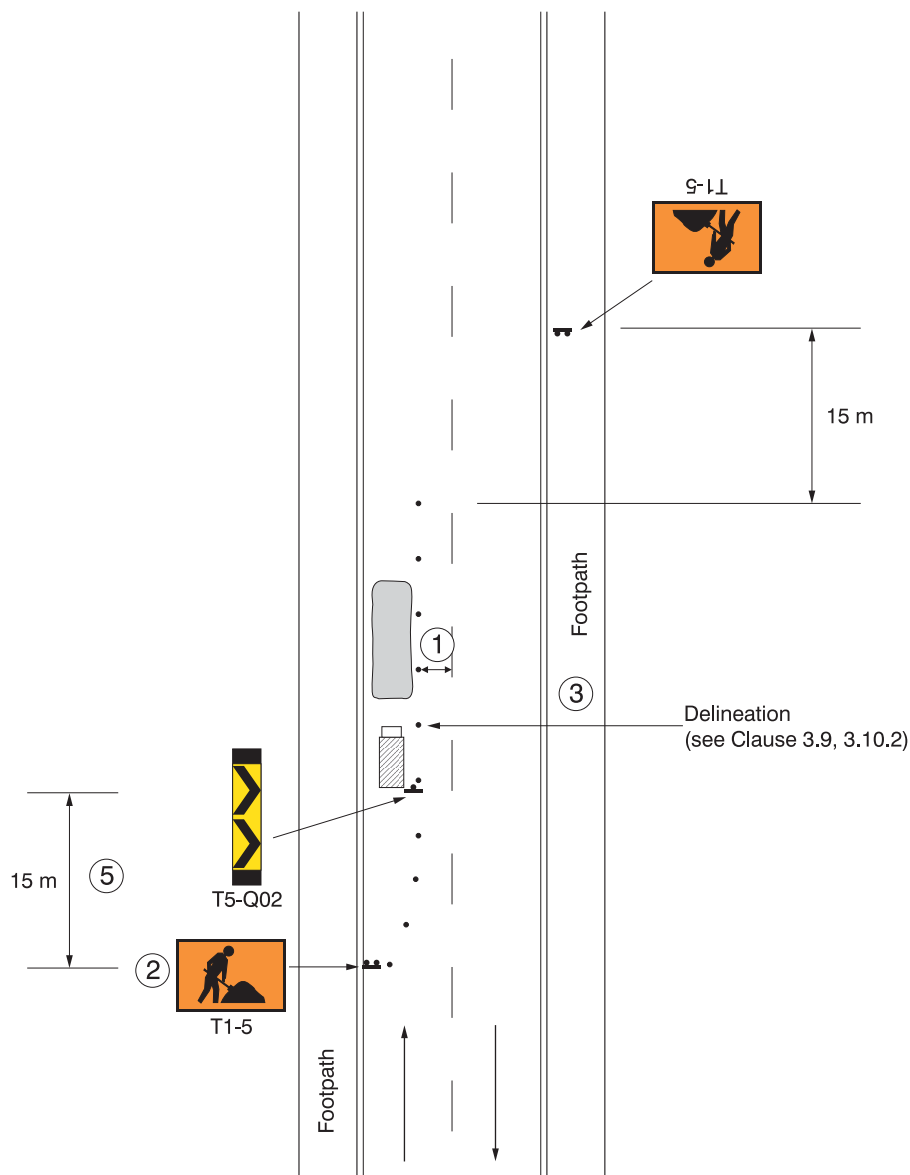
See Notes
NOT TO SCALE

APPLICATION	
Term	Short
Road Type	Residential Street
Traffic Volume	Low
Travelled Path (a) Direction	Around
(b) Width	See Note 1
Control	Nil. See Note 3
Operation	Maintenance. Full lane closure

DIAGRAM 2 SHORT-TERM - FULL LANE CLOSURE: RESIDENTIAL STREET - LOW SPEED

NOTES TO DIAGRAM 2:

1. If the remaining clear roadway width is 5.5 m or more, two-way operation should be maintained. If 5.5 m cannot be maintained, the width should be reduced to no more than 3.5 m (see Clause 4.13.5) to ensure vehicles operate in single file under shuttle working conditions.
2. The Workers (symbolic) sign shall be removed when workers have left the area or are no longer visible to traffic.
3. Direct control of traffic may not be required if there is clear visibility of and beyond the work area for 75 m, and the length of shuttle lane does not exceed 60 m (see Clause 4.13.5(b)). If these conditions cannot be maintained some form of traffic control will be required.
4. Refer to Table 4.6 for recommended taper lengths.



See Notes
NOT TO SCALE

APPLICATION	
Term	Short. See Note 4
Road Type	Low speed urban e.g. business or shopping streets
Traffic Volume	All
Travelled Path (a) Direction	Around
(b) Width	See Note 1
Control	Nil.
Operation	Maintenance. Part lane closure

DIAGRAM 3 SHORT TERM - PART LANE CLOSURE: TWO-WAY ROAD - LOW SPEED

NOTES TO DIAGRAM 3:

1. The minimum lane width shall be 3.0 m (see Clause 4.13.3). Where this remaining width is insufficient for a lane of traffic and vehicles need to cross the centreline to travel around the work area, Diagram 11 should be used. Where traffic controllers are used to control traffic, use Diagram 4.
2. The Workers (symbolic) sign shall be removed when workers have left the area or are no longer visible to traffic.
3. Consider the need to prohibit parking along this kerb.
4. For short term, low impact works see Clause 4.4.
5. Refer to Table 4.6 for recommended taper lengths.

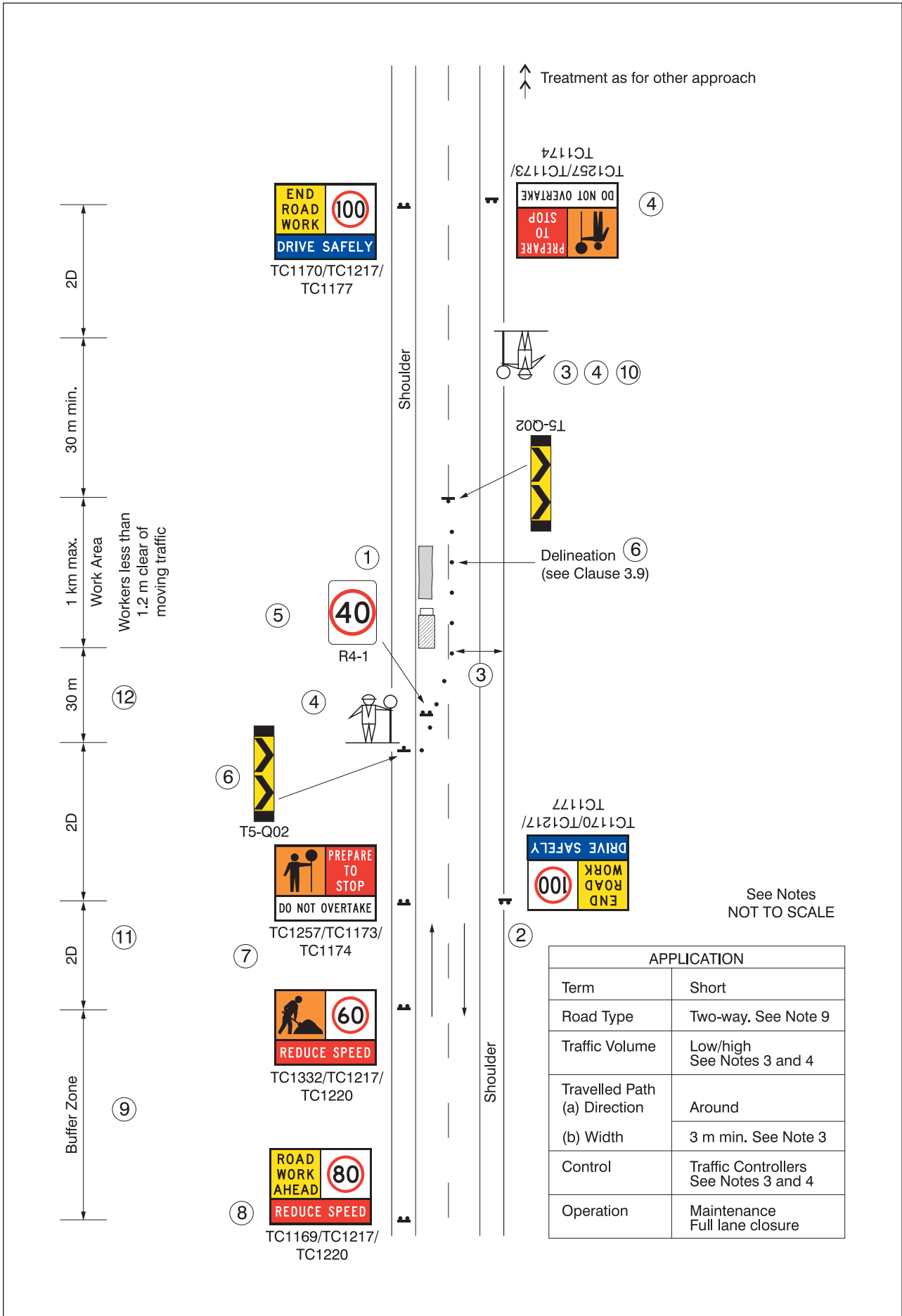


DIAGRAM 4 SHORT-TERM - FULL LANE CLOSURE: TWO-WAY ROAD

NOTES TO DIAGRAM 4:

1. The vehicle should be parked-
 - (a) so it does not unduly obstruct motorists' vision of the travelled path;
 - (b) to leave a clear escape path for workers; and
 - (c) where necessary, in advance of the work area to protect workers.
2. A Traffic Controller Ahead/PREPARE TO STOP sign may be required on the right-hand side of high volume roads.
3. The minimum lane width including trafficable shoulder shall be 3.0 m (see Clause 4.13.3). For widths of 6 m or more, see Diagram 11. Where only one traffic controller is available, and high traffic volumes or barrier lines make it necessary to direct traffic through the work area see Diagram 5.
4. For traffic volumes of 40 vpd or less and posted speed during roadworks 70 km/h or less, where the length of single lane does not exceed 60 m, traffic control may not be required. Where the requirements of Clause 4.13.1 are met, the GIVE WAY and ONE WAY sign assembly may be used (see Diagram 12).
5. Consider the need for a temporary speed zone to meet workplace or traffic safety requirements (see Clause 4.2). Remove when workers have left the work area or are no longer visible to traffic.
6. May be omitted if continuous operations are in progress and vehicle has a vehicle-mounted warning device activated.
7. A maximum speed limit of 60 km/h shall be used (see Clause 4.10.4).
8. Consider use of ROADWORK 1 km Ahead and ROADWORK 500 m Ahead signs in advance of the taper at the work site for approach speeds of 90 km/h or greater when the work site requires a reduction in speed of 40 km/h or more see Clause 4.7.2.
9. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.
10. For works on unsealed roads see Clause 4.5.
11. The distance D for sign spacing is given in Table 4.2.
12. Refer to Table 4.6 for recommended taper lengths.

NOTES TO DIAGRAM 5:

1. The vehicle should be parked-
 - (a) so it does not unduly obstruct motorists' vision of the travelled path;
 - (b) to leave a clear escape path for workers; and
 - (c) where necessary, in advance of the work area to protect workers.
2. A Traffic Controller Ahead/PREPARE TO STOP sign may be required on the right-hand side of roads where the volume is 10 000 vpd or greater.
3. Work area should not extend beyond centreline.
4. Traffic controller stops and holds all traffic in obstructed lane then when work area is temporarily clear, directs traffic to the left of the Temporary Hazard Marker and through the work area.
5. Traffic should not be held for longer than 5 min at any time.
6. This arrangement should be used where-
 - (a) the minimum lane width including trafficable shoulder shall be 3.0 m (see Clause 4.13.3);
 - (b) where only one traffic controller is available; and
 - (c) barrier lines are present.
7. For works on unsealed roads see Clause 4.5.
8. A maximum speed limit of 60 km/h shall be used (see Clause 4.10.4).
9. Consider use of ROADWORK 1 km Ahead and ROADWORK 500 m Ahead signs in advance of the taper at the work site for approach speeds of 90 km/h or greater when the work site requires a reduction in speed of 40 km/h or more see Clause 4.7.2.
10. The distance D for sign spacing is given in Table 4.2.
11. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.
12. May be omitted if continuous operations are in progress and vehicle has a vehicle-mounted warning device activated.

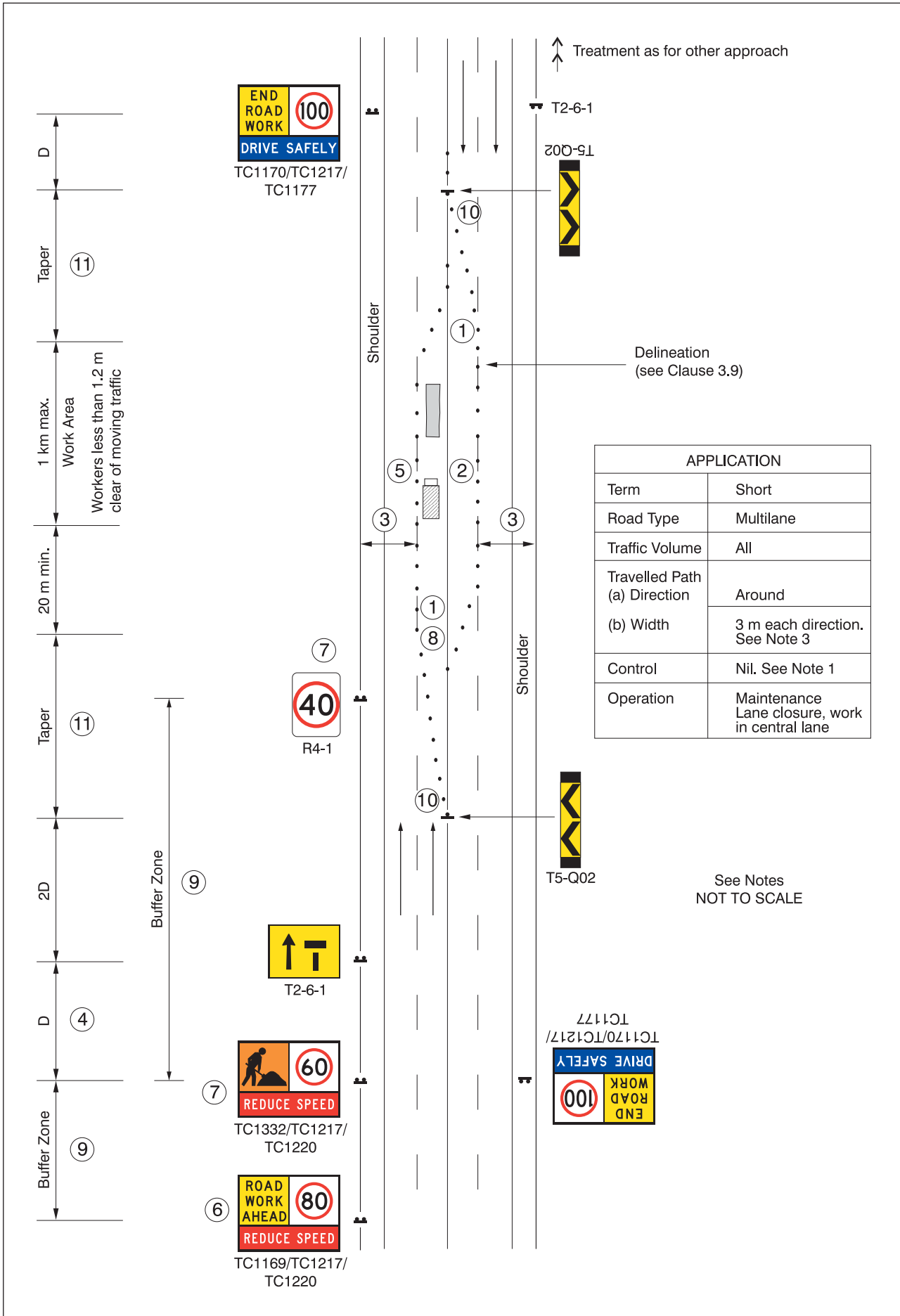


DIAGRAM 6 SHORT-TERM - LANE CLOSURE: WORK IN CENTRE LANE - MULTILANE ROAD

NOTES TO DIAGRAM 6:

1. If traffic control is required, a Traffic Controller Ahead / PREPARE TO STOP sign is used 2D in advance of the traffic controller.
2. A central traffic lane should not be closed in isolation.
3. The minimum lane width including trafficable shoulder shall be 3.0 m (see Clause 4.13.3).
4. The distance D for sign spacing is given in Table 4.2.
5. The vehicle should be parked-
 - (a) so it does not unduly obstruct motorists' vision of the travelled path;
 - (b) to leave a clear escape path for workers; and
 - (c) where necessary, in advance of the work area to protect workers.
6. Consider use of ROADWORK 1 km Ahead and ROADWORK 500 m Ahead signs in advance of the taper at the work site for approach speeds of 90 km/h or greater when the work site requires a reduction in speed of 40 km/h or more see Clause 4.7.2.
7. Consider the need for a temporary speed zone to meet workplace or traffic safety requirements (see Clause 4.2). Remove when workers have left the work area.
8. An illuminated flashing arrow shall be used where the traffic volume is 1500 vpd or greater and the posted speed during roadworks is 70 km/h or greater (see Clause 4.8.3).
9. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.
10. A manoeuvre requiring the left hand stream to shift laterally into the right hand stream is to be preferred see Clause 4.8.2.
11. Refer to Table 4.6 for recommended taper lengths.

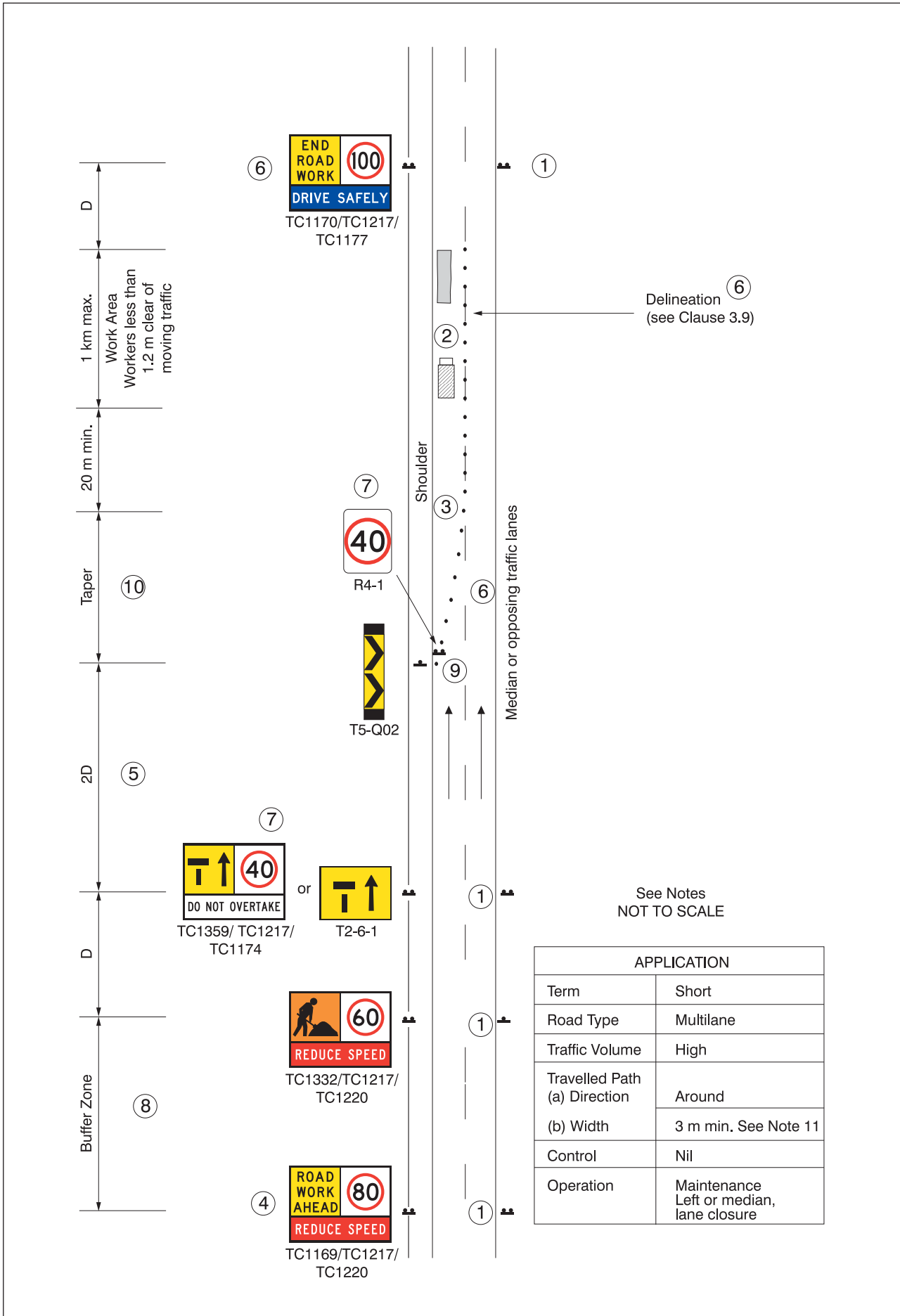


DIAGRAM 7 SHORT-TERM - LEFT OR MEDIAN LANE CLOSURE: MULTILANE ROAD

NOTES TO DIAGRAM 7:

1. Signs shall be duplicated on the right-hand side of a one-way roadway, where practicable. These signs may be required for the multi-lane undivided road situation.
2. The vehicle should be parked-
 - (a) so it does not unduly obstruct motorists' vision of the travelled path;
 - (b) to leave a clear escape path for workers; and
 - (c) where necessary, in advance of the work area to protect workers.
3. An illuminated flashing arrow shall be used where the traffic volume is 1500 vpd or greater and the approach speed of traffic is 70 km/h or greater (see Clause 4.8.3).
4. Consider use of ROADWORK 1 km Ahead and ROADWORK 500 m Ahead signs in advance of the taper at the work site for approach speeds of 90 km/h or greater when the work site requires a reduction in speed of 40 km/h or more see Clause 4.7.2.
5. The distance D for sign spacing is given in Table 4.2.
6. May be omitted if continuous operations are in progress and vehicle has a vehicle-mounted warning device activated.
7. Consider the need for a temporary speed zone to meet workplace or traffic safety requirements (see Clause 4.2). Remove when workers have left the work area.
8. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.
9. For a median lane closure, a manoeuvre requiring the left hand stream to shift laterally into the right hand stream is to be preferred see Clause 4.8.2.
10. Refer to Table 4.6 for recommended taper lengths.
11. The minimum lane width including trafficable shoulder shall be 3.0 m (see Clause 4.13.3).

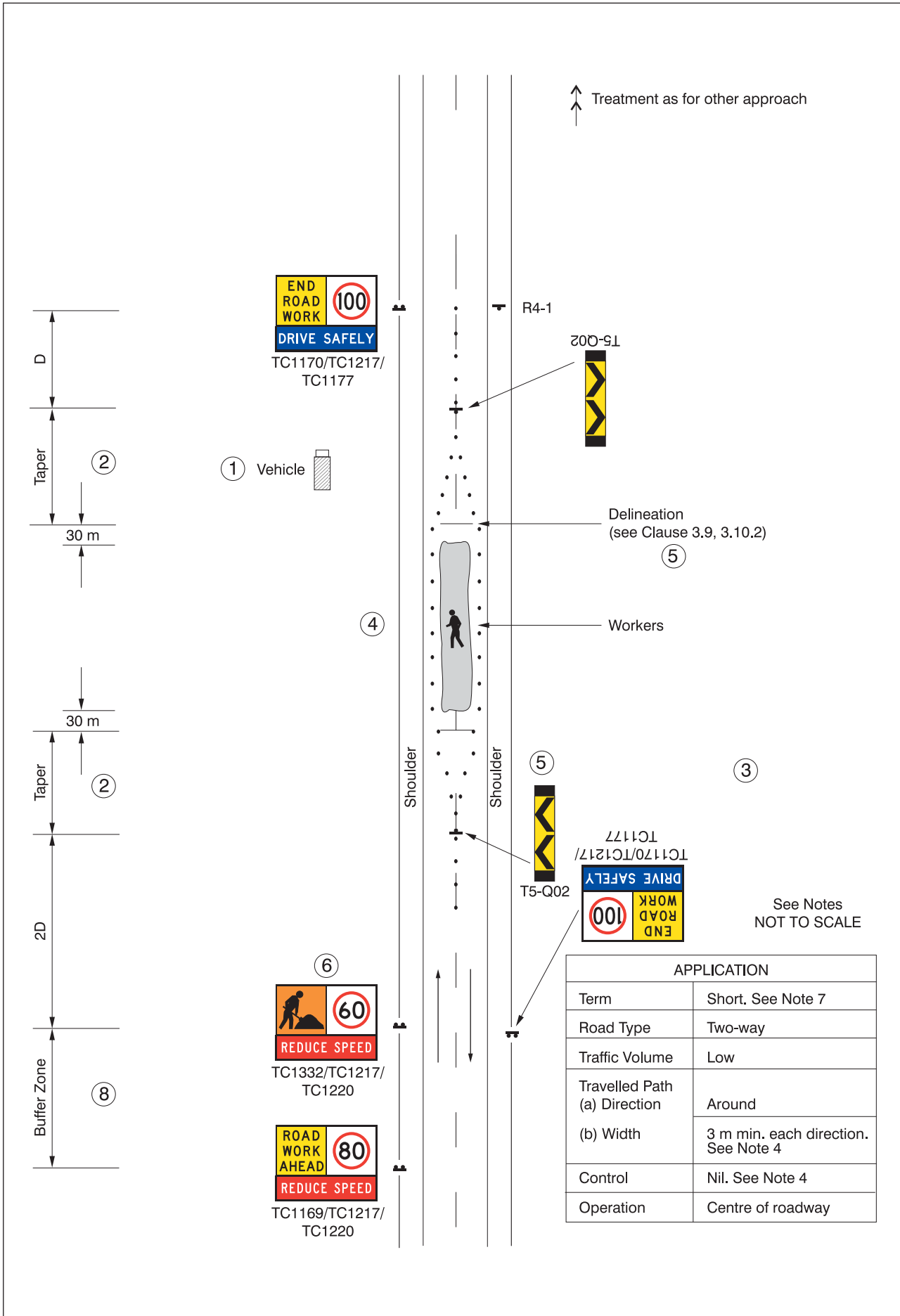


DIAGRAM 8 SHORT-TERM - OCCUPATION OF CENTRE OF ROADWAY: TWO-WAY ROAD

NOTES TO DIAGRAM 8:

1. Any vehicles should be parked off the roadway, beyond the work area. A vehicle so parked should not display vehicle-mounted warning devices.
2. The distance D for sign spacing is given in Table 4.2. Refer to Table 4.6 for recommended taper lengths.
3. For work carried out on other areas of the roadway, see Diagrams 4, 7 and 11.
4. The minimum lane width shall be 3.0 m (see Clause 4.13.3). If the width is less than this in one direction, consideration should be given to the use of traffic control.
5. For continuous operations such as paint spotting, the temporary hazard markers may be replaced with vehicles fitted with appropriate vehicle-mounted warning devices and the delineation traffic cones omitted.
6. Consider the need for a temporary speed zone to meet workplace or traffic safety requirements (see Clause 4.2). Remove when workers have left the work area.
7. For short term, low impact works in open road areas see Clause 4.3 and in built-up areas see Clause 4.4.
8. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.

NOTES TO DIAGRAM 9:

1. Where practicable, signs shall be erected on both sides of the roadway where the volume is 10,000 vpd or greater.
2. The vehicle should be parked-
 - (a) so it does not unduly obstruct motorists' vision of the travelled path;
 - (b) to leave a clear escape path for workers; and
 - (c) where necessary in advance of the work area to protect workers.
3. An illuminated flashing arrow shall be used where the traffic volume is 1500 vpd or greater and the approach speed of traffic is 70 km/h or greater (see Clause 4.8.3).
4. See Clause 3.8.2 if a special sign is required.
5. The distance D for sign spacing is given in Table 4.2.
6. A maximum speed limit of 60 km/h shall be used (see Clause 4.10.4).
7. Consider use of ROADWORK 1 km Ahead and ROADWORK 500 m Ahead signs in advance of the taper at the work site for approach speeds of 90 km/h or greater when the work site requires a reduction in speed of 40 km/h or more see Clause 4.7.2.
8. Normally a traffic controller with boom barrier should be used, however, for work of short duration outside of peak period a traffic controller with STOP/SLOW bat may be used.
9. The Traffic Controller Ahead/PREPARE TO STOP sign must only be used when traffic controller is on duty.
10. Use PROBABLE DELAY 15 MINUTES sign (T1-Q02) where expected delays are considerable. Also, consider the need for special signs to warn of delays at junctions with alternate routes.
11. Consider local traffic access. Parking restrictions should apply throughout the work site.
12. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.
13. Refer to Table 4.6 for recommended taper lengths.
14. The minimum lane width including trafficable shoulder shall be 3.0 m (see Clause 4.13.3).

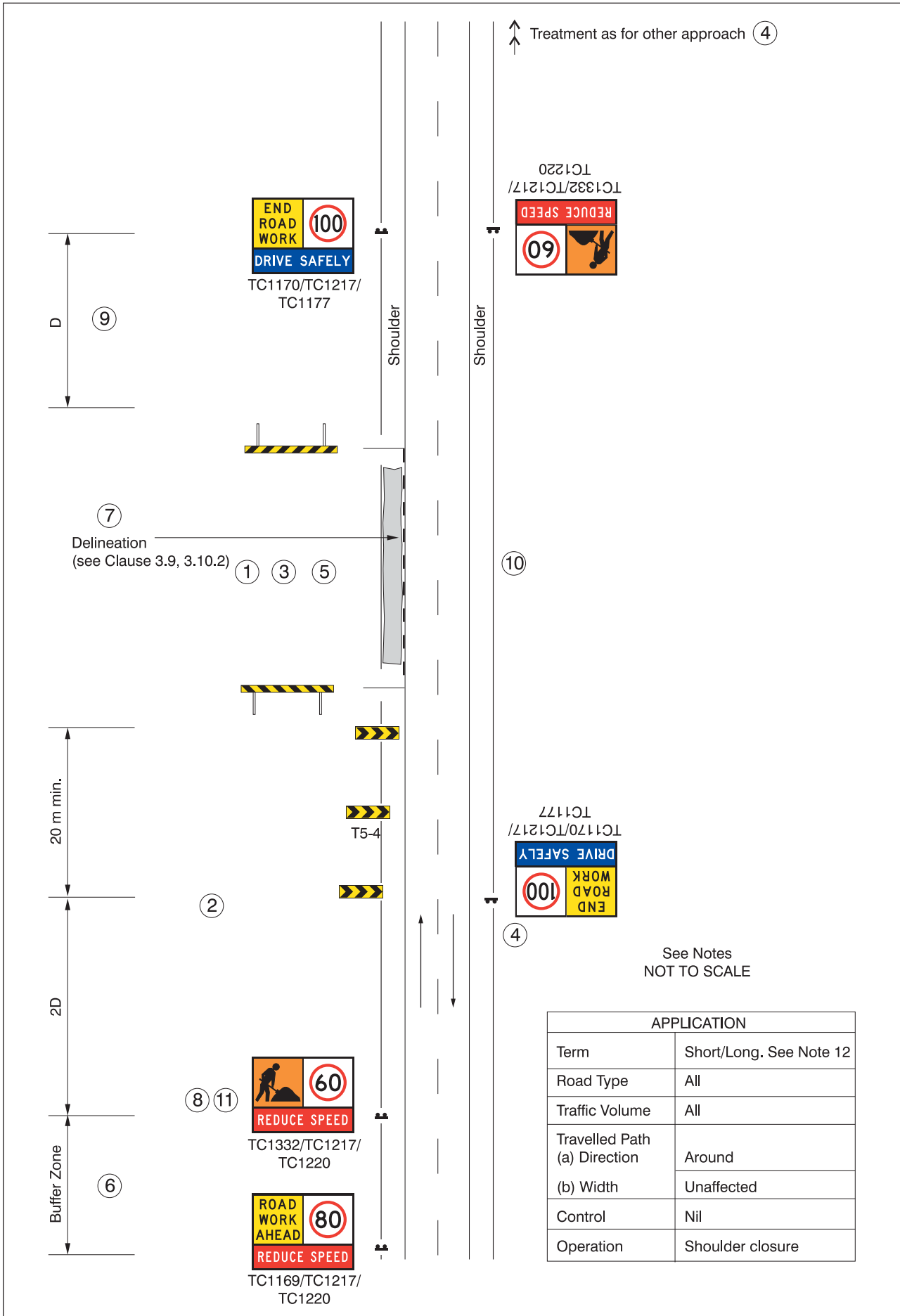


DIAGRAM 10 SHOULDER CLOSURE - ALL ROADS

NOTES TO DIAGRAM 10:

1. In built-up areas, access for pedestrians should be considered together with appropriate signs.
2. In built-up areas, parking may need to be prohibited within the work site.
3. Access for local traffic should be considered.
4. These signs should be omitted on a one-way roadway.
5. At night, or when no work is being carried out, barricades may be erected along the work site at right angles to traffic flow (see Clause 3.8.3).
6. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.
7. May be omitted when work is less than 20 m in length, no truck or major plant item is in use and no excavation is involved.
8. Consider the need for a temporary speed zone to meet workplace or traffic safety requirements (see Clause 4.2). Cover or alter if inappropriate at night.
9. The distance D for sign spacing is given in Table 4.2.
10. Where traffic flow must be temporarily interrupted, traffic controllers with appropriate signing (see Diagram 12) should be used.
11. The Workers (symbolic) sign shall be removed when workers have left the work area or are no longer visible to traffic.
12. Advance signs shall be displayed as prominently as possible by selecting the longitudinal location of the sign for best sight distance for approaching traffic. Signs continuously required for works which will be in progress for periods longer than 2 weeks should be erected in a permanent manner, e.g. on posts sunk into the ground, and duplicated on the right side of the road.

Flashing lamps may be used to draw attention to advance signs (see Clause 3.11).

NOTES TO DIAGRAM 11:

1. Where works are continuously moving, advance warning signs may be vehicle mounted.
2. If a barrier line is present for traffic in either direction, traffic control is required (see Diagrams 4 and 5).
3. The vehicle should be parked-
 - (a) so it does not unduly obstruct motorists' vision of the travelled path;
 - (b) to leave a clear escape path for workers; and
 - (c) where necessary, in advance of the work area to protect workers.
4. The minimum lane widths including trafficable shoulder shall be 3.0 m (see Clause 4.13.3). A temporary hazard marker and cones may be required to separate opposing traffic.
5. May be omitted if continuous operations are in progress and vehicle has a vehicle-mounted warning device activated.
6. For works on unsealed roads see Clause 4.5.
7. The distance D for sign spacing is given in Table 4.2.
8. Consider use of ROADWORK 1 km Ahead and ROADWORK 500 m Ahead signs in advance of the taper at the work site for approach speeds of 90 km/h or greater when the work site requires a reduction in speed of 40 km/h or more see Clause 4.7.2.
9. Consider the need for a temporary speed zone to meet workplace or traffic safety requirements (see Clause 4.2). Remove when workers have left the work area.
10. Advance warning shall be provided by means of a buffer zone comprising either the Speed Limit AHEAD sign or a speed zone see Clause 4.9.5.
11. Refer to Table 4.6 for recommended taper lengths.